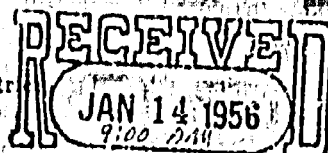


No. 419-2Water Division No. 2 Fall River Distr.
(Blanks to be filled by the Engineer for the W. R. C.)

APPLICATION FOR PERMIT

STATE WATER RESOURCES COM.

PIERRE SOUTH DAKOTA

To appropriate Water within the State of South Dakota

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

1. Name of applicant Wind Cave National Park, Earl M. Semingsen, Superintendent
 Postoffice address Hot Springs, County Custer, State South Dakota

I. If a corporation U. S. Government(a) Name of same National Park Service, Department of the Interior(b) Date and place of incorporation Park established by Act of Congress Jan. 9, 1903(c) Amount of capital stock Does not apply(d) Amount paid in Does not apply(e) Names and addresses of directors Conrad J. Wirth, Director, NPS, Washington, D.C.Howard W. Baker, Regional Director, Region Two, Omaha, NebraskaEarl M. Semingsen, Superintendent, Wind Cave National Park

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

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

(a) Method of accomplishing work (Whether by contract, employment of others, or by direct labor)

By contract awarded to Sioux Drilling Co., Rapid City, South Dakota(b) Cash on hand, \$ ---(c) Treasury stock, \$ ---(d) Bonds to be issued, \$ ---(e) Other resources, \$ ---2. Name of diversion work ---(f) Contract let for \$ 22,860.003. Amount of water claimed 0.24 cubic feet per second See call/minute4. Source of water supply Deep Well5. Location of point of diversion On Wind Cave Canyon, Wind Cave National Park Sect. 6, T5S, R6E(See map attached for detailed location on drainage bank Custer County)6. Annual period or periods during which water is to be used Year around depending on existing7. To be used for: spring supplyI. Irrigation or domestic use: Gravity, overhead sprinkling or combination system? Domestic and public primary combination system.(a) Number of acres to be irrigated approx. 6 acres lawns at park headquarters(b) Legal subdivisions to be irrigated See map headquarters area

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

(c) Statement as to domestic use (giving location, etc.) For public visitor use and domestic use for Park employee staff.

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

(a) Nature of use Fire protection, wildlife watering, public visitor use and
Name any of the above uses claimed domestic use.(b) Amount of power to be generated None horse power.Amount claimed for engine cooling None(c) Location of plant None(d) Method of developing power Power line to service well pump to be constructed by Black Hills Power and Light Co.(e) Point where water will be returned to stream Sewer disposal system, Wind Cave Canyon at Utility Area

Map No. 441-2

8. Estimated cost of work:

(a) Head Gates, \$-----

(b) Pumping plant, \$4,000.00

(c) Flumings, \$-----

(d) Canal-earth, \$-----

Rock, \$-----

(e) Other structures

Drilling Well

\$22,960.

Total, \$-----

Pipilino Construction

\$113,000.

9. Description of diversion works:

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

Water well with pumping plant

II. Dimensions of works:

(a) Dam: Height-----feet; length at bottom-----feet; length at top-----

feet; thickness at bottom-----feet; thickness at top-----

feet; slope at front water face-----; slope at back face-----

material used in construction-----

(b) Reservoir: Capacity when filled 65,000 gal. reservoir existing

Surface area at highwater

mark-----acres. Plans for additional 100,000 gal. reservoir to be

constructed.

DEPTH AT OUTLET-Feet	SURFACE AREA AT EACH DEPTH AT OUTLET--ACRES	FEET	ACRE-Feet CAPACITY
	Does not apply		

(c) Gate: Width-----feet; height-----feet;

Material-----

(d) Canal: Total length-----miles.

LOCATION BELOW HEADGATE	DEPTH	BOTTOM WIDTH	WIDTH AT WATER-LINE	GRADE PER MILE
At-----Mile	feet	feet	feet	feet
At-----Mile	Does not apply	feet	feet	feet
At-----Mile	feet	feet	feet	feet
At-----Mile	feet	feet	feet	feet
At-----Mile	feet	feet	feet	feet
At-----Mile	feet	feet	feet	feet

(Give dimensions where reductions in size are made.)

10. Time required for completion of work 6 months

11. Time required for complete application of water to the proposed beneficial use

12. Choice of newspaper for publication of notice of intention to appropriate Custer County Chronicle

STATE OF SOUTH DAKOTA

County of Custer

ss.

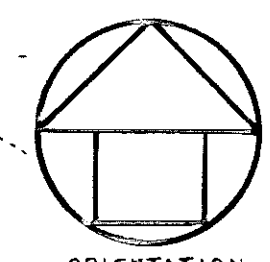
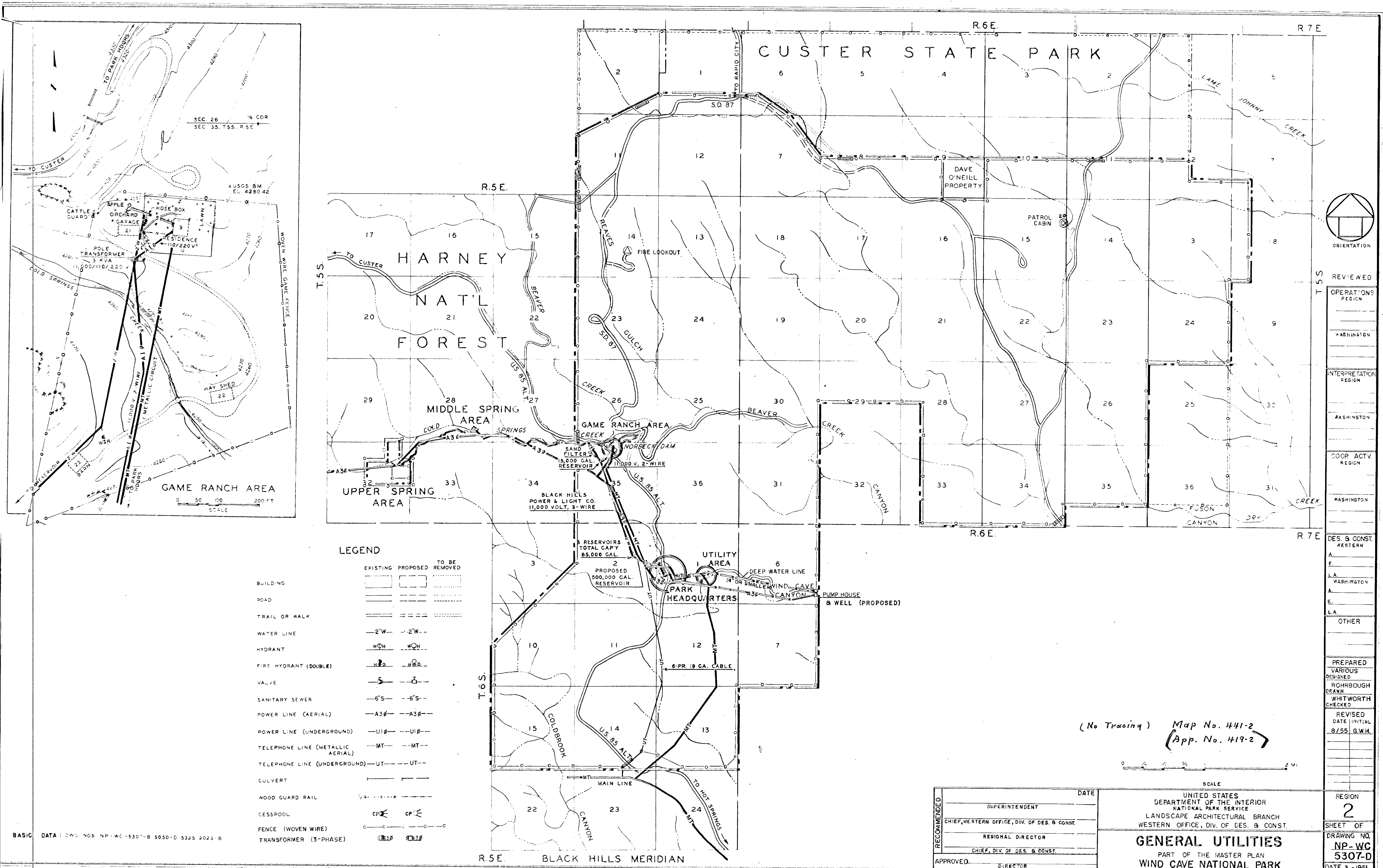
I, Karl M. Serlingaen, Superintendent, Wind Cave Nat'l Park, being first duly sworn on my oath depose and say: That my relation to the above described undertaking is that of owner, that I have read the above foregoing statement, examined the map accompanying the same, and that I know of my own personal knowledge that the matters therein stated and shown are true.

Signed Karl M. Serlingaen

Subscribed and sworn to before me this-----day of-----10-----

Notary Public (or other qualified officer.)

*Each diversion must have a headgate or measuring device.



REVIEWED

OPERATIONS REGION

WASHINGTON

INTERPRETATION REGION

WASHINGTON

COOP. ACTV. REGION

WASHINGTON

DES. & CONST. WESTERN

A.

E.

L.A.

WASHINGTON

A.

E.

L.A.

OTHER

PREPARED

VARIOUS

DESIGNED

ROHRBOUGH

DRAWN

WHITWORTH

CHECKED

REVISED

DATE

INITIAL

8/55 G.W.H.

REGION

2

SHEET OF

DRAWING NO.

NP-WC 5307-D

DATE 3-1951

(No Tracing) Map No. 441-2
(App. No. 419-2)

SCALE

RECOMMENDED	DATE
	SUPERINTENDENT
	CHIEF, WESTERN OFFICE, DIV. OF DES. & CONST.
	REGIONAL DIRECTOR
CHIEF, DIV. OF DES. & CONST.	
APPROVED	DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
LANDSCAPE ARCHITECTURAL BRANCH
WESTERN OFFICE, DIV. OF DES. & CONST.

GENERAL UTILITIES
PART OF THE MASTER PLAN
WIND CAVE NATIONAL PARK

BASIC DATA : DWG. NOS NP-WC-5307-B 5050-D 5325 2023-B

Remarks by State Water Resources Commission:

STATE OF SOUTH DAKOTA
County of Douglas } ss.

Pierre, South Dakota, Jan 14, 1956

This is to certify that the foregoing application was received by the Commission at 9:00 o'clock
4 m. upon the 29 day of Dec, 1955.

State Water Resources Commission

By: J. W. Primes
Chief Engineer, Executive Officer

Number of permit 419-2

Date of first receipt of application Dec 29, 1955

Date of return to applicant for correction, amendments or changes required as follows: Jan 5, 1956

Date of receipt of corrected application Jan 14, 1956

Date from which applicant may claim right Dec 29, 1955

Approved May 7, 1956 Recorded in Book 3 Page 131

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

1st. The equivalent of at least one-fifth of the work above specified is to be completed on or before December 12, 1956

2nd. The whole of said work is to be completed on or before June 12, 1957

3rd. The limit of time for proof of beneficial use of water appropriated in accordance herewith is

June 12, 1957

4th. The water appropriated shall be used for the purpose of Irrigation, domestic use, fire protection, wild-life watering & business use.

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

6th. The amount of the appropriation herein granted shall not exceed 0.4 cubic feet per second; neither shall it exceed the capacity of the above described system of diversion works, nor the least amount of water that experience may hereafter indicate as necessary for the production of crops in the exercise of the best husbandry; and further, said appropriation must be limited to not more than one-seventieth (1/70) of one cubic foot of water per second of time for each acre of land to which water is actually

and beneficially applied for irrigation on or before June 12, 1957, said water to be used during the following described annual period:

During the entire year

Witness my hand this 12 day of June, 1956

State Water Resources Commission

By: J. W. Primes
Chief Engineer, Executive Officer

Certificate of Construction Issued JUNE 24, 1955

Water License Issued JUNE 24, 1955

9. (continued)

III. Well Specifications

(a) Hole and casing

Size of drill hole or excavation 10" diameter

Depth up to 800 ft.

Type of casing Steel pipe, black (I.O.)
(concrete, steel, etc.)

Size of casing 8", Thickness of casing not less than
Length of casing 800 ft. If collection gallery, .277 inches
length, size, and depth of gallery none

(b) Screens

Type of perforated screen none

Size of perforated screen none
(diameter) (length)

Thickness of gravel pack unknown, length of gravel
pack unknown

(c) Water Bearing Materials

Distance to water unknown as yet

Character of water bearing materials unknown

Thickness of water bearing material unknown

(d) Pump and Motor

Type of pump submergible - planned for installation
(centrifugal, propeller, mixed flow, etc.)

Name of pump not purchased yet, size

Kind of motor ---
(gasoline, electric, diesel, etc.)

Horsepower Approximately 25 to 30 H.P. estimated

Name of motor ---

(e) Complete well

Capacity at drawdown of

Estimated cost \$22,960. (less depth required to be drilled)

(f) Owner of land upon which well is located

National Park Service Name
Wind Cave National Park, Hot Springs, South Dakota
Address

(g) Distance to nearest existing wells

On same Owner's property none rods

On property owned by others 10 miles, VA Center, Hot Springs rods

Ernl M. Semingsen
Superintendent

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 419-2

(1) WHEREAS, On the 29th day of December A. D. 19 55

Wind Cave National Park

made Water Right Application No. 419-2 for a permit to use .44 cubic feet per second of the waters of ground water and springs

County of Custer State of South Dakota, for park operation

purpose; and

(2) WHEREAS, On the 12th day of June A. D. 19 56

Permit No. 419-2, with a date of priority of December 29, 1955

was issued to said applicant for the diversion of said water, and provided for the completion of construction of the water

supply system therein described on or before the 12th day of June A. D. 19 57 and for the

application to beneficial use of said water on or before the 12th day of June A. D. 19 57

and:

(3) WHEREAS, It is hereby certified that the applicant has complied with the provisions of the laws of the State of South Dakota relating to completion of the construction of the water supply system and is entitled to divert .15 cubic feet per second of water for beneficial use and,

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

water is used for operations in Wind Cave National Park.

(5) NOW, THEREFORE, By the virtue of the authority vested in us by the laws of the State of South Dakota, We hereby grant and confirm to Wind Cave National Park

_____ of Hot Springs

the holder _____ and owner _____ of said permit No. 419-2 a water right, dating from December 29, 1955

_____ to use of .15 cubic feet per second of the waters of ground water and springs

in the County of Custer and State of South Dakota, or so much thereof as may be necessary for the purposes hereinbelow mentioned, to be diverted at wells; 1000' N of the SE corner, Section 6, T6S, R6E, and springs; in the NE⁴, Section 32, T5S, R5E

_____ ed
and conduct ~~XXXXXX~~ through the Park water distribution system

_____ for the purpose of park operation

Subject to any limitations listed in Water Right Permit No. 419-2 and subject to the laws of the State of South Dakota.

WITNESS, My hand and seal of our office at Pierre, South Dakota
this 24th day of June A. D.

Nineteen Hundred and seventy-five

WATER RESOURCES COMMISSION

By:

Chief Engineer, Executive Officer
Vern W. Butler, Acting

Form 15.

Permit No. 419-2

Water Diversion No. 2 Fall River Water District

CERTIFICATE OF CONSTRUCTION

This is to Certify, That Wind Cave National Park

_____ the holder _____ of
Permit No. 419-2, issued upon Application No. 419-2, bearing date of priority of December 29,
_____ authorizing the diversion of .44 cu. ft. per second of the waters of _____
ground water & spring County of Custer, State of South Dakota at _____
wells; 1000' N of the SE corner, Section 6, T6S, R6E, and springs;
in the NE⁴, Section 32, T5S, R5E
_____, for park operation

purposes, has _____ complied with the provisions of the laws of the State of South Dakota relating to proof of
completion of the works of diversion set out and described in said Permit; that said works are found in satisfactory
condition for diverting and conveying to the place of intended use .15 cu. ft. per second of water.

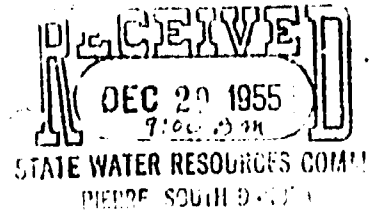
Date June 24, 1975

By: **WATER RIGHTS COMMISSION**

**Vern W. Butler, Acting
Chief Engineer**

Water Rights

Notice of Intention
to the
State Engineer
of the
State of South Dakota



Supplemental Groundwater Supply Project

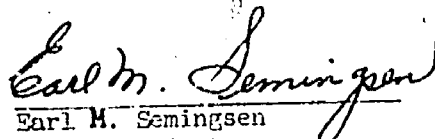
December 27, 1955

Wind Cave National Park

The United States of America, National Park Service, by Earl M. Semingsen, Superintendent of Wind Cave National Park, Hot Springs, South Dakota, hereby notifies the State Engineer of South Dakota, of its intentions to appropriate by drilling, construction, withdrawal, diversion, storage and beneficial use, the aforesaid unappropriated waters of South Dakota under Section 61.0123, Chapter 430 and Section 61.0404, Chapter 431 of the 1955 revised laws of South Dakota:

1. The name of Project is Supplemental Groundwater Supply for Wind Cave.
2. The amount of water claimed is 200,000 gallons per day.
3. The source of water is an artesian basin in the Hasapa limestone formation under Beaver Creek drainage, tributary to the Cheyenne River.
4. The point of diversion, or withdrawal, will be at a well in SE $\frac{1}{4}$ SE $\frac{1}{4}$ or NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 6, T 6 S. R 5 E, of Black Hills Meridian, in Custer County.
5. The water will be used during all 12 months of each year.
6. The water will be used for domestic, recreational, irrigation and fire protection in Wind Cave National Park.
7. The estimated cost of the Project is \$200,000.
8. The well is to have a minimum diameter of 10 inches, depth between 600 and 750 feet, and 8 inch steel casing with minimum thickness of 0.277 inch.
9. The water will be pumped approximately 1.5 miles through 4 inch steel pipe to existing Park water system which serves the Park under Federal Water Withdrawal No. 33-2.

10. Regulatory storage will be provided in existing and additional reservoir units with capacities varying from 50,000 gallons to 500,000 gallons.
11. The well is to be tested for maximum potential yield of 200 gallons per minute.
12. Plans will be filed within one year, the details being dependent on results of proposed well drilling and pump tests for which contract was awarded before December 6, 1955.
13. The initial unit, to divert and deliver part of the water to the existing distribution system, will be started before June 30, 1956, and completed by June 30, 1957. The total project will be completed on schedule to serve increasing water demands, probably about June 30, 1955.


Earl M. Semingsen
Superintendent
Wind Cave National Park

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA }
County of Custer } ss.

Carl H. Sundstrom being duly sworn, deposes and says the annexed printed copy of Notice of Intention to Appropriate Water was taken from the

CUSTER COUNTRY CHRONICLE a newspaper which during the whole itme of publication of said notice herein after stated, has been and is printed and published in the

City of Custer County of

Custer, and State of South Dakota; that the said notice was published in said newspaper on the following dates:

February 2, 1956
February 9, 1956
February 16, 1956
February 23, 1956

in each and every issue of the full number thereof, the first publication being made on the 2 day of February 1956 and the last publication on the 23 day of February 1956, upon which days or times of publication aforesaid the newspaper was regularly published, and that during the whole time of said publication he was the printer and publisher of the said newspaper.

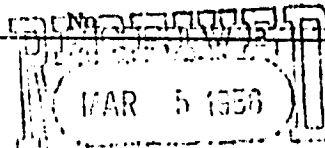
/s/ Carl H. Sundstrom

Subscribed and sworn to before me this 23 day of February A. D. 1956

Jessie I. Sundstrom

Notary
Seal.

Notary Public Custer County, S. D.



STATE WATER RESOURCES COMMISSION
PIERRE, SOUTH DAKOTA

Custer Country Chronicle
THURSDAY, FEB. 16, 1956

APPROPRIATION OF WATER No. 419-2

Office of State Water
Resources Commission,
Pierre, S. Dak.,
January 24, 1956

Notice is hereby given that Wind Cave National Park, Earl M. Semingsen, Sup't., whose post-office address is Hot Springs, S. Dak., has made an application in accordance with the provisions of the water laws of South Dakota for a permit to appropriate for beneficial use 0.2 cubic feet of water per second of time from ground water through a well, the point of diversion of which is to be located on government land in Section 6 Twp. 5S Range 6E. Said water to be used for the purpose of providing irrigation on the following described land: approximately 6 acres at Wind Cave National Park headquarters and for fire protection, wildlife watering, public and domestic purposes.

This application will be taken up by the State Water Commission at their office at Pierre for consideration upon the 5th day of March, 1956, at 2:00 P. M. All interested persons may appear and be heard.

Appropriate action will be taken by the Water Resources Commission after suitable time has elapsed for the consideration of

any or all information presented.
State Water Resources
Commission
By:
J. W. Grimes,
Chief Engineer,
Executive Officer 467F23

(First Publication before February 9 1956)**APPROPRIATION OF WATER**

Office of State Water Resources Commission,

Pierre, S. Dak., January 24, 1956

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 cubic feet of water per second of time from ~~the~~ ground water through ~~the~~
a well, the point of diversion of which is to be located on ~~the~~ government
 land in ~~XXXXXX~~ Section 6
 Twp. 5S Range 6E Said water to be used for the purpose of providing irrigation on the fol-
 lowing described land: approximately 6 acres at Wind Cave National Park
headquarters

and for fire protection, wildlife watering, public and domestic purposes.

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

State Water Resources Commission

By:

J. W. Orimes, Chief Engineer, Executive Officer

cc: Mr. Carl H. Sundstrom
 Custer County Chronicle
 Custer, South Dakota

Permit No. 419-2Water Division 2 Fall River Water District

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

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

I have this day made a thorough examination of the water use system constructed by Wind Cave
National Park of Hot Springs, S.D. holder
of Permit No. 419-2, bearing date of priority of December 29, 1955
authorizing the diversion of .44 cu. ft. per second of the waters of ground water & springs
for domestic & irrigation purposes, in Fall River County.

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

The Water Use System consists of,

A. Works used to divert the water:
700 foot well, 5 inch steel casing
Electric submersible pump
20 h.p. electric Peerless booster pump

B. Works used to transport water to place of use,
Approx. 7000 feet 4" cast iron
Approx. 17,000 feet 6" cast iron
Approx. 10,000 feet 2" cast iron

C. Works used to apply water to beneficial use.

Storage reservoir: (1 - 100,000 gal.) to service connections.
3 - 25,000 gal.

The system is in the following condition: excellent

The point of diversion is located well: 1000 feet north of SE corner Sec 6, T6S,
R6E, B.H.M.; springs: NE¼ Sec 32, T5S, R5E, B.H.M.

The works are capable of diverting and conveying to the place of use .15
cu. ft. per second of water which is to be used for domestic & irrigation purposes

Water has been put to beneficial use to the maximum extent as follows: _____

NW¼ SW¼ Section 1, T6S, R5E, B.H.M.

comprising a total of 6 acres of land.

Send to: Lester F. McClanahan,
Superintendent
Wind Cave National Park
Hot Springs, S.D. 57747

Date 5-5-75

Thomas Gardner
(Signature)
Thomas Gardner
Water Resources Engineer

449-2

For :

J. W. Grimes
Chief Engineer.
State Water Resources Commission
Pierre, S. D.

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WIND CAVE NATIONAL PARK
HOT SPRINGS, SOUTH DAKOTA

Part of Application for Permit
to drill water well
Wind Cave National Park
Hot Springs, S. D.

November 15, 1955 *Exd.*

INVITATION FOR BIDS

BID FORM

AND

SPECIFICATIONS

FOR

DRILLING OF A WATER WELL

AT

WIND CAVE NATIONAL PARK

SOUTH DAKOTA

DRILLING OF A WATER WELL AT WIND CAVE NATIONAL PARK, SOUTH DAKOTA

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DRILLING OF A WATER WELL AT WIND CAVE NATIONAL PARK, SOUTH DAKOTA

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INSTRUCTIONS TO BIDDERS

(CONSTRUCTION CONTRACTS)

(These instructions are not to be incorporated in the contract)

1. **Explanation to Bidders.** Any explanation desired by bidders regarding the meaning or interpretation of the drawings and specifications must be requested in writing and with sufficient time allowed for a reply to reach them before the submission of their bids. Oral explanations or instructions given before the award of the contract will not be binding. Any interpretation made will be in the form of an addendum to the specifications or drawings and will be furnished to all bidders and its receipt by the bidder shall be acknowledged.

2. **Conditions at Site of Work.** Bidders should visit the site to ascertain pertinent local conditions readily determined by inspection and inquiry, such as the location, accessibility and general character of the site, labor conditions, the character and extent of existing work within or adjacent thereto, and any other work being performed thereon.

3. **Bidder's Qualifications.** Before a bid is considered for award, the bidder may be requested by the Government to submit a statement of facts in detail as to his previous experience in performing similar or comparable work, and of his business and technical organization and financial resources and plant available and to be used in performing the contemplated work.

4. **Bid Guaranty.** Where security is required, failure to submit the same with the bid may be cause for rejection. The bidder, at his option, may furnish a bid bond, postal money order, certified check, or cashier's check, or may deposit, in accordance with Treasury Department regulations, bonds or notes of the United States (at par value) as security in the amount required: *Provided*, That where the total amount of the bid is \$2,000 or less, the contracting agency may declare a bid bond unacceptable by so stating in the specifications or Invitation for Bids.

In case security is in the form of postal money order, certified check, cashier's check, or bonds or notes of the United States, the Government may make such disposition of the same as will accomplish the purpose for which submitted.

Checks may be held uncollected at the bidder's risk. Checks, or the amounts thereof, and bonds or notes of the United States deposited by unsuccessful bidders will be returned as soon as practicable after the opening.

5. **Preparation of Bids.** (a) Bids shall be submitted on the forms furnished, or copies thereof, and must be manually signed. If erasures or other changes appear on the forms, each such erasure or change must be initialed by the person signing the bid.

(b) The form of bid will provide for quotation of a price, or prices, for one or more items which may be lump sum bids, alternate prices, scheduled items resulting in a bid on a unit of construction or a combination thereof, etc. Where required on the bid form, bidders must quote on all items and *they are warned* that failure to do so may disqualify the bid. When quotations on all items are not required, bidders should insert the words "no bid" in the space provided for any item on which no quotation is made.

(c) Alternative bids will not be considered unless called for.

(d) Unless specifically called for, telegraphic bids will not be considered. Modification by telegram of bids already submitted will be considered if received prior to the time fixed in the Invitation for Bids. Telegraphic modifications shall not reveal the amount of the original or revised bid.

6. **Submission of Bids.** Bids must be submitted as directed on the bid form.

7. **Receipt and Opening of Bids.** (a) Bids will be submitted prior to the time fixed in the Invitation for Bids. Bids received after the time so fixed are late bids; and the exact date and hour of mailing such bids, as shown by the cancellation stamp or by the stamp of an approved metering device will be recorded. Such late bids will be considered, *Provided*, They are received before the award has been made, *And provided further*, The failure to arrive on time was due solely to a delay in the mails for which the bidder was not responsible; otherwise late bids will not be con-

sidered but will be held unopened until the time of award and then returned to the bidder, unless other disposition is requested or agreed to by the bidder.

(b) Subject to the provisions of paragraph 5(d) of these instructions, bids or bid modifications which were deposited for transmission by telegraph in time for receipt, by normal transmission procedure, prior to the time fixed in the Invitation for Bids and subsequently delayed by the telegraph company through no fault or neglect on the part of the bidder, will be considered if received prior to the award of the contract. The burden of proof of such abnormal delay will be upon the bidder and the decision as to whether or not the delay was so caused will rest with the officer awarding the contract.

(c) No responsibility will attach to any officer for the premature opening of, or the failure to open, a bid not properly addressed and identified.

8. Withdrawals of Bids. Bids may be withdrawn on written or telegraphic request received from bidders prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

9. Bidders Present. At the time fixed for the opening of bids, their contents will be made public for the information of bidders and others properly interested, who may be present either in person or by representative.

10. Bidders Interested in More than One Bid. If more than one bid be offered by any one party, by or in the name of his or their clerk, partner, or other person, all such bids will be rejected. A party who has quoted prices to a

bidder is not thereby disqualified from quoting prices to other bidders or from submitting a bid directly for the work.

11. Award of Contract. (a) The contract will be awarded as soon as practicable to the lowest responsible bidder, price and other factors considered, provided his bid is reasonable and it is to the interest of the Government to accept it.

(b) The Government reserves the right to waive any informality in bids received when such waiver is in the interest of the Government. In case of error in the extension of prices, the unit price will govern.

(c) The Government further reserves the right to accept or reject any or all items of any bid, unless the bidder qualifies such bid by specific limitation; also to make an award to the bidder whose aggregate bid on any combination of bid items is low.

12. Rejection of Bids. The Government reserves the right to reject any and all bids when such rejection is in the interest of the Government; to reject the bid of a bidder who has previously failed to perform properly or complete on time contracts of a similar nature; and to reject the bid of a bidder who is not, in the opinion of the Contracting Officer, in a position to perform the contract.

13. Contract and Bonds. The bidder to whom award is made shall, within the time established in the bid and when required, enter into a written contract with the Government and furnish performance and payment bonds on Government Standard Forms. The bonds shall be in the amounts indicated in the specifications or the Invitation for Bids.

INVITATION FOR BIDS
(CONSTRUCTION CONTRACT)

DATE November 15, 1955

NAME AND LOCATION OF PROJECT

Drilling of a Water Well at
Wind Cave National Park,
South Dakota

DEPARTMENT OR AGENCY

U. S. Department of the Interior
National Park Service
Wind Cave National Park

BY (Issuing office)

Earl M. Semingsen, Superintendent
Wind Cave National Park
Hot Springs, South Dakota

Sealed bids in duplicate for furnishing all labor, equipment, and materials and performing all work for the project described herein will be received until 2:00 p.m., M.S.T., November 28, 1955

in the Office of the Superintendent, Wind Cave National Park

and then publicly opened.

Information regarding bidding material, bid guarantee, and bonds

A guarantee of 10% of the amount will be required with each bid (see paragraph 4 of the Instructions to Bidders).

Performance Bond of 50% of the contract price will be required.

Payment Bond of 50% of the contract price will be required.

Liquidated damages will be assessed as per Article 2, Section III of the Specifications.

Article on patents will be made a part of the contract. (See Article 13 of General Provisions of Construction Contract, U. S. Standard Form 23A).

Description of work

Furnishing all plant, labor, equipment, appliances, and materials, and performing all operations in connection with the Drilling of a Water Well at Wind Cave National Park, South Dakota.

Information regarding liquidated damages (if any), payments, etc., is attached or made a part of the specifications. Bids shall be submitted on the forms furnished or copies thereof.

STANDARD FORM 21

REVISED MARCH 1951

GENERAL SERVICES ADMINISTRATION

GENERAL REGULATION NO. 13

BID FORM
(CONSTRUCTION CONTRACT)

REFERENCE

Read the Instructions to Bidders (Standard Form 22)

This form to be submitted in

DATE OF INVITATION

November 15, 1955

NAME AND LOCATION OF PROJECT

Drilling of a Water Well at Wind Cave National Park, South Dakota

TO: Earl M. Semingsen, Superintendent
Wind Cave National Park
Hot Springs, South Dakota

(Date)

In compliance with your invitation for bids of the above date, the undersigned hereby proposes to furnish all labor, equipment, and materials and perform all work for **Drilling of a water well**

at Wind Cave National Park, South Dakota

in strict accordance with the specifications, schedules, drawings, and conditions for the consideration of the following amount(s)

SEE ATTACHED CONTRACT BID SCHEDULE

and agrees that, upon written acceptance of this bid, mailed, or otherwise furnished, within 30 calendar days (30 calendar days unless a shorter period be inserted by the bidder) after the date of opening of bids, he will within 15 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract, and give performance bond and payment bond on Government standard forms, if these forms are required, with good and sufficient surety or sureties.

The undersigned agrees that if awarded the contract, he will commence the work **within 15 days** after the date of receipt of notice to proceed, and that he will complete the work within **90** calendar days after the date of receipt of notice to proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (*Give number and date of each*):

The undersigned represents (*Check appropriate boxes*): (1) that the aggregate number of employees of the bidder and its affiliates is ☐ 500 or more, ☐ less than 500; (2) (a) that he ☐ has ☐ has not, employed or retained any company or person (*other than a full-time bona fide employee working solely for the bidder*) to solicit or secure this contract; and (b) that he ☐ has, ☐ has not, paid or agreed to pay to any company or person (*other than a full-time bona fide employee working solely for the bidder*) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating thereto as requested by the contracting officer. (*Note: For interpretation of the representation, including the term "bona fide employee," see General Services Administration Regulations, Title 44, secs. 150.7 and 150.5 (d) Fed. Reg., Dec. 31, 1952, Vol. 17, No. 253.*)

Enclosed is bid guarantee, consisting of

in the amount of

NAME OF FIRM OR INDIVIDUAL (<i>Type or print</i>)	FULL NAME OF ALL PARTNERS (<i>Type or print</i>)
BUSINESS ADDRESS (<i>Type or print</i>)	
BY (<i>Signature in ink. Type or print name under signature</i>)	
TITLE (<i>Type or print</i>)	
STATE OF INCORPORATION (<i>Type or print</i>)	

DIRECTIONS FOR SUBMITTING BIDS

Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:

Bid for Drilling of a Water Well
Superintendent
Wind Cave National Park
Hot Springs, South Dakota

(To be opened 2:00 p.m., M.S.T., November 28, 1955)

CAUTION: Do not include in the envelope any bids for other work.
Bids should not be qualified by exceptions to the bidding conditions.

CONTRACT BID SCHEDULE

Drilling of a Water Well, Wind Cave National Park

(BIDDER PLEASE NOTE: Before preparing the Proposal, read carefully, "Invitation for Bids" and "Instructions to Bidders".)

The bidder shall insert a bid price in this Schedule opposite each item for which a quantity appears. A bid price is not to be entered for any element except those shown below.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
1.	100	Lin.Ft., 10-inch bore, surface to 100 feet at _____ per lin.ft.	_____	_____
2.	100	Lin.Ft., 10-inch bore, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
3.	100	Lin.Ft., 10-inch bore, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
4.	100	Lin.Ft., 10-inch bore, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
5.	100	Lin.Ft., 10-inch bore, 400 feet to 500 feet at _____ per lin.ft.	_____	_____
6.	100	Lin.Ft., of 10-inch bore, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
7.	100	Lin.Ft., 10-inch bore, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
8.	100	Lin.Ft., 10-inch bore, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
9.	100	Lin.Ft., 8-inch casing installed, surface to 100 feet at _____ per lin.ft.	_____	_____

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
10.	100	Lin.Ft., 8-inch casing installed, 100 feet to 200 feet at _____ _____ per lin.ft.	_____	_____
11.	100	Lin.Ft., 8-inch casing installed, 200 ft. to 300 feet at _____ _____ per lin.ft.	_____	_____
12.	100	Lin.Ft., 8-inch casing installed, 300 feet to 400 feet at _____ _____ per lin.ft.	_____	_____
13.	100	Lin.Ft., 8-inch casing installed, 400 feet to 500 feet at _____ _____ per lin.ft.	_____	_____
14.	100	Lin.Ft., 8-inch casing installed, 500 feet to 600 feet at _____ _____ per lin.ft.	_____	_____
15.	100	Lin.Ft., 8-inch casing installed, 600 feet to 700 feet at _____ _____ per lin.ft.	_____	_____
16.	100	Lin.Ft., 8-inch casing installed, 700 feet to 800 feet at _____ _____ per lin.ft.	_____	_____
17.	1	Each, Developing Well at _____ _____ each.	_____	_____
18.	50	Hours, pumping test at _____ _____ per hour.	_____	_____
19.	800	Lin.Ft., Filling of abandoned 10-inch bore at _____ _____ per lin.ft.	_____	_____

TOTAL COST, MAIN BID, Items 1 through 19 \$ _____

The quantities shown above will be used for the purposes of canvassing the bids and awarding the work. However, payment to the Contractor will be made on the basis of actual quantities of work required

by the Contracting Officer and performed by the Contractor.

It is to the interest of the Government that award be made to one bidder. Therefore, award will not be made on the basis of the low bid on individual items, but on the basis of the low bid for the complete work.

ALTERNATE BID "A"

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
1.	100	Lin.Ft., 12-inch bore, surface to 100 feet at _____ per lin.ft.	_____	_____
2.	100	Lin.Ft., 12-inch bore, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
3.	100	Lin.Ft., 12-inch bore, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
4.	100	Lin.Ft., 12-inch bore, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
5.	100	Lin.Ft., 12-inch bore, 400 feet to 500 feet at _____ per lin.ft.	_____	_____
6.	100	Lin.Ft., 12-inch bore, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
7.	100	Lin.Ft., 12-inch bore, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
8.	100	Lin.Ft., 12-inch bore, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
9.	100	Lin.Ft., 10-inch casing installed, surface to 100 feet at _____ per lin.ft.	_____	_____

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
10.	100	Lin.Ft., 10-inch casing installed, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
11.	100	Lin.Ft., 10-inch casing installed, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
12.	100	Lin.Ft., 10-inch casing installed, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
13.	100	Lin.Ft., 10-inch casing installed, 400 feet to 500 feet at _____ Per lin.ft.	_____	_____
14.	100	Lin.Ft., 10-inch casing installed, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
15.	100	Lin.Ft., 10-inch casing installed, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
16.	100	Lin.Ft., 10-inch casing installed, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
17.	1	Each Developing Well at _____ each.	_____	_____
18.	50	Hours, pumping test at _____ per hour.	_____	_____
19.	800	Lin.Ft., Filling of abandoned 12-inch bore at _____ per lin.ft.	_____	_____

TOTAL COST, ALTERNATE BID "A", Items 1 through 19 \$ _____

The quantities shown above will be used for the purposes of canvassing the bids and awarding the work. However, payment to the Contractor will be made on the basis of actual quantities of work required by the Contracting Officer and performed by the Contractor.

It is to the interest of the Government that award be made to one bidder. Therefore, award will not be made on the basis of the low bid on individual items, but on the basis of the low bid for the complete work.

ADDITIONAL ITEMS

Each Additional Item shown below will be required only if directed by the Contracting Officer and provided there are sufficient funds available for payment. The quantities shown below will be used for canvassing the bids and will apply to either the Main Bid or Alternate Bid "A". Payment to the Contractor will be made on the basis of actual quantities of work required by the Contracting Officer and performed by the Contractor.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
20.	800	Lin.Ft., Combination Gamma-Ray-Neutron log of well from surface to 800 feet, at _____		
		_____ per lump sum.		\$ _____
21.	800	Lin.Ft., Section Gage (Hole Caliper) Survey from surface to 800 feet at _____		
		_____ per lump sum		_____
22.	800	Lin.Ft., Temperature Survey from surface to 800 feet at _____		
		_____ per lump sum		_____
TOTAL OF ADDITIONAL ITEMS, Items 20 through 22				\$ _____

STANDARD FORM 21
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 13

BID FORM
(CONSTRUCTION CONTRACT)

REFERENCE

*Read the Instructions to Bidders (Standard Form 22)
This form to be submitted in*

DATE OF INVITATION

November 15, 1955

NAME AND LOCATION OF PROJECT

Drilling of a Water Well at Wind Cave National Park, South Dakota

TO: Earl M. Semingsen, Superintendent
Wind Cave National Park
Hot Springs, South Dakota

(Date)

In compliance with your invitation for bids of the above date, the undersigned hereby proposes to furnish all labor, equipment, and materials and perform all work for drilling of a water well

at Wind Cave National Park, South Dakota

in strict accordance with the specifications, schedules, drawings, and conditions for the consideration of the following amount(s)

SEE ATTACHED CONTRACT BID SCHEDULE

and agrees that, upon written acceptance of this bid, mailed, or otherwise furnished; within 30 calendar days (30 calendar days unless a shorter period be inserted by the bidder) after the date of opening of bids, he will within 15 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract, and give performance bond and payment bond on Government standard forms, if these forms are required, with good and sufficient surety or sureties.

The undersigned agrees that if awarded the contract, he will commence the work **within 15 days** after the date of receipt of notice to proceed, and that he will complete the work within **90** calendar days after the date of receipt of notice to proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (Give number and date of each):

The undersigned represents (Check appropriate boxes): (1) that the aggregate number of employees of the bidder and its affiliates is ☐ 500 or more, ☐ less than 500; (2) (a) that he ☐ has ☐ has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract; and (b) that he ☐ has, ☐ has not, paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating thereto as requested by the contracting officer. (Note: For interpretation of the representation, including the term "bona fide employee," see General Services Administration Regulations, Title 44, secs. 150.7 and 150.5 (d) Fed. Reg., Dec. 31, 1952, Vol. 17, No. 23.)

Enclosed is bid guarantee, consisting of

in the amount of

NAME OF FIRM OR INDIVIDUAL (Type or print)	FULL NAME OF ALL PARTNERS (Type or print)
BUSINESS ADDRESS (Type or print)	
BY (Signature in ink. Type or print name under signature)	
TITLE (Type or print)	
STATE OF INCORPORATION (Type or print)	

DIRECTIONS FOR SUBMITTING BIDS

Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:

Bid for Drilling of a Water Well
Superintendent
Wind Cave National Park
Hot Springs, South Dakota

(To be opened 2:00 p.m., M.S.T., November 28, 1955)

CAUTION: Do not include in the envelope any bids for other work.
Bids should not be qualified by exceptions to the bidding conditions.

CONTRACT BID SCHEDULE

Drilling of a Water Well, Wind Cave National Park

(BIDDER PLEASE NOTE: Before preparing the Proposal, read carefully, "Invitation for Bids" and "Instructions to Bidders".)

The bidder shall insert a bid price in this Schedule opposite each item for which a quantity appears. A bid price is not to be entered for any element except those shown below.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
1.	100	Lin.Ft., 10-inch bore, surface to 100 feet at _____ per lin.ft.	_____	_____
2.	100	Lin.Ft., 10-inch bore, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
3.	100	Lin.Ft., 10-inch bore, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
4.	100	Lin.Ft., 10-inch bore, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
5.	100	Lin.Ft., 10-inch bore, 400 feet to 500 feet at _____ per lin.ft.	_____	_____
6.	100	Lin.Ft., of 10-inch bore, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
7.	100	Lin.Ft., 10-inch bore, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
8.	100	Lin.Ft., 10-inch bore, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
9.	100	Lin.Ft., 8-inch casing installed, surface to 100 feet at _____ per lin.ft.	_____	_____

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
10.	100	Lin.Ft., 8-inch casing installed, 100 feet to 200 feet at _____ _____ per lin.ft.	_____	_____
11.	100	Lin.Ft., 8-inch casing installed, 200 ft. to 300 feet at _____ _____ per lin.ft.	_____	_____
12.	100	Lin.Ft., 8-inch casing installed, 300 feet to 400 feet at _____ _____ per lin.ft.	_____	_____
13.	100	Lin.Ft., 8-inch casing installed, 400 feet to 500 feet at _____ _____ per lin.ft.	_____	_____
14.	100	Lin.Ft., 8-inch casing installed, 500 feet to 600 feet at _____ _____ per lin.ft.	_____	_____
15.	100	Lin.Ft., 8-inch casing installed, 600 feet to 700 feet at _____ _____ per lin.ft.	_____	_____
16.	100	Lin.Ft., 8-inch casing installed, 700 feet to 800 feet at _____ _____ per lin.ft.	_____	_____
17.	1	Each, Developing Well at _____ _____ each.	_____	_____
18.	50	Hours, pumping test at _____ _____ per hour.	_____	_____
19.	800	Lin.Ft., Filling of abandoned 10-inch bore at _____ _____ per lin.ft.	_____	_____

TOTAL COST, MAIN BID, Items 1 through 19 \$ _____

The quantities shown above will be used for the purposes of canvassing the bids and awarding the work. However, payment to the Contractor will be made on the basis of actual quantities of work required

by the Contracting Officer and performed by the Contractor.

It is to the interest of the Government that award be made to one bidder. Therefore, award will not be made on the basis of the low bid on individual items, but on the basis of the low bid for the complete work.

ALTERNATE BID "A"

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
1.	100	Lin.Ft., 12-inch bore, surface to 100 feet at _____ per lin.ft.	_____	_____
2.	100	Lin.Ft., 12-inch bore, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
3.	100	Lin.Ft., 12-inch bore, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
4.	100	Lin.Ft., 12-inch bore, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
5.	100	Lin.Ft., 12-inch bore, 400 feet to 500 feet at _____ per lin.ft.	_____	_____
6.	100	Lin.Ft., 12-inch bore, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
7.	100	Lin.Ft., 12-inch bore, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
8.	100	Lin.Ft., 12-inch bore, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
9.	100	Lin.Ft., 10-inch casing installed, surface to 100 feet at _____ per lin.ft.	_____	_____

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
10.	100	Lin.Ft., 10-inch casing installed, 100 feet to 200 feet at _____ per lin.ft.	_____	_____
11.	100	Lin.Ft., 10-inch casing installed, 200 feet to 300 feet at _____ per lin.ft.	_____	_____
12.	100	Lin.Ft., 10-inch casing installed, 300 feet to 400 feet at _____ per lin.ft.	_____	_____
13.	100	Lin.Ft., 10-inch casing installed, 400 feet to 500 feet at _____ Per lin.ft.	_____	_____
14.	100	Lin.Ft., 10-inch casing installed, 500 feet to 600 feet at _____ per lin.ft.	_____	_____
15.	100	Lin.Ft., 10-inch casing installed, 600 feet to 700 feet at _____ per lin.ft.	_____	_____
16.	100	Lin.Ft., 10-inch casing installed, 700 feet to 800 feet at _____ per lin.ft.	_____	_____
17.	1	Each Developing Well at _____ each.	_____	_____
18.	50	Hours, pumping test at _____ per hour.	_____	_____
19.	800	Lin.Ft., Filling of abandoned 12-inch bore at _____ per lin.ft.	_____	_____

TOTAL COST, ALTERNATE BID "A", Items 1 through 19 \$ _____

The quantities shown above will be used for the purposes of canvassing the bids and awarding the work. However, payment to the Contractor will be made on the basis of actual quantities of work required by the Contracting Officer and performed by the Contractor.

It is to the interest of the Government that award be made to one bidder. Therefore, award will not be made on the basis of the low bid on individual items, but on the basis of the low bid for the complete work.

ADDITIONAL ITEMS

Each Additional Item shown below will be required only if directed by the Contracting Officer and provided there are sufficient funds available for payment. The quantities shown below will be used for canvassing the bids and will apply to either the Main Bid or Alternate Bid "A". Payment to the Contractor will be made on the basis of actual quantities of work required by the Contracting Officer and performed by the Contractor.

ITEM NO.	ESTIMATED QUANTITY	ITEM WITH UNIT BID PRICE (WRITTEN IN WORDS)	UNIT PRICE (IN FIGURES)	AMOUNT BID
20.	800	Lin.Ft., Combination Gamma-Ray-Neutron log of well from surface to 800 feet, at _____	_____ per lump sum.	\$ _____
21.	800	Lin.Ft., Section Gage (Hole Caliper) Survey from surface to 800 feet at _____	_____ per lump sum	_____
22.	800	Lin.Ft., Temperature Survey from surface to 800 feet at _____	_____ per lump sum	_____
TOTAL OF ADDITIONAL ITEMS, Items 20 through 22				\$ _____

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WESTERN OFFICE
DIVISION OF DESIGN AND CONSTRUCTION
SAN FRANCISCO 9, CALIFORNIA

Amendment to

Standard Form 32 and Standard Form 23A

The following clause supersedes Article 18 of Standard Form 32, General Provisions (Supply Contract), and Article 19 of Standard Form 23A (Construction Contract):

"NONDISCRIMINATION IN EMPLOYMENT

"In connection with the performance of work under this contract, the contractor agrees not to discriminate against any employee or applicant for employment because of race, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the nondiscrimination clause.

"The contractor further agrees to insert the foregoing provision in all subcontracts hereunder, except subcontracts for standard commercial supplies or raw materials."

A new provision is added and made part of each of the above-mentioned forms as follows:

"UNITED STATES-FLAG VESSEL PROVISION: The Contractor agrees to ship on privately owned United States-flag commercial vessels at least 50 per centum of the gross tonnage of any equipment, materials, or commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) which may be transported on ocean vessels. Pursuant to section 901(b) of the Merchant Marine Act, 1936, as amended (46 U.S.C. sec. 1241(b)), the Secretary or his duly authorized representative may permit shipment in a manner other than that required by this provision upon the basis of evidence furnished by the Contractor that United States-flag commercial vessels are not available at fair and reasonable rates for United States-flag commercial vessels. The Contractor will be required to certify compliance with this requirement prior to final payment."

The following clause supersedes Clause 6 of Standard Form 23A (General Provisions, Construction Contracts) and Clause 12 of Standard Form 32 (General Provisions, Supply Contract):

"Disputes - Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall furnish to the Contractor a written copy of his decision. Such decision shall be final and conclusive unless within 30 days from the date of receipt thereof, the Contractor appeals therefrom by mailing or otherwise furnishing to the Contracting Officer a written appeal addressed to the Secretary. The decision of the Secretary or his duly authorized representatives upon such appeal shall be final and conclusive unless the decision is fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith, or is not supported by substantial evidence. In connection with any appeal proceeding under the 'Disputes' clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision."

SECTION I

GENERAL PROVISIONS

Supplementing U. S. Standard Form No. 23A

1. BIDS AND BID BONDS. All bids and bid bonds shall be submitted in duplicate and all applicable blank spaces provided therefor on the respective forms shall be completed. (See Standard Form 21 and Standard Form 24.)

The amount of the bid bond shall be 10% of the total amount of the bid. The right is reserved to consider as informal any bid on which any alteration of or departure from the Form of Bid has been made. Unless otherwise specifically provided for in these specifications, it is expected that all of the work covered by these specifications will be let as a whole to one bidder.

The Bid form has an entry for all items on which estimates will be given or payments made, and no allowance of any kind will be made unless specifically provided for in these specifications, in the contract or in written orders for extra work.

2. CONTRACT AND BONDS. The bidder to whom award is made will be required to execute written contract with the United States, with good and approved performance bond, and payment bond, each in an amount not less than 50% of the amount of the contract, within 15 days after being notified of the acceptance of his bid.

The contract, performance bond and payment bond, which the bidder and sureties promise to execute shall be the standard Government Form of Contract for Construction, the Standard Government Form of Performance Bond, and the Standard Government Form of Payment Bond.

3. DEFINITION OF TERMS. Whenever the term "Contracting Officer" is used in these specifications, it is understood to refer to the Park Superintendent under whose supervision the work will be done. He will be represented on the work by as many assistants as may be necessary. Whenever the term "Contractor" is used, it is understood to refer to the second party of the contract. Subcontractors, as such, will not be recognized.

Whenever "as directed", "required", "as permitted", "approval", "acceptance", or other words of similar import are used, it shall be understood that the direction, requirements, permission, approval or acceptance of the Contracting Officer is intended unless stated otherwise.

4. BIDDERS TO VISIT SITE. All bidders are expected to visit the site of the work and to inform themselves as to all existing conditions.

Failure to do so will in no way relieve the successful bidder from the necessity of furnishing all equipment and materials and performing all work required for the completion of the contract in conformity with the specifications.

No allowance will be made for the failure of the bidder correctly to estimate the difficulties attending the execution of the work.

5. REPUTATION OF BIDDERS. The reputation of bidders as being skillful and successful in carrying out the work of the type and magnitude required by these specifications, and the adequacy of their resources and facilities for accomplishing the work satisfactorily and within the specified time, will be considered in making the award.

The Contracting Officer shall have the right to submit questionnaires to the bidder concerning the latter's financial resources, experience and equipment, and to reject the bid if the bidder fails to reply to the questionnaires, or if the replies thereto are unsatisfactory. The information contained in the replies of the questionnaires will be considered confidential.

6. SUBCONTRACTORS. Upon request and previous to the award, bidders shall submit lists of all subcontractors to whom they propose to sublet the various parts of the work. The Contracting Officer shall have the right to take such steps as he deems necessary to determine the ability of the subcontractors to handle their respective portions of the work successfully. Furthermore, bidders shall furnish to the Contracting Officer such information as may be required concerning the reputation and experience of the subcontractors and shall otherwise assist the Contracting Officer in ascertaining the fitness of the subcontractors for their respective parts of the work.

The Contracting Officer shall have the right to reject any bid if any of the subcontractors named on the list furnished are found to be inexperienced or if their reputation for doing only first class work is not demonstrated to the satisfaction of the Contracting Officer. However, bidders may, with the prior permission of the Contracting Officer, revise the list by selecting other subcontractors until it becomes satisfactory to the Contracting Officer.

Subsequent to the award, the Contractor shall, if he has not previously done so, submit for approval a complete list of subcontractors who will be engaged by him in the execution of the work. After the list of subcontractors has been approved, no changes shall be made in it without the permission and approval of the Contracting Officer. The Contracting Officer will, however, permit the Contractor to take the work out of the hands of any or all of the subcontractors and complete it himself, if for any reason it becomes necessary or desirable for him to do so.

7. SUPERVISION AND INSPECTION. All work done under this contract will be under the immediate supervision of duly qualified representatives appointed by the Contracting Officer, whose salaries will be paid by the United States.

The Contractor shall remove, reconstruct, replace and make good as directed, all defective materials and workmanship without additional charge and regardless of any previous approval or acceptance of such defective materials and workmanship.

In all questions relating to the interpretation of any part of these specifications, the decision of the Contracting Officer shall be final.

When the completed work is ready for final inspection, the Contractor shall notify the Contracting Officer in writing, and all defects and omissions the Contracting Officer may find during such final inspection shall be made good prior to final acceptance.

8. SPIRIT AND INTENT OF SPECIFICATIONS. It is the spirit and intent of these specifications, and of the drawings forming part of them, to provide that the work and all parts thereof shall be fully completed and suitable in every way for the purposes for which they are designed. The Contractor shall supply all materials and do all work which is described or which may be reasonably implied as being incidental to the work of this contract.

9. MINOR MODIFICATIONS. The Contractor shall make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the Contracting Officer, may be necessary or expedient to carry out the intent of the contract. No increase over the contract price will be paid to the Contractor on account of such minor modifications, provided that at the time the change is to be made the work involved has not already been executed. Work which materially increases the cost to the Contractor will not be ordered under the provisions of this paragraph.

10. ERRORS AND OMISSIONS. The Contractor will not be allowed to take advantage of any errors or omissions in these specifications or in the accompanying contract drawings as full instructions will always be given if such errors or omissions are discovered.

The Contractor shall, immediately upon his discovery of any statement or detail which is discrepant or which otherwise appears to be in error, bring the same to the attention of the Contracting Officer for decision or correction.

11. EXTRA WORK. The Contractor shall perform all extra work not covered by these specifications which, in the judgment of the Contracting Officer, may be necessary or expedient to carry out the intent of the contract or incidental in any way to the work of the contract, and which is ordered in writing by the Contracting Officer within his authority.

The cost of the respective items of extra work carried out under the provision of this paragraph will be paid for by one or the other of the following methods at the election of the Contracting Officer.

- (a) On the basis of a stated lump sum price, or other consideration fixed and agreed upon by negotiation between the Contracting Officer and the Contractor in advance, or
- (b) On the basis of actual cost of the extra work to the Contractor (including the hire or rental of such plant as may be used exclusively for such extra work and including overhead), plus fifteen per cent (15%) of that cost to cover profit and all indirect charges against such extra work except those specifically mentioned herein to be included.

In either case an appropriate extension of the working time, if such be necessary, will also be fixed and agreed upon, and stated in the written order in which the extra work is requested or otherwise established.

12. OWNERSHIP. All parts and materials paid for shall become thereby the sole property of the United States, but this provision shall not be interpreted as relieving the Contractor from the sole responsibility for the proper care and protection of said parts and materials prior to the completion of the work and its final acceptance by the United States, or from any other of the provisions of this contract; nor shall this provision be interpreted as preventing the Contracting Officer from requiring the Contractor to store and handle the parts and materials so as to preserve them from danger.

If any of the materials or parts of the work be lost, damaged, or destroyed by any cause or means whatsoever, the Contractor shall satisfactorily repair or replace the same at his own cost and shall be responsible for delays or incidental expenses that may result therefrom.

13. RESPONSIBILITY FOR EMPLOYEES AND PLANT. The Contractor shall be responsible for the safety of his employees, plant, and material, and for any injury or damage to or by them from any source or cause. He shall save and hold the United States free from all claims for damages to any and all persons and (or) property arising from the execution of the work covered by these specifications.

The Contractor shall make good at his own expense all damage to any property of the United States, arising from his operations under these specifications, or from the fault or neglect of any of his employees.

14. CONTRACTOR TO BE PRESENT. The Contractor shall be at all times either personally present at the construction site or be represented by a responsible agent, to be designated in writing by the Contractor, who shall be clothed with full authority to act for him in all cases and to carry out any instructions relative to the work which may be given by the Contracting Officer, either personally or through an authorized representative.

15. LEGAL RESTRICTIONS AND PERMITS. The Contractor shall procure at his own expense all necessary licenses and permits, and shall give due and adequate notice of all work which he proposes to start to those in control of properties which may be affected by his operations. The Contractor shall conform to all applicable laws, regulations and ordinances with regard to labor and methods employed on his operations.

16. EIGHT-HOUR LAWS, CONVICT LABOR, SUNDAY, HOLIDAY AND NIGHT WORK. Attention is invited to the Article on Labor Standards attached to and made part of the Standard Government Form of Contracts, revised April 3, 1942, covering the application of the eight-hour laws to the work to be done under this contract.

The Contractor shall employ no person undergoing sentence of imprisonment at hard labor.

No work shall be done on Sunday, on days declared by Congress as holidays for per diem employees of the United States, nor at night unless authorized in writing by the Contracting Officer.

17. LIMITATION OF OPERATIONS. The Contractor shall so conduct his operations as not to interfere with the ordinary use of the roads and other utilities. He shall provide and maintain all temporary roadways which may be authorized, barriers, colored lights, danger signals, and other devices necessary to provide for the traffic and safety. He shall keep his equipment and materials confined to the limits of the park roadways wherever possible. If departure from this rule is necessary, he shall obtain the Contracting Officer's permission before carrying on operations outside the park roadway.

Special attention shall be given the landscape features of the park and especial care taken to protect the natural surroundings. The Contractor shall not deface, injure, or destroy trees or shrubs, or remove or cut them without special authority. Any vegetation or ground surface damaged by departure from the above rules shall be replaced or restored as nearly as possible to original conditions by the Contractor at his expense.

18. COMPENSATION INSURANCE. The Contractor shall furnish compensation insurance for employees engaged in this work, and shall comply with the Workmen's Compensation Laws of the State in which the work is to be performed, and shall give proof of such insurance satisfactory to the Contracting Officer.

19. PROTESTS. If the Contractor considers any work demanded of him to be outside the requirements of the contract, or considers any record or ruling of the Contracting Officer or of the inspector to be unfair, he shall immediately ask for written instructions or decision and, within ten (10) days after the receipt of same, he shall file a written protest with the Contracting Officer, stating clearly the basis of his objection. Unless the Contractor files protest as thus provided, he will be considered to have accepted the record or ruling.

20. PARK SERVICE RULES AND REGULATIONS. The Contractor and his subordinates shall at all times during their presence in the Park Service Area conduct themselves in strict accordance with the Park Service rules and regulations promulgated by the constituted authority - The Secretary of the Interior. Upon written request from the Contracting Officer, the Contractor shall discharge from his employ any official or employee who does not obey said Park Service rules and regulations and such official or employee so discharged shall not be rehired or re-employed by the Contractor for any work to be done on this contract.

21. ACCIDENT PREVENTION. In the performance of this contract, the Contractor shall comply with all pertinent provisions of the "Federal Requirements for Safety in Excavation, Building, and Construction Work", and will furnish and will cause to be used such additional safeguards, safety devices and protective equipment as the Contracting Officer may determine to be reasonably necessary to protect the life and health of employees. The Contractor will maintain an accurate record of, and will report to the Contracting Officer all accidents arising out of and in the course of employment on work under this contract resulting in death, occupational disease, or injury requiring medical attention or causing loss of time from work on Form 10-403 furnished by the Contracting Officer. Nothing in this article shall be construed to relieve the Contractor from compliance with applicable State and local safety, health and sanitation laws.

22. FEDERAL TAX. If any Federal sales or other Federal tax is imposed or changed after the date set for the opening of this bid and is made applicable to and paid by the Contractor on the articles or supplies herein contracted for, then the prices named in this bid will be increased or decreased accordingly.

23. PATENTS. The Contractor shall hold and save the Government, its officers, agents, servants and employees, harmless from liability of any nature or kind, including costs and expenses, for or on account of any patented or unpatented invention, article or appliance manufactured or used in the performance of this contract, including their use by the Government.

24. APPROVAL. This contract shall be subject (1) to the written approval of the Regional Director, provided the amount of the contract is in excess of \$25,000.00 but less than

\$50,000.00 or (2) to the approval of the Director, National Park Service, Washington, D.C., provided the amount of the contract is in excess of \$50,000.00, and shall not be binding until so approved.

25. GUARANTY. All work under this contract shall be guaranteed for one year from date of acceptance by the Government, except when a different period is specifically prescribed. All guaranties embraced in or required by this contract are subject to the terms of this paragraph unless otherwise expressly agreed in writing by the parties to the contract. Wherever work is required to be guaranteed, the Contractor, when notified by the Contracting Officer, must immediately (1) place in satisfactory condition in every particular any of the guaranteed work, and (2) make good all damages to the structures and grounds or equipment and contents thereof if such unsatisfactory condition or damage develops within the period stipulated by the guaranty and is due to the use of materials or workmanship which are inferior, defective, or not in accordance with this contract, and must make good any work or materials or the equipment and contents of said structures or grounds which are disturbed in fulfilling the requirements of this contract or of any guaranty embraced in or required hereby.

26. LAYOUT OF WORK. The Contracting Officer will set construction stakes establishing lines, slopes, and grades. These stakes and marks shall constitute the field control by and in accordance with which the Contractor shall govern and execute the work.

The Contractor shall furnish, free of charge, all additional stakes, all templates, batter boards, and other materials and supplies necessary for marking and maintaining points and lines established, and shall furnish the Contracting Officer such labor as he may reasonably require in establishing points and lines necessary to the prosecution of the work to satisfactory completion. The Contractor shall be held responsible for the preservation of all stakes and marks, and if any of the construction stakes or marks have been carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them shall be charged against him, and shall be deducted from the payment for the work.

In the case of "changed" or "changed conditions" which involve any changes in stakeout, the Contractor shall cooperate with the Contracting Officer and facilitate the prompt re-establishment of the field control for the altered or adjusted work.

SECTION II

LABOR PROVISIONS

1. REPORTS OF EMPLOYEES. The Contractor shall furnish each week, and shall cause all subcontractors to furnish in like manner, a sworn affidavit with respect to the wages paid each employee during the preceding week. The affidavit shall be in the following form:

State of _____

County of _____

I, _____ (Name of party
signing affidavit) _____ (title),
being duly sworn, do depose and say: That I pay or supervise
the payment of the persons employed by _____
_____ (Contractor or subcontractor) on the _____

_____ (building or work); that during the pay-roll period commencing
on the _____ day of _____, 19____, and ending on
the _____ day of _____, 19____, all persons em-
ployed on said project have been paid the full weekly wages earned,
that no rebates have been or will be made either directly or
indirectly to or on behalf of said _____
(Contractor or subcontractor) from the full weekly wages earned by
any person and that no deductions have been made either directly
or indirectly from the full weekly wages earned by any person,
other than permissible deductions, as defined in the regulations
under the "Kickback" Act (48 Stat. 948) and described below:

(Paragraph describing deductions, if any)

(Signature and Title)

Sworn to before me this _____ day of _____, 19____.

Said affidavit shall be executed and sworn to by the officer or employee of the Contractor or subcontractor who supervises the payment of its employees.

Said affidavit shall be delivered, within seven days after the payment of the payroll to which it pertains, to the Government representative in charge at the site of the particular project in respect of which it is furnished, who shall forward the same promptly to the Contracting Officer. If no Government representative is in charge at the site, such shall be mailed within such seven-day period to the Contracting Officer.

At the time that the first affidavit with respect to the wages paid to employees is required to be filed by the Contractor pursuant to the requirements of these specifications, there shall also be filed, in the manner required above, a statement under oath by the Contractor, setting forth the name of its officer or employee who supervises the payment of employees, and that such officer or employee is in a position to have full knowledge of the facts set forth in the form of an affidavit required above. A similar affidavit shall be filed immediately in the event of a change in the officer or employee who supervises the payment of employees. In the event the Contractor is a corporation, such affidavit shall be executed by its president or vice-president. In the event the Contractor is a partnership, such affidavit shall be executed by a member of the firm.

Weekly payrolls shall be submitted.

Each Contractor or subcontractor shall preserve his weekly payroll records for a period of three years from date of completion of the contract. The payroll records shall set out accurately and completely the name, occupation and hourly wage rate of each employee, hours worked by him during the payroll period, the full weekly wages earned by him, any deductions made from such weekly wages, and the actual weekly wages paid to him. Such payroll records shall be made available at all times for inspection by the Contracting Officer or his authorized representative.

2. REPORT OF MATERIALS. The Contractor shall, upon request of the Contracting Officer, to do so, furnish to the latter copies of bills of all materials intended for use either in the permanent structure or in the plant or falsework. The Contractor shall also upon request of the Contracting Officer, to do so, make daily reports to the Contracting Officer covering the amounts of materials received or enroute and the number and classification of all men engaged upon the work for the preceding day.

3. NON-DISCRIMINATION. The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and shall require an identical provision to be included in all subcontracts made in connection with this agreement in accordance with Executive Order No. 9346, dated May 27, 1943.

4. EQUIPMENT RENTAL. No individual shall be employed as a laborer on this contract except on a wage basis, but this shall not be construed to prohibit the rental of teams, trucks or other equipment from individuals. No such rental agreement, or any charges for food, gasoline, supplies or repairs on account of such agreement, shall cause any deduction from the wages accruing to any employee.

All of the above provisions shall also apply where work is to be performed by piece work, station work, or by subcontract. The minimum wage shall be exclusive of equipment rental or any equipment which the Contractor's employee may furnish for accomplishing his work.

5. **CLASSIFICATION OF LABOR.** Any class of laborers and mechanics not listed in Article 6 of this section for minimum wage rates, who will be employed on this contract, shall be classified or reclassified conformably to that schedule. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendations of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.

6. **MINIMUM WAGE RATES.** (Article 20 of Construction Contract Standard Form No. 23.) In compliance with the Act of August 30, 1935 (49 Stat. 1011, as amended), the Secretary of Labor has made a determination for the minimum prevailing wage rates which may be paid the following classes of labor to be employed on the work, as per attached Sheet.

The wage rates contained in this decision are straight hourly wage rates. In some areas management and labor organizations in the construction industry have collectively bargained for health and welfare fund contributions. Such contributions are not included in wage rates determined by the Secretary of Labor for construction projects.

Apprentices employed pursuant to this determination of wage rates must be registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Federal Committee on Apprenticeship, U. S. Department of Labor; or if no such recognized agency exists in a State, it shall mean a program registered with the Bureau of Apprenticeship, U. S. Department of Labor.

While the wage rates shown are the minimum hourly rates required by the specifications to be paid during the life of the contract, it is the responsibility of bidders to inform themselves as to the local labor conditions, such as the length of workday and workweek, overtime compensation, health and welfare contributions, labor supply, and prospective changes or adjustment of wage rates. No increase in the contract price shall be allowed or authorized on account of the payment of wage rates in excess of those listed herein. (5 USC, 1946 ed. Sec. 22).

7. **SUBSISTENCE.** Deleted

6. MINIMUM WAGE RATES (Continued from Page 10)

The Secretary of Labor has made a determination as of September 6, 1955, Case No. P-3121, for the minimum prevailing wage rates which may be paid the following classes of labor to be employed on the work:

Minimum Wage Rates

	<u>Per Hour</u>
Cement masons	\$ 2.35
Electricians	2.60
Laborers	1.25
Air tool. op. (jackhammer, vibrator)	1.45
Plumbers	2.50
Truck drivers, under 3 tons	1.25
Truck drivers, 3 to 5 tons	1.35
Truck drivers, over 5 tons	1.50
Air compressors, portable	1.43
Mixing plant, 1 or more mixers	2.05
Pumps	1.43
Drilling machine, core or diamond	1.92

8. SELECTION OF LABOR. Insofar as possible all unskilled labor to be employed shall be selected from lists furnished the Contractor by the State Employment Service. Labor which has been referred by an office designated by the State Employment Service and accepted for employment on any previous work by the Contractor may be employed on this project. The Contractor shall have on file proper Introduction Cards for all such labor so employed. The Contractor may avail himself of the services of an employment agency for obtaining labor of the intermediate and skilled classes.

SECTION III

PAYMENTS, TIME, ETC.

1. COMMENCEMENT, PROSECUTION, AND COMPLETION. The Contractor shall commence work under this contract within 15 days after the date of receipt of notification to proceed. He shall prosecute the work with faithfulness and energy and in a neat and orderly manner so as to complete the entire work under this contract within 90 calendar days after the date of receipt of notification to proceed.

The above interval of 90 calendar days is hereby agreed upon as the time necessary for the completion of the entire work.

Due to the urgency of obtaining the flow characteristics of the well in order to design necessary pumping equipment this winter for installation next spring under another contract, the Contractor will be expected to work overtime and weekends in order to complete the work this fall.

2. LIQUIDATED DAMAGES. The time of completion for the entire work as stated in the foregoing paragraph, will be made a part of the contract which will provide for liquidated damages in lieu of actual damages in the amount of \$50.00 per calendar day for the entire delay in completing the work beyond the time fixed and agreed upon in Article 1, Section III, for its completion or beyond such time as may be established because of justifiable extensions of time granted pursuant to other provisions of the contract.

3. PAYMENTS. Upon completion of the entire work by the Contractor and acceptance thereof by the Contracting Officer, the amount due the Contractor for the entire work will be paid.

4. PAYMENT AND BID PRICES. Payment for all items listed in these specifications, when made at the unit price bid, shall comprise full payment for all materials, tools, labor incidentals, superintendence and overhead expense necessary to produce a finished job complying with these specifications.

5. METHOD OF MEASUREMENT. The method of measurement for the several classes of work are described in Section IV of these specifications.

6. PROGRAM OF CONSTRUCTION AND PLANT. Except as is otherwise specified, the Contractor's procedure and methods of construction may, in general, be of his own choosing, provided they follow general practice and are calculated to secure results which will satisfy the requirements of these specifications and the supervision of the work.

Before beginning any work, the Contractor shall outline and submit in writing to the Contracting Officer for approval his program of construction. He shall also submit written revisions of the program as modifications may become necessary or as may be required. Such outlines and revisions shall be in sufficient detail to enable the Contracting Officer to judge the adequacy of the Contractor's operations and to anticipate such conditions as may tend to impair or retard the progress and completion of the work. The Contractor shall not proceed with the work until his program and layout have been approved in writing by the Contracting Officer.

The Contractor shall supply all plant, tools and equipment of every kind, ample in quantity and capacity, in good working order, and suitable in character to execute the work of his contract in accordance with the approved program.

7. TEMPORARY SUSPENSION OF WORK. The Contracting Officer shall have the authority to suspend the work, wholly or in part, for such period as he may deem to be the best interest of the Government due to conditions which are considered unfavorable to the suitable prosecution of the work, or for failure on the part of the Contractor to carry out orders given or to perform any provisions of the contract. The Contractor shall immediately respect the written order of the Contracting Officer to suspend the work wholly or in part. The Contractor shall not suspend work without such written authority, and shall immediately resume work when conditions are favorable or when methods have been corrected, as approved by the Contracting Officer in writing.

8. PROTECTION AND RESTORATION. The Contractor will be required to repair at his own expense all damage done to Government and to private property by or because of his work under the contract. Upon the completion of each distinct portion of his contract, the Contractor shall remove all apparatus, plant, tools, surplus material, rubbish, etc., and shall leave the premises clean, neat, orderly, and otherwise in as good condition as they were before the beginning of the work.

Particular attention is called to the necessity of protecting trees and shrubs in the vicinity of the work. Where in the opinion of the Contracting Officer, trees may be damaged by being struck by articles, materials, or equipment, they shall be protected by a covering of boards or other satisfactory material wired in such manner that the tree will not be scarred. Tree protection shall be removed when no longer needed.

No additional payment shall be claimed for providing the protection required in the preceding two paragraphs.

The time necessary for the final restoration work is understood to be included in the time named in Article 1, Section III, for the completion of the entire work.

9. FINAL INSPECTION AND ACCEPTANCE OF WORK. When all work provided and contemplated by this contract has been completed and the clean-up performed, the Contracting Officer will make the final inspection. When any errors and omissions disclosed by the final inspection have been corrected, acceptance will be given in writing, but until such acceptance, the Contractor will be responsible for the work covered by this contract.

10. TERMINATION OF CONTRACTOR'S RESPONSIBILITY. This contract shall be considered complete when all work has been completed, the final inspection made, the work accepted by the Contracting Officer, and the final estimate paid. The Contractor will then be released from further obligation except on proof of error and as set forth in the performance bond.

11. STORAGE OF MATERIALS AND EQUIPMENT. No space in existing buildings shall be used for storage of materials, equipment or incidentals except with the approval of the Contracting Officer. The Contractor shall maintain all spaces used for storage in a safe and orderly condition. Inflammables shall be kept in enclosed containers and fire extinguishers of a proper size and type shall be provided in quickly accessible locations.

An area will be provided where the Contractor may store any material and equipment or may erect any shop buildings which he may require. No storage will be allowed elsewhere without written approval of the Contracting Officer.

12. UTILITIES. No utilities are available at the site. The Contractor will have to provide all of his requirements, and the Government shall not be held liable because of his failure to do so.

SECTION IV

DRILLING OF WATER WELL

1. PROPOSED WORK. The Contractor shall furnish all labor and materials, power and equipment, and perform all work required for the drilling, logging and testing of a water well to be located in a tract of land owned by the U. S. Government and known as the Wind Cave National Park, South Dakota. The Contractor shall be a licensed well driller as required by the State of South Dakota and shall comply with all laws pertaining to water well drilling. All developing, testing, installation of casing, and grouting shall be done in the presence of the Contracting Officer or his representative.

Water is expected to be developed in the upper few feet of the Pahasapa limestone formation at a maximum depth of 750 feet below the ground surface and should rise to within 300 feet of the surface. This information is intended to assist the Contractor in preparing his bid. The Government does not guarantee its accuracy, and the Contractor shall satisfy himself regarding all local conditions affecting his work. Neither the information contained herein nor that derived in any manner from the Government, its agents or employees shall act to relieve the Contractor from any responsibility hereunder or from fulfilling any and all of the terms of the contract.

The well shall be located approximately $1\frac{1}{2}$ to 2 miles east of the Park Headquarters in Wind Cave Canyon near the east boundary of Wind Cave National Park. The exact location of the well is to be determined by the Contracting Officer. The Contractor shall confine his activities to within the boundaries of Government property.

2. CONTRACT DRAWINGS. The Contractor shall submit for approval shop drawings of all mechanical and electrical installations as requested in these specifications or by the Contracting Officer and these shop drawings, upon approval by the Contracting Officer, shall become part of the contract and contract drawings.

3. FEDERAL SPECIFICATIONS. Federal Specifications referred to herein shall be and become a part of this contract, and be considered as though incorporated in these specifications. The latest revised editions, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. of such Federal Specifications shall apply.

4. TRADE NAMES. The use of the name of a manufacturer or of any special brand in describing an item does not restrict bidders to that manufacturer's product, or to the specific brand named. This method is used merely to indicate the particular type, design, character or quality of the article desired. Bids will be considered on products of other manufacturers and other brands provided they conform to these general requirements.

5. PROTECTION OF SITE. The Contractor shall protect all structures, trees, shrubbery, etc., during the progress of his work; he shall remove from the site all cuttings, drillings, debris and unused materials; and shall, upon completion of the work, restore the site as nearly as possible, to its original condition. Water pumped from the well shall be conducted to a place where it will be possible to dispose of it without erosion or other damage to property or the creation of a nuisance.

6. TYPE OF WELL AND DETAILS. The well shall be of the single casing type and is expected to be finished to a point in the Pahasapa limestone, it being intended to terminate the well in the upper portion of this water bearing limestone stratum. The exact depth of the well is to be determined by the Contracting Officer and the Contracting Officer may terminate the well prior to reaching this water bearing limestone stratum if an adequate and desirable water supply is intercepted at any lesser depth. Cement grout shall be placed between the well casing and the bore as hereinafter described under "GROUTING".

(a) Drilling. The well may be drilled by either the cable tool or rotary method, at the discretion of the Contractor. If a rotary drill is used, a standard commercial mud shall be used.

(b) Bore. The well shall be drilled a minimum of 10 inches in diameter and shall be straight and plumb. The Contracting Officer shall have the option of abandoning the well upon completion of the bore without further payment to the Contractor if in his judgment a suitable water supply cannot be obtained.

7. MATERIALS.

(a) Casing. Casing shall be constructed of 8-inch (I.D.) black steel pipe not less than .277-inch thick, weighing not less than 24.70 pounds per lineal foot. Joints may be either welded or standard threads and couplings, at the discretion of the Contractor.

(b) All materials specified shall be new and free from objectionable defects. No used or old material will be accepted. However, if in the opinion of the Contractor it appears necessary or desirable to use temporary casing, the casing may be used or new, subject to the approval of the Contracting Officer. The temporary casing shall remain the property of the Contractor and shall be removed by him prior to final completion of the well.

8. WORKMANSHIP. All work performed shall be done in a careful and workmanlike manner.

(a) Welding. In event the Contractor elects to use welded joints, all sections of casing shall be properly welded together; a welding sequence shall be followed which will avoid excessive distortion. All welding shall be in accordance with applicable provisions of the American Welding Society Specifications for "PIPE LINES".

(b) Grouting. It is intended that the annular space between the casing and bore shall be sealed for the entire depth above the water-producing formation to ground surface. In the event that grout cannot be returned to the ground surface, the Contractor shall provide a permanent grout seal between the casing and the bore for a depth of 15 feet below the ground surface. Before proceeding with placing of the grout, the Contractor shall secure approval of the Contracting Officer of the method he proposes to use. No method will be approved that does not specify the forcing of grout from the bottom of the space to be grouted toward the surface. A suitable cement retainer, packer or plug shall be provided at a point near the top of the water bearing stratum so that grout does not leak into the bottom of the well. The grouting shall be done continuously and in such a manner as will insure the entire filling of the annular space in one operation. The cement used shall be "Incor Cement" or equal. The grout shall be a neat cement, mixed with not less than 1 part cement to 1 part water by volume. This grout shall be allowed to set for not less than 48 hours after placement, without doing any work which may disturb it or cause it to crack.

9. DEVELOPING AND TESTING.

(a) Developing. The Contractor shall develop, clean and pump the well by such methods as may be approved by the Contracting Officer. The Contractor shall furnish all necessary pumps, compressors, plungers, or other needed equipment to develop the well to give maximum yield of water per foot of drawdown and to extract from the water bearing formation the maximum practical quantity of matter as may be pumped under maximum conditions of drawdown. At conclusion of the development, the well shall be cleared of all accumulations of mud, sand or sediment to the full depth of the well. All equipment and material furnished and installed by the Contractor for developing the well shall remain his property and shall be removed by him upon completion of the work.

(b) Log. The Contractor shall keep an accurate daily log and record for the well of all materials passed through and the depths at which the changes in the formations occur, together, with such other information as may be called for by the Contracting Officer. Samples of the materials found in each stratum shall be taken at intervals of not more than 10 feet and preserved in receptacles to be furnished by the Contractor. The samples shall be plainly marked to show the well, and the depth below the ground surface from which the sample was obtained. The log of the well shall show all material penetrated and full descriptive notes made of everything found by the drill and of all difficulties or unusual conditions met in drilling. All water bearing strata shall be described in special details as to whether the material is loose, compact, its color, and if gravel, whether it is water worn or angular. The presence of clay must be noted. Upon completion of the well, the log shall be prepared in quadruplicate, signed by the Contractor and delivered to the Contracting Officer for approval.

Logging of the well by electrical methods as hereinafter described may be required as directed, however, the Contracting Officer shall exercise the option as to whether or not these logs shall be made. The electrical logging may include a Gamma Ray Log, Neutron Log, and a Section Gauge (Hole Caliper) Survey as one set up. In event grout is not returned to the surface as described under 8(b) GROUTING: the Contracting Officer, at his discretion and direction, may also require a Temperature Survey of the hole to determine the height to which the grout has risen.

(c) Plumbness and Alignment Test. Plumbness and alignment shall be tested by lowering into the well, to a depth determined by the Contracting Officer (lowest anticipated pump setting), a section of pipe forty (40) feet long or a dummy of the same length. The outer diameter of the plumb shall be not more than 1/2-inch smaller than the diameter of that part of the casing or hole being tested. If a dummy is used, it shall consist of a rigid spindle with three rings, each ring being 12 inches wide. The rings shall be truly cylindrical and shall be placed at each end of the dummy and one ring in the middle thereof. The central member of the dummy shall be rigid so that it will maintain the alignment of the axes of the rings. Should the dummy, or pipe, fail to move freely through the length of the casing or hole, to the depth required by the Contracting Officer, or should the well vary from the vertical in excess of two-thirds of the smallest inside diameter of that part of the well being tested per 100 feet of depth, or beyond limitations of this test, the plumbness and alignment of the well shall be corrected by the Contractor at his own expense and, should he fail to correct such faulty alignment or plumbness, the Contracting Officer may refuse to accept the well.

(d) Test Pump and Equipment. The Contractor shall furnish, install, and operate necessary pumping equipment capable of pumping from the well a maximum of 200 gpm. Throttling devices shall be furnished so that the discharge may be reduced to zero gpm. The pumping unit shall be complete with prime mover of ample power, controls and appurtenances and shall be capable of being operated without interruption for a period of 48 hours. The Contractor shall furnish all necessary discharge piping for the pumping unit, which shall be of sufficient size and length to conduct the water being pumped to the point of final discharge as directed by the Contracting Officer. He shall also furnish, install and operate equipment of approved size and type for measuring the flow of water, such equipment to be a weir box, orifice or water meter. To measure the elevation of the water level in the well, an air line, complete with gauge, hand pump and check valve shall be provided. Unless otherwise directed, the air line shall be securely fastened to the pumping unit, and shall terminate approximately at the maximum desired pumping level, but in no case shall it be within two (2) feet of the end of the suction pipe. All equipment and material furnished and installed by the Contractor for the pumping test shall remain his property, and shall be removed by him upon completion of the work.

(e) Duration of Pumping Test. Except as otherwise provided, the Contractor shall furnish all labor, motive power, lubricating oil, and other necessary materials, equipment, labor and supplies required and shall operate the pumping unit as hereinafter described. Accidental interruptions may, if so agreed upon between the Contractor and the Contracting Officer, be compensated for by correspondingly extending the time of the completion of the test run. After completion of the final test, the Contractor shall remove by bailing, sand pumping or other methods, any sand, stones, or other foreign material that may become deposited in the well. The time stated for the duration of the final test is a minimum only and the Government reserves the right to extend such period of test, or to make additional tests.

(f) Maximum Yield. The Contractor shall operate the pumping equipment at increasing discharge rates until the water level reaches a point where further increases would pump the well dry or a maximum of 200 gpm. The Contractor shall then pump continuously for a period of six hours at a maximum rate which causes no further drawdown of the water level. The Contractor shall make certain that the water level remains stationary during this pumping period. At the end of this test, the well shall be allowed to fully recover its static water level.

(h) Desired Yield. Upon completion of the above test, and at the discretion of the Contracting Officer, the Contractor shall determine the gallons per minute delivered at fifty per cent of the maximum drawdown at maximum yield or the point where no foreign material is pumped, whichever is the lesser. He shall then operate his pump, delivering water at this rate, for a period of not less than twenty-four (24) hours after the pumping level reaches stability. The Contractor shall make certain that the water level remains stationary during this pumping period.

(i) Pumping Test Data. Drawdown reading and discharge rates for the "Maximum Yield Test" shall be taken every five minutes until the maximum drawdown for such increment of discharge has been reached and held for a period to be determined by the Contracting Officer. At the end of this test, recovery levels shall be measured every five minutes until the water surface has risen to within five (5) feet of the original or starting level. Drawdown readings and discharge rates for the "Desired Yield Test" shall also be taken every five minutes. All data shall be carefully recorded and a written report, containing all data shall be delivered to the Contracting Officer in quadruplicate.

Reports. When the well and tests have been completed, the Contractor shall submit to the Contracting Officer a written report, in quadruplicate, showing its log and all pertinent data relative thereto.

10. PROTECTING WATER SUPPLY. The Contractor shall take such precaution as are necessary or as may be required permanently to prevent

contaminated water or water having undesirable physical or chemical characteristics, from entering, through the opening made by the Contractor in drilling the well, the stratum from which the well is to draw its supply. He shall also take all necessary precautions during the construction period to prevent contaminated water, gasoline, etc., from entering the well either through the opening or by seepage through the ground surface.

11. CORRECTIVE WORK. In the event that the well becomes contaminated or that water having undesirable physical or chemical characteristics, does enter the well due to the neglect of the Contractor, he shall, at his own expense, perform such work or supply such casings, seals, sterilizing agents or other material as may be necessary to eliminate the contamination or shut off the undesirable water.

12. TEMPORARY CAPPING. At all times during the progress of the work, the Contractor shall protect the well in such a manner to effectively prevent either tampering with the well or the entrance of foreign matter into it, and, upon its completion, he shall provide and set a substantial screwed, flanged or welded cap satisfactory to the Contracting Officer at a distance not less than one foot or more than three feet above the normal ground surface.

13. ABANDONMENT OF BORE OF WELL. If a satisfactory water supply is not found within a reasonable distance of the estimated depth and, at the direction of the Contracting Officer the Contractor should abandon drilling operations, the Contractor shall fill the abandoned hole with clay or clay and concrete.

If for any reason, other than at the direction of the Contracting Officer, the Contractor should abandon drilling operations at any one location in favor of drilling in another location or should fail to complete the well to the depth specified or to such lesser depth as ordered by the Contracting Officer, the Contractor shall, if requested and as directed, fill the abandoned hole with clay or clay and concrete at no cost to the Government and shall not receive compensation for drilling operations performed at that site.

14. MEASUREMENT AND PAYMENT.

(a) Estimated Quantities. Estimated quantities contained in these specifications are given for the purpose of indicating the approximate magnitude of the work and for serving as an equitable basis for award. Payments will be based on the actual quantity of work required and performed and made at the unit prices bid.

(b) Drilling of Bore. Under this item, the Contractor shall be paid for drilling of a 10-inch bore only, including bringing his rig to the job and removing same, setting of his well drilling equipment, capping the top of control pipe, clearing site, furnishing written reports in quadruplicate, daily logs, samples of earth formations, and miscellaneous work and materials called for in the specifications.

but not set up as a separate pay item. The unit of payment will be the linear feet of bore measured between the ground surface and the bottom of the bore. Measurement of depth shall be made by the Contractor with a steel line and in the presence of the Contracting Officer.

(c) Casing. Under this item the Contractor shall be paid for furnishing and placing of 8-inch (I.D.) casing and grouting of casing. The unit of payment will be the linear feet of casing placed and grouted.

(d) Developing Well. Under this item the Contractor shall be paid a lump sum for the furnishing of the necessary material, equipment and labor for the development of the well as specified.

(e) Pumping Test. Under this item, the Contractor shall be paid for making the required pumping tests, including tests for yield and drawdown, and report. Test shall be made with equipment previously described herein and for such periods as directed by the Contracting Officer. The unit of payment will be the number of hours the pump is in operation and deductions shall be made for all breakdowns or stops or for such tests as are not made in complete accordance with specifications. No payment will be made hereunder for tests made by the Contractor for his own information or for pumping to develop the well.

(f) Filling of Abandoned Bore. Under this item, the Contractor shall be paid for filling of bore when the Government determines that such a location is not suitable to its needs. The unit of payment will be the linear feet of bore filled, measured between the bottom of the bore and the ground surface.

(g) Gamma Ray-Neutron Log. Under this item, the Contractor shall be paid for a combination Gamma Ray-Neutron Log of the well.

(h) Section Gauge Survey. Under this item, the Contractor shall be paid for a Section Gauge (Hole Caliper) Survey of the bore, made from the same set-up as used for the combination Gamma Ray-Neutron Log above.

(i) Temperature Survey. Under this item, the Contractor shall be paid for a Temperature Survey of the well.

15. ALTERNATE BID "A". (Drilling of 12" bore and installation of 10-inch I.D. casing). An alternate bid may be submitted stating what unit prices shall apply if the minimum size of bore is 12 inches and the casing is 10-inches (I.D.) black steel pipe not less than 3/8 inch thick, weighing not less than 32.75 pounds per lineal foot. Under this alternate bid, the same specifications as for the 10-inch bore and 8-inch casing, as applicable, shall apply and the time for completion of the well shall remain the same.

Bids need not be submitted on Alternate Bid "A", but if submitted, acceptance by the Contracting Officer will be governed by the availability of funds. If alternate "A" is accepted, it will be to the exclusion of the primary bid.

10-23
(June 1910)

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

----- NATIONAL PARK

FILE NO.

IMPORTANT

This file constitutes a part of the official records of the National Park Service and should not be separated or papers withdrawn without express authority of the official in charge.

All Files should be returned promptly to the File Room. Officials and employees will be held responsible for failure to observe these rules, which are necessary to protect the integrity of the official records.

419-2



IN REPLY REFER TO

United States Department of the Interior

NATIONAL PARK SERVICE
DENVER SERVICE CENTER
12795 W. ALAMEDA PARKWAY
P.O. BOX 25287
DENVER, COLORADO 80225-0287

L2415 (DSC-EN)
WICA-149-07

JUN 1 1998



Eric Gronlund
Joe Foss Building
Building 523 East Capital
Pierre, South Dakota 57501

Dear Mr. Gronlund:

Reference: Wind Cave National Park, Pkg. 149, PT: 07

Subject: Drilling Backup Well

The National Park Service is preparing to drill a back-up water well for Wind Cave National Park. The new back-up well will be an additional point of diversion from the same source of water as the existing well. The existing well, covered under water right number 419-2, provides water service for the entire park facility. Operation of the two wells will not exceed the water discharge appropriated under the original water right permit. The existing well number is 06-06-06 DDA. The location is in the NE 1/4, SE 1/4, SE 1/4, Section 6, T. 6 S., R. 6 E. and is in the Deadwood Formation (Pahasapa Limestone) aquifer. The depth of the well is 787 to 795 feet.

A USGS open file report, "Water-Supply Sites for Wind Cave National Park, Custer county, South Dakota," was completed in 1974. It recommends a site 500 feet west of the existing water-supply facilities as having potential for development as a supplementary ground water supply. The proposed new well will be drilled at a location 600 feet west of the existing well. For the locations of the existing well and the proposed well, see the enclosed map.

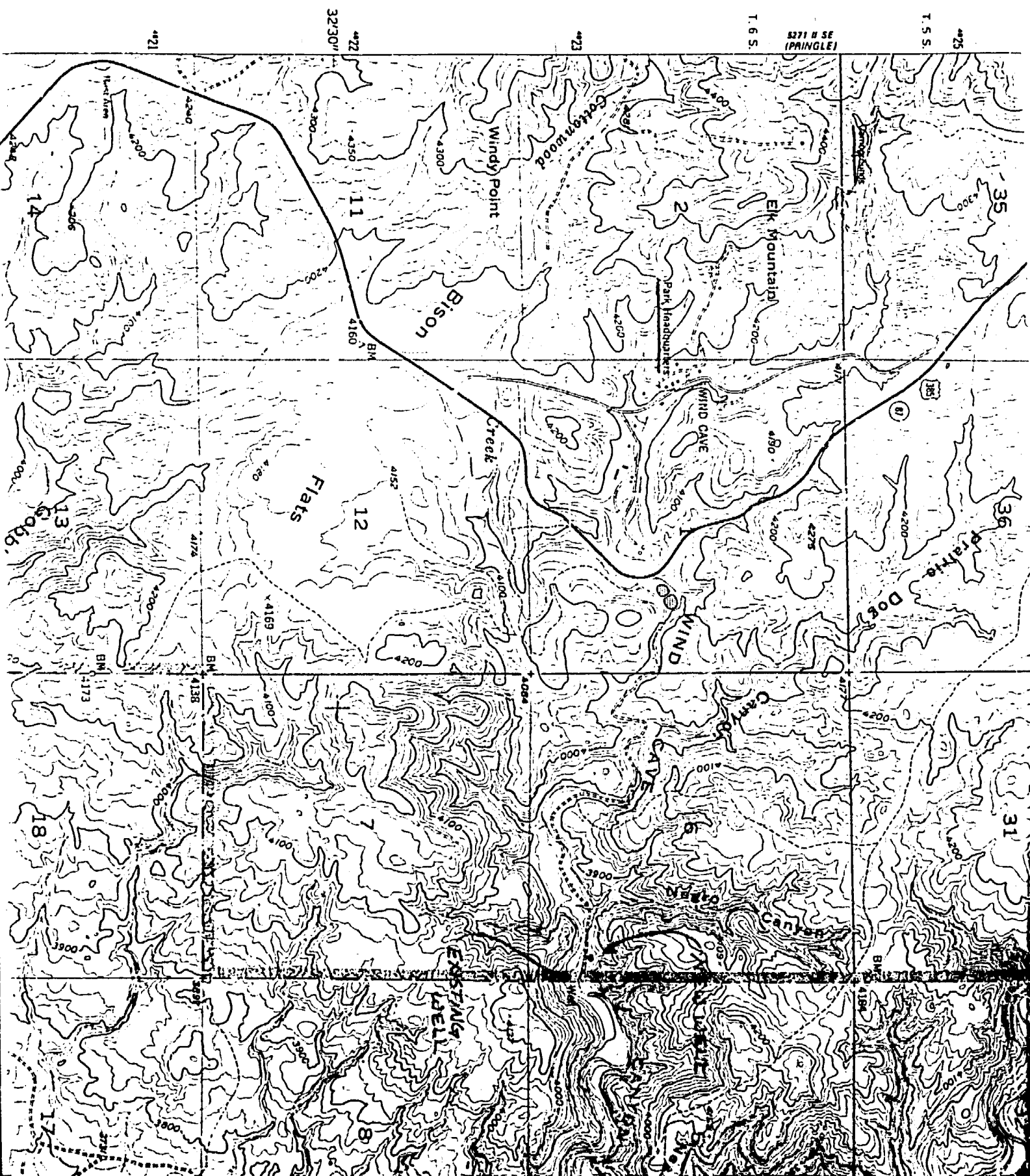
The construction of the new well will follow the South Dakota Codified Law 74:02:04, Well Construction Standards. The new well will be drilled to a depth of 750 to 800 feet into the same aquifer. If differing geologic conditions are encountered at the new site, you will be contacted to insure all statutes are met.

As per state statute 46-5-13.1, please review the proposed additional point of diversion for Wind Cave National Park to clarify that existing diversions are not effected. If there are any questions, please feel free to contact Bob Morrick at (303) 969-2487 or Sena Morrell at (303) 969-2413. Thank you for your time on this matter.

Sincerely,

Sena Morrell
for Sena Morrell
Enclosure

T.6S.
R.6E.
S1C6



DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
WATER RIGHTS PROGRAM

June 24, 1998

RE: Request for an additional point of diversion for Water Right No. 419-2, Wind Cave National Park

The National Park Service has submitted an application requesting authorization for an additional point of diversion for Water Right No. 419-2. SDCL 46-5-13.1 provides that a point of diversion may be changed or additional points of diversion may be approved without application or publication of a notice of hearing if the additional point of diversion is from the same source of water, no additional water is appropriated and the chief engineer makes a finding that the change does not increase the potential for interference with existing diversions.

Water Right No. 419-2 appropriates 0.15 cubic feet of water per second (cfs) from one well (approximately 790 feet deep) located in the SE1/4 SE1/4 Section 6, T6S, R6E. Water is used to provide water service to the entire park facility. The additional diversion point is to be used as a back-up well to the existing well authorized by Water Right No. 419-2.

The National Park Service requests an additional diversion point located approximately 500 feet west of the existing well. The proposed well is to be constructed into the Deadwood Formation and will be located in the SE1/4 SE1/4 Section 6, T6S, R6E. The request states that the additional well will be constructed to a depth of 750 to 800 feet into the same formation and the operation of the two wells will not exceed the 0.15 cfs appropriated under Water Right No. 419-2.

As part of the review of this request for an additional diversion point, a review of well construction reports on file with the Water Rights Program and existing water rights was conducted. There are no existing water rights utilizing the Deadwood Formation in the area. The nearest well completion reports on file are found approximately 2 1/2 miles to the northwest toward Pringle and 3 miles southeast of the proposed additional diversion point.

This additional diversion point is to be used as a back-up water supply. No additional appropriation of water is authorized. The additional well must be constructed in accordance with SD Well Construction Standards. Standard 74:02:04:28 is the applicable construction standard. The additional well must be grouted from the top of the formation to the land surface in order to comply with the standards.


Eric Gronlund
Natural Resources Engineer
Water Rights Program

The Chief Engineer makes a finding that the additional diversion point does not increase the potential for interference with existing diversions. In making the finding, "does not increase the potential for interference" is interpreted to mean potential for adverse interference. An additional point of diversion for Water Right No. 419-2 may be constructed without requiring application or publication of a notice of hearing pursuant to SDCL 46-2A-4. A new water right permit is necessary for any diversions greater than 0.15 cfs at Wind Cave National Park


John Hatch, Chief Engineer 6-26-98
Water Rights Program



419-2
DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSG BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3181
www.state.sd.us/dennr

June 29, 1998

Sena Morrell
National Park Service
P.O. Box 25287
Denver, CO 80225-0287

Dear Ms. Morrell:

I am writing in regard to the National Park Service request for an additional diversion point (Deadwood Formation well) under Water Right No. 419-2. Water Right No. 419-2 appropriates 0.15 cubic feet of water per second from the Deadwood Formation for use at Wind Cave National Park.

The Park Service has requested an additional well to act as a back-up well to the existing well. The new well is to be located in the SE1/4 SE1/4 Section 6, T6S, R6E and is to be constructed into the Deadwood Formation. No additional water will be appropriated.

Upon review of the request and pursuant to SDCL 46-5-13.1, National Park Service is authorized to develop the addition diversion point (well) without application or publication of a notice of hearing pursuant to SDCL 46-2A-4. A new water right permit is necessary for any diversion greater than 0.15 cfs at Wind Cave National Park.

The additional well must be constructed in accordance with SD Well Construction Standards. Standard 74:02:04:28 is the applicable construction standard. The additional well must be grouted from the top of the formation to the land surface in order to comply with the standards. If you have any questions on well construction, please contact Jim Goodman at (605) 773-3352.

Very truly yours,

A handwritten signature in dark ink, appearing to read "John Hatch", is written over a horizontal line.

John Hatch, Chief Engineer
Water Rights Program
(605) 773-3352

WATER USE FOR 1995

PERMIT NO. 419-2

NAME FIRST Wind Cave National Park

ADDRESS 1 1 Superintendent

ADDRESS 2 P.O. Box 190

CITY Hot Springs, SD 57747

SOURCE OF WATER (PLEASE CHECK):

GROUND WATER ☒ NUMBER AND DEPTH OF WELLS 1 well, 759 feet deep

SURFACE WATER _____ NAME OF STREAM OR LAKE _____

TYPE OF WATER USE (PLEASE CHECK):

INDUSTRIAL _____ COMMERCIAL _____ INSTITUTIONAL _____
GEOTHERMAL _____ POWER _____ MINING _____
MUNICIPAL WATER SUPPLY _____

None of above uses. Park uses water for domestic uses (water for employees and visitors) and for other park operations.

ESTIMATED TOTAL 1995 WATER USE 4,324,500 GALLONS

NAME OF CONTACT PERSON Jimmy Taylor (Superintendent)
TELEPHONE NO. (605) 745-4600

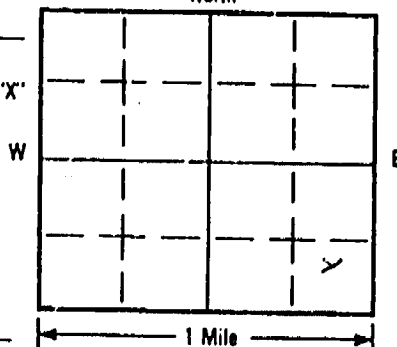
ADDRESS CORRECTION none

SOUTH DAKOTA WATER WELL COMPLETION REPORT

4119-2
07-92

Location SE 1/4 SE 1/4 Sec 6 Twp 6S Rg 6E
County Custer

Please mark well location with an "X"



Well Completion Date

Well Owner: National Park Service

Business Name:

Address: Wind Cave National Park
Custer, SD 57730

WELL LOG:

FORMATION	DEPTH	
	FROM	TO
<u>Boulders, silt & shale</u>	<u>0</u>	<u>13</u>
<u>Minerals</u>	<u>13</u>	<u>429</u>
<u>Madison</u>	<u>429</u>	<u>685</u>

LOCATION:

Distance from nearest potential pollution source (septic tank, abandoned well, feed lot, etc.) 2 miles from Sewage Lagoon (identify source).

PROPOSED USE:

- ☐ Domestic/Stock ☐ Municipal ☐ Business ☐ Test Holes
☐ Irrigation ☐ Industrial ☒ Institutional ☐ Monitoring well

METHOD OF DRILLING:

air rotary

CASING DATA:

- ☒ Steel ☐ Plastic ☐ Other

If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
<u>28.55</u> LB/FT	<u>8 5/8</u> IN	<u>0</u> FT	<u>435</u> FT	<u>12 1/4</u> IN
<u>23</u> LB/FT	<u>7</u> IN	<u>427</u> FT	<u>685</u> FT	<u>17 1/8</u> IN
<u>52</u> LB/FT	<u>13 3/8</u> IN	<u>0</u> FT	<u>20</u> FT	<u>19</u> IN

GROUTING DATA

Grout Type	No. of Sacks	Grout Weight	From	To
<u>1-11</u>	<u>300</u>	<u>15</u> lb./gal	<u>0</u> ft	<u>435</u> ft

Describe grouting procedure Pressure Grouted
through casing 1" to Top off

SCREEN: ☒ Perforated pipe ☐ Manufactured

Diameter 7 IN Length _____ FEET

Material Steel

Slot Size 1/2" / 12" Set From _____ Feet to _____ Feet

Other information 31-627 626-681
touch cut slots

WAS A PACKER OR SEAL USED? ☐ YES ☒ NO

If so, what material?

Describe packer(s) and location?

DISINFECTION: Was well disinfected upon completion?

☒ YES, How: chlorine

____ NO, Why? solution

Laboratory sent to for water quality analysis

Mid Continent

STATIC WATER LEVEL 177

Feet

If flowing: closed in pressure _____ PSI

GPM flow _____ through _____ inch pipe

Controlled by ☐ Valve ☐ Reducers ☐ Other

Reduced Flowrate _____ GPM

Can well be completely shut in?

WELL TEST DATA:

☐ Pumped

Describe:

☐ Bailed

air developed

☐ Other

Pumping Level Below Land Surface

_____ ft. After 1 Hrs. pumped 200 + GPM

_____ ft. After _____ Hrs. pumped _____ GPM

If pump installed, pump rate 70 GPM

REMARKS

RECEIVED

MAR - 1 2002

This well was drilled under license # 331 WATER RIGHTS PROGRAM

And this report is true and accurate.

Drilling firm Taylor Drilling

Signature of License Representative:

Reg L Taylor

Signature of Well Owner or Equitable Property Holder:

Date:

419-2

NATIONAL PARK SERVICE
Water Resources Division
1201 Oak Ridge Drive Suite 250
Fort Collins CO 80525

RECEIVED

OCT 19 2006

WATER RIGHTS
PROGRAM

16 October 2006

Eric,

As we discussed, here is a couple of well logs for the H.Q. well 419-2.

The second well log, completed by the S.D. school of Mines & Tech, shows where the well hole intersects the various geologic formations. I made a mark on the log where the Pahasapa formation is encountered.

Also note that the well is cased to 300' below the surface and is open in the Madison, Englewood & Deadwood formations.

I have also included a little information on the backup well, although you may already have this.

Please let me know if you have any questions.

Jeff Hughes

970 225-3527

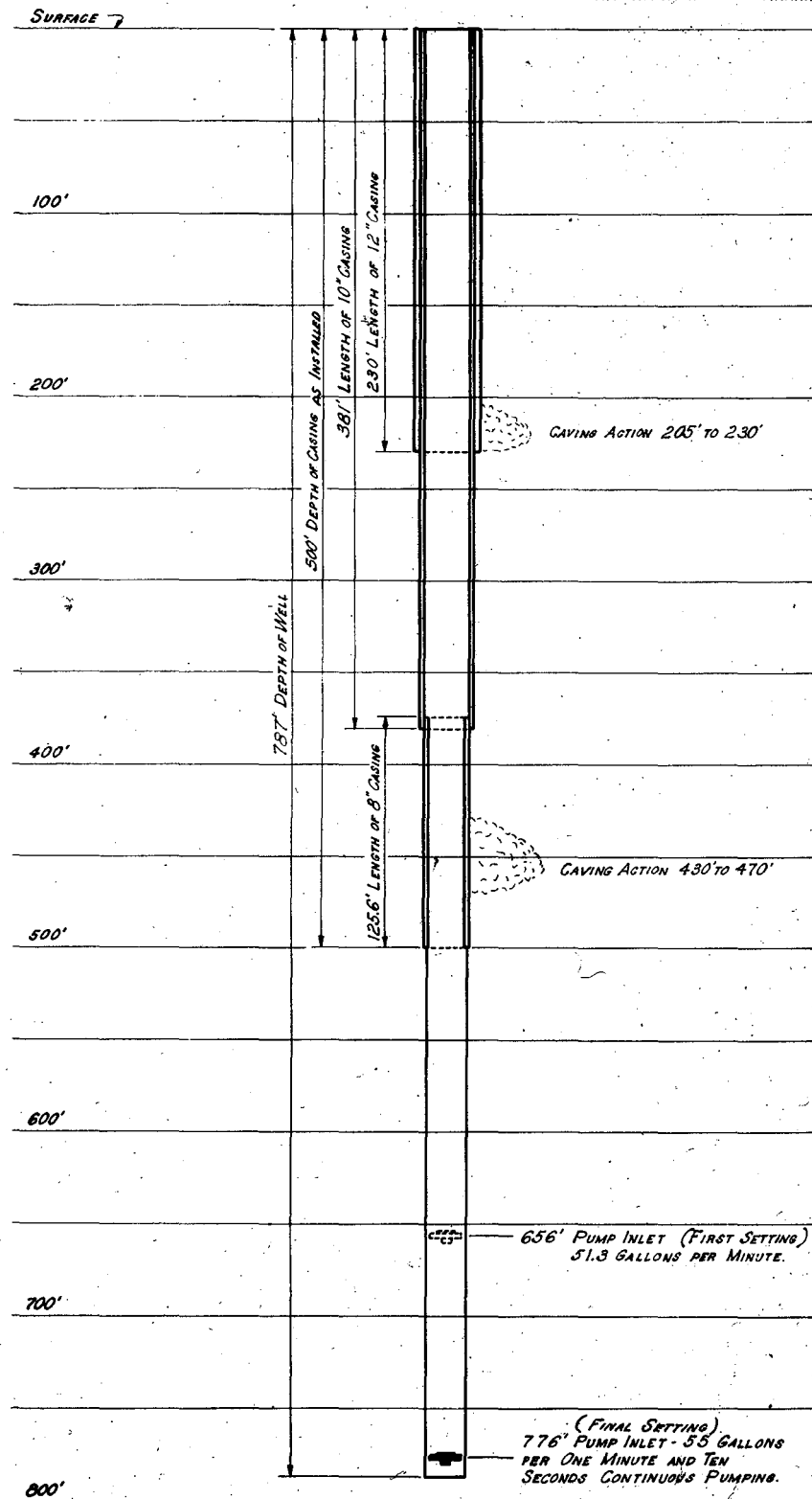
jeff_hughes@nps.gov

**WATER WELL
WIND CAVE NATIONAL PARK
SOUTH DAKOTA**

COMPLETED APRIL 1956

INFORMATION FROM NARRATIVE STATEMENT
AND COMPLETION REPORT

DEPTH - FEET BELOW GROUND SURFACE



REGION TWO OFFICE

DATE: NOV 1960

DRAWN BY: J.E.H.

Top 100

THE SIOUX DRILLING CO.

ROTARY & CABLE TOOLS

WELL SERVICE

RAPID CITY, S. D.

Superintendent, Rapid City Service

*Water Well
File*

DRILLER'S LOG OF WIND CAVE WATER WELL.

Started Drilling Dec 15, 1954, Well Completed April 20, 1955.

Contract # 14-10-232-131

0	5	top soil
5	20	gravel (20' of 6" surface casing)
20	70	sandy lime (surface water at 51')
70	90	red shale
90	105	gray shale
105	136	sandy lime
136	139	open cave
139	160	sandy lime (very hard and sharp)
160	165	dark shale
165	230	lime and chert
230	260	sandy lime (232 ft. of 12" casing in place)
260	270	shale and lime shells
270	310	sandy lime
310	340	sandy shale
340	350	gray lime
350	380	red shale and gyp shells (very cavy)
380	410	lime (380' of 10" casing, cemented with 135 bags cement)
410	470	red shale and gyp shells, (very cavy)
470	510	lime, hard Run 120' of 8" liner (from 370' to 500')
510	520	lime (hard) water in top 20' of above formation
520	540	lime, sandy
540	575	lime, hard
575	579	lime, sandy--- 20 g.p.m. at this point
579	650	lime, sandy
650	690	lime and quartz
690	720	lime, sandy
720	730	lime, hard
730	750	lime, sandy
750	760	lime and red shale breaks
760	770	lime, sandy
770	787	lime, hard and sharp
787		TOTAL DEPTH

avg. 10 g.p.m.



5 Copies of each

Wind Cave National Park Water Well
Drilled by Sioux Drilling Company, Rapid City, S. D. 1936
Located in Wind Cave Canyon, in ~~Sec. 6, T. 6 S., R. 6 E.~~
Guster County, South Dakota
Sample set on file at S. D. School of Mines.
Samples studied by J. P. Gries, 1936.

Minnelush formation (well starts roughly 180 feet below top of formation)

- 0 - 10 surface soil and gravel. Gravel consists of fragments of Minnelush dolomite and sandstone, chert and quartz.
- 20 gravel, same but more pink to yellow dolomite
- 30 sandstone, poorly sorted, very calcareous, pink to orange-brown, $2/3$; grading to limestone, sandy, same colors, $1/3$.
- 40 sandstone, orange to white, poorly sorted, very calcareous, 80%; limestone, as above, 20%.
- 50 sandstone, orange to white, poorly sorted, calcareous
- 70 sandstone, same
- 80 clay, gray to red-brown and hematite red, micaceous
- 90 shale, red-brown to hematite red, micaceous
- 95 shale, same, to silvery gray, micaceous
- 105 shale, dark gray to black
- 110 dolomite, finely crystalline, gray-brown, glassy
- 120 dolomite, same, and with much milky chert
- 130 dolomite, same, to dolomite, buff, finely crystalline, slightly earthy; some is sandy
- 135 dolomite, same
- 140 sample is mostly finely drilled up milky and brown chert with a trace of dolomite
- 160 sample same; trace of sand below 150
- 170 sandstone, fine to medium, yellow to white, calcareous
- 180 sandstone, same
- 190 sandstone, same; some new finely crystalline earthy yellow-brown dolomite
- 200 limestone and dolomite, pink to buff, still much chert
- 210 shale, black, looks petroliferous; caves badly
- 220 dolomite, finely crystalline, hard, gray to brown, mottled red; trace sandstone
- 230 dolomite, same; some sandy; may be some streaks of dolomitic sandstone. $1\frac{1}{2}$ 5/4" set at 232'
- 240 dolomite, finely crystalline, granular, light brown with pinkish cast; faintly porous, trace milky chert and drusy quartz
- 250 detrital material; earthy finely crystalline dolomite, shale, black, chert, chalcidony
- 260 dolomite, light cream, fine- to medium crystalline, some earthy, very porous, with spar calcite crystals
- 270 dolomite, same, and dolomite, finely crystalline, earthy, pale pink to pale green; green is almost a silty shale
- 280 sandstone, fine, dolomitic, off-white; chert, white to milky
- 290 dolomite, finely crystalline, glassy, some sandy, light gray, more calcite spar
- 300 dolomite, finely crystalline, pink, very sandy
- 310 dolomite, same, and dolomite, very finely crystalline, gray with embedded frosted quartz grains

Wind Cave

- 2 -

- 310 - 320 sandstone, fine to coarse, off-white to faintly yellow, calcareous but drills to free grains
- 330 dolomite, very finely crystalline, hard, nearly white; some rhombic dolomite, some sandy dolomite
- 340 dolomite, finely crystalline, glassy to earthy; nearly white to lavender, to greenish shale; trace red shale?
- 350 dolomite, same; dolomite, silty, lavender; shale, silty lavender to maroon
- 360 dolomite, finely crystalline to medium crystalline, glassy, nearly white to faint pinkish-brown
- 370 dolomite, same, and shale, red-brown to maroon; siltstone, maroon
- 380 limestone, fine- to coarsely crystalline, white
- at 390 limestone, very finely crystalline, white to very light brown, trace milky chert. 10" set at 381'
- 390 limestone, same
- 400 limestone, same; and may be some silty shale and pink calcareous ss
- 410 sandstone, red to orange, with red and maroon flaky shale
- 420 sand, orange; sand, colorless; shale, maroon; coarse fragments detrital chert
- 430 shale, waxy, maroon to hematite red; trace green; some streaks sandstone as above
- 440 shale, same, with few coarse frosted quartz grains
- 450 shale, maroon to hematite red
- 460 shale, red to pale green; much new fine to medium white sandstone with coarse embedded frosted quartz grains
- 470 shale, same; more sand, some with white and light green interstitial clay
- 472 shale, same, and maybe some new dense to medium crystalline white limestone. Water and top Pahasapa at 472'
- 480 same as '72, perhaps more limestone 8" at 486' (E-log pick)
- 490 limestone, fine- to medium crystalline (sample mostly maroon shale)
- 500 probably same, sample 95% shale
- 502 limestone, dolomitic, very finely crystalline, white (about 1/3 shale)
- 510 limestone, fine- to medium crystalline, soft, white
- 520 limestone, same, 2/3; dolomite, medium- to coarsely crystalline, glassy, colorless to white, porous, 1/3
- 540 limestone, fine- to medium crystalline, soft, white, still stained flesh pink from shale cavings
- 550 dolomite, finely crystalline, white to flesh pink, earthy
- 560 dolomite, same, and dolomite, medium- to coarsely crystalline, colorless to flesh pink, some intergranular porosity
- 570 dolomite, medium to coarsely crystalline, colorless to flesh pink, some intergranular porosity
- 572 dolomite, same
- 580 no sample
- 590 limestone, very finely crystalline, white, dense
- 600 dolomite, fine- to medium crystalline, earthy, light brown, vuggy por
- 610 dolomite, finely crystalline, white to coarsely crystalline, pink, pink is very porous
- 620 dolomite, medium crystalline, glassy, pink to gray-brown
- 630 dolomite, fine- to medium crystalline, white to pink and salmon, no porosity
- 640 dolomite, same, but much spar calcite

- 640 - 680 dolomite, same and some more coarsely crystalline to rhombic, flesh pink, very porous
- 660 dolomite, finely crystalline, gray to brown, slightly saccharoidal, some iron
- 670 dolomite, finely crystalline, saccharoidal, light gray-brown some porosity, some hematite red mottlings in the gray
- 680 dolomite, fine- to medium crystalline, pale pink to salmon, glassy, some vuggy porosity
- 690 dolomite, fine- to coarsely crystalline and rhombic, pale pink to nearly white, some vuggy and intergranular porosity
- 700 dolomite, fine- to coarsely crystalline, white to pale pink, some rhombic, much intergranular vuggy porosity
- 720 dolomite, finely crystalline, glassy, nearly white to faintly pink, some coarsely crystalline, rhombic, porous
- 730 dolomite, fine to medium crystalline, some rhombic, light gray-brown to faintly pink.

Englewood formation

- 730 - 740 dolomite, finely crystalline, light brown to pink, vuggy porosity
- 760 dolomite, finely crystalline, nearly, red-brown, argillaceous, some red to orange shale or clay
- 760 dolomite, fine- to medium crystalline, nearly to rhombic, red-brown to maroon and gray; trace porosity, trace maroon shale

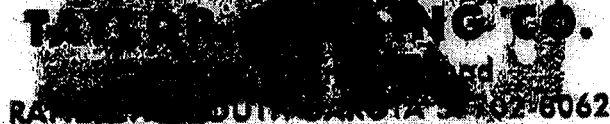
Deadwood formation

- 760 - 770 sandstone, colorless to red-brown, quartzitic, poorly sorted; trace of igneous and metamorphic rock fragments
- 780 sandstone, colorless to gray, quartzitic, tight, few fragments igneous or metamorphic rock
- 785 sandstone, colorless to white, trace hematite stain; fine to very coarse, quartzitic, more metamorphic quartz

PreCambrian schists

- 785 - 795 quartz-mica schist, gray to white

419-2
back up well



RALPH L. TAYLOR, JR. (Randy)
KIM E. TAYLOR

December 4, 2002

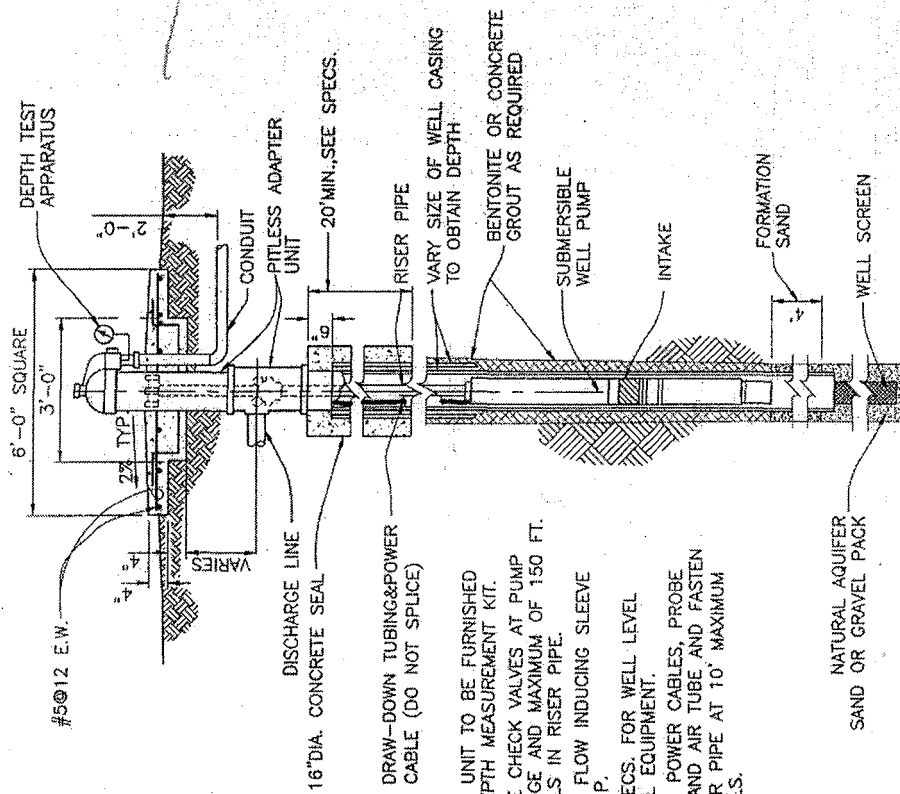
TELEPHONE:
Office: (605) 345-3400
After Hours: (605) 341-8417
or: (605) 767-4989

Wind Cave: New Well

Pump intake at	517 feet
check valves at	489 feet
	321 feet
	153 feet
	7 feet
bottom of air tube at	503 feet
sensor probes at	502, 482 and 462 feet

DATUM IS GROUND LEVEL

MAILING ADDRESS: P.O. BOX 7738 • RAPID CITY, SOUTH DAKOTA 57709-7738



NEW WELL CONSTRUCTION
WITH SUBMERSIBLE WELL
PUMP AND PITLESS UNIT

NOTES

1. PITLESS UNIT TO BE FURNISHED WITH DEPTH MEASUREMENT KIT.
2. PROVIDE CHECK VALVES AT PUMP DISCHARGE AND MAXIMUM OF 150 FT. INTERVALS IN RISER PIPE.
3. INSTALL FLOW INDUCING SLEEVE ON PUMP.
4. SEE SPECS. FOR WELL LEVEL CONTROL EQUIPMENT.
5. BUNDLE POWER CABLES, PROBE WIRES, AND AIR TUBE AND FASTEN TO RISER PIPE AT 10' MAXIMUM INTERVALS.

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT 7 SPL

COMPLETION REPORT OF CONSTRUCTION PROJECT

REGION Two	AREA Wind Cave National Park	COUNTY Custer	STATE South Dakota
PROJECT OR JOB TITLE Water Supply System for Headquarters Area			PCP NO. U-11-1 & 11-2
LOCATION IN AREA Headquarters Area		MASTER PLAN NO. ---	BUILDING NO. ---
WORKING DRAWING NO. AND TITLE NP-WC-3106-C			
APPROPRIATION TITLE AND SYMBOL 14X1035 Buildings and Utilities			ACCOUNT NO. WICA-XXXX 332.3
CONTRACT NO. 14-10-232-172		DATE WORK STARTED 9-1-56	DATE WORK COMPLETED 4-26-57
NAME OF CONTRACTOR Anchor Construction Company		ADDRESS 614 Standard Oil Bldg., Omaha, Nebraska	

COST ANALYSIS

CONSTRUCTION ITEMS	QTY.	UNIT COST IN PLACE	TOTAL COST IN PLACE
Contract	1st est.	10,878.97	10,878.97
	2nd est.	24,219.98	35,098.95
	3rd est.	20,774.20	55,873.15
	4th est.	15,894.28	71,767.43
	5th est.	15,931.14	87,698.57
	6th est.	5,439.20	93,137.77
	7th est.	1,645.00	94,782.77
Other Direct Expenses			
Telephone & Telegraph			66.47
Buckingham Transportation			2.10
Supplies and Materials			79.47
Facilitating Charges			718.00 718.00
TOTAL			95,648.81 95,648.81

COST AGREE WITH FFD RECORDS
C. D. VAN KIRK, SUPERVISORY ACCT.
REGION TWO OFFICE FFD
DATE FEB 18 1958

SUMMARY OF EXPENDITURES other than contractual:

PERSONAL SERVICES	EQUIPMENT	MATERIALS AND SUPPLIES
		79.47 ind. of contrac
OTHER	Facilitating Services: \$718.00 ; Other Direct Expenses: \$68.57 718.00	

CHANGE ORDERS			
ORIGINAL CONTRACT AMOUNT 92,063.10 90,618.60	FIRST 487.00	SECOND 2,092.50	THIRD 495.00
FINAL CONTRACT AMOUNT 95,846.60 94,782.77	FOURTH 709.00	INCREASE Increase in quantities - 380.67	

THIS PROJECT OR JOB HAS BEEN COMPLETED IN ACCORDANCE WITH
APPROVED DRAWINGS, SPECIFICATIONS, AUTHORIZED CHANGES

SUBMITTED BY (Name and title) E. J. Axline, Project Supervisor	DATE November 22, 1957
APPROVED BY (Name and title) Earl M. Semingsen, Superintendent	DATE November 22, 1957

(ATTACH NARRATIVE STATEMENT, PHOTOGRAPHS, AND "AS BUILT" DRAWINGS TO THIS FORM)

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Narrative Statement

INTRODUCTION

On April 21, 1956 a 790 foot water well, PCP U-13, was completed near the east boundary of Wind Cave National Park. The work was accomplished by the Sioux Drilling Company of Rapid City, South Dakota, under Contract No. 14-10-232-131, for a total sum of \$22,960.00.

The purpose of the well is to supplement the present water supply at Wind Cave National Park. The Park now obtains all water for the Headquarters Area from a spring located some distance away. For a number of years the supply has not been adequate due to drought and the continual increase in demand. This project makes the additional water supply of the well available when the spring supply is low and the public use is high.

This contract provides for an electrically driven deep-well pump to lift the water in the well from the 650 foot level to an electrically driven booster pump. From the booster pump the water flows through about 8100 feet of 4 inch pipe and about 2800 feet of 6 inch pipe to a connection with the water system in place, thence on into the reservoirs. In addition to the above the contract also provided for a branch line to the utility area, five new fire hydrants, an electric pump control circuit from the well to the reservoir, and related items such as check valves, air release valves, etc.

A new agreement was made with the Black Hills Power and Light Company whereby they would install a new overhead power system from the Park carpenter shop to the pumphouse at the well to furnish electricity for the pumps. It was also agreed that the National Park Service would be permitted to install a two wire pump control circuit from the pumphouse to the reservoirs on the power company's poles.

For location of new water supply system, please see contract drawing No. NP-WC-3106C.

For location of Black Hills Power and Light power line in the Park, see drawing attached to the above agreement.

SURVEYS AND PLANS

In the fall of 1955 the Superintendent of Wind Cave National Park started negotiations for a survey of the necessary pipe line from the well to the Headquarters Area. It was found that the Park Engineer was too busy with his regular duties to make the survey, also that there were no engineers available from the Western Division of Design and Construction in San Francisco. With these sources eliminated, the alternate was to contact various professional engineers in this state with the proposal that they contract the necessary survey.

Invitations to Bid were mailed to four engineering companies in this area, only two of which offered a bid. Walker and Gantz of Custer, South Dakota submitted the low bid of \$1,250.00. The contract was awarded to this firm on October 22, 1955. Mr. Gardner Gantz and survey crew completed required survey on November 29, 1955. A recheck of this survey prior to construction showed a few minor errors with some minor changes in alinement required to save trees and generally benefit the Park.

The plans and specifications for this project were prepared in the Western Division of Design and Construction, based on the survey made by Mr. Gardner Gantz.

CONTRACTUAL PROCEDURE

The plans and specifications for this project were mailed from the Western Division of Design and Construction to the interested Park Service offices on July 17, 1956 for distribution to the contractors on their mailing lists. Invitations to Bid were immediately mailed to each prospective bidder.

The bids were opened in the office of the Regional Director, Region Two, Omaha, Nebraska at 3:00 P.M., C.S.T., on August 7, 1956.

Four bids were received. Anchor Construction Company was low with a total bid of \$92,063.00. However, due to shortage of funds, certain items were deleted and the Contract No. 10-14-232-172 was awarded to the Anchor Construction Company, 614 Standard Oil Building, Omaha, Nebraska for \$90,618.60 on August 20, 1956.

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Notice to Proceed was acknowledged by the Contractor on August 31, 1956, making September 1, 1956 as the first day of the contract period and December 29, 1956 as the last day of this period, according to the specifications.

On December 21, 1956 the Contractor asked for an extension of time on this contract amounting to 30 calendar days due to delay in receiving the booster pump and the check valve to be installed in the pumphouse. He has submitted evidence to prove that the delay is due to others over whom he has no control. This evidence was rejected by Regional Counsel on the grounds that delay in receipt of materials was not sufficient cause. However, under Change Orders Nos. 1 through 4 an extension of time was granted in an amount that no liquidated damages were assessed.

The entire project was accepted in accordance with the contract and specifications on June 26, 1957, and Estimate No. 7-- Final Payment was prepared.

CONSTRUCTION

Please refer to Drawing No. NP-WC 3501-C, Plan As Built.

On September 13, 1956 none of the Contractor's personnel or equipment had arrived on the project site, however there had been considerable correspondence concerning materials. The Contracting Officer warned the Contractor that September 15, 1956 was the official starting date for construction and inquired as to his intentions. The Contractor advised that a carload of water pipe had been shipped from Birmingham, Alabama and that the construction superintendent, with a crew, would arrive on the job soon.

On September 18, 1956 a carload of 6 inch cast iron, cement-lined, mechanical joint pipe arrived at Hot Springs, South Dakota. This same day, four of the Contractor's men arrived with a boom-truck, Northwest backhoe and a compressor. They immediately proceeded to haul the pipe to the project.

On September 24, 1956 the Contractor started ditch excavation and laying the 6 inch pipe at Sta. 82 + 24. He continued digging and laying pipe to Sta. 109 + 92 on our revised alignment. Some rock was encountered, requiring blasting, but with the use of mats there was very little throw. The rock in the pipe ditch also required the Contractor to obtain select material for pipe bedding. The Superintendent of Wind Cave National Park arranged for this material from the South Dakota State Park at no expense to the Con-

tractor, however he had it hauled about 8.5 miles to the job site.

While testing this section of pipe line considerable trouble was experienced with the mechanical joints sweating during the test. We found about 30 joints sweating in 2000 feet which was considered too many even though the loss of water was less than permitted in the specifications. With the assistance of the Contractor it was found that the outside bituminous coating was too thick and rough to permit a watertight seal between the gaskets and the pipe. The Contractor agreed to scrape off all extra coating before the joints were made up. This reduced the number of sweating joints to a very few.

Up to November 2, 1956 all pipe had been tested before covering, but at this time a storm foretold of colder weather ahead so it was agreed that in the future the pipe would be tested to 120 psi with air then backfilled in the usual manner and to be tested with water after reaching the pumphouse. The Contractor understood that the line would not be accepted until tested. This would prevent frozen pipe and save filling the pipeline with water several times. All 6 inch pipe was tested when laid.

Due to the rocky material a great deal of select material was required for pipe bedding. The available source within the Park was very small so the Contractor paid for hauling some 350 cubic yards from a pit in State Park about 8.5 miles from the project.

The ditch excavation up and down the steep slopes was accomplished by holding the backhoe with a cable to a tractor. This method was satisfactory and no accident occurred.

On December 11, 1956 virtually all of the pipe had been installed up to the pumphouse and the construction of the pipeline complete except for the drains, air release valves and Type B manholes. The pipeline was to be tested from the pumphouse to the 4" gate valve later, after the installation of the pumps.

The Contractor immediately started work on the base for the deep well pump which arrived December 3, 1957. The footing for the pumphouse was poured shortly after. On December 6, the Contractor opened a crate containing the installation instructions for this pump and determined that the pump guarantee was void unless the pump column was placed in a well that was completely cased, which ours was not. He tried to get more information from the pump company, but could not until December 18, when he notified the Project Supervisor that the pump company had verified the statement on the instructions. WODC

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was immediately notified and asked for recommendations.

On December 27, 1956 the Black Hills Power and Light Company completed their line to the well so that the Contractor could have started installation of the pump circuit at this time, but his men had been laid off for Christmas and this work would not have required the whole crew. The copperweld wire for the pump circuit was not obtained from the freight depot until January 2, 1957 and work was started at once on the pump control circuit.

On January 3 the Contractor informed the Project Supervisor that he must know at once as to what action would be taken on casing the Wind Cave well so that he could install the deep well pump. WDC and Region Two were called and both gave approval of casing the well. However, there was some question as to the straightness of the well, so the Contractor voluntarily probed the well, first with a pipe containing 4 fins of iron 7-5/8" OD x 3'. This probe lodged in the well. Then he tried a 26' pipe with fins 7" OD which went to the bottom. This gave us hopes that 7" OD casing would go in the well. Also, this was the minimum size deemed advisable to allow sufficient water to flow between the casing and the pump column. Change Order No. 2 was written to the Contractor, directing him to install 310' of 7" OD, perforated casing on the bottom of the well where it had not been cased. On January 19, a well driller from Newcastle, Wyoming brought in a small rig. They bailed out about 10' of mud. The mud was very fine and loose, red in color. There was also a strong odor when the bailer was opened. It seemed to be a sulphurous odor.

The next Monday, January 21 the casing was welded and lowered in the well. It went below 570', where the probe had lodged, by about 24' and stuck. It was raised back to the collar of the hole and left. WDC and Region Two were called again to advise them of the situation. WDC recommended that we recall the original well driller to correct the well, but Region Two determined that for legal reasons, this could not be done, and recommended a Directional Survey of the well with a new caliper survey. This would determine if the well could be reamed or if it would have to be redrilled in part or entirely.

Change Order No. 3 was written to the Contractor January 25, 1957 directing him to have the above surveys made of the well at the earliest possible date. The continuous Directional Survey with a Hole Caliper was made by Schlumberger Well Surveying Corp. of Newcastle, Wyoming on January 28, 1957. The results of this survey showed that the bore was as specified in the drilling specifications, but that it had deviated considerably from the vertical, and was not straight.

At this time it was decided that a conference concerning the procedure for correcting the well was required. A conference was arranged to be held in Omaha on February 6 and 7, with Mr. P. E. Smith from WODC, Mr. Robertson of Region Two, Counsels Cook and Mullady, Superintendent Semingsen of Wind Cave National Park and Mr. E. V. Axline, Project Supervisor from WODC. It was decided that a Change Order should be written to Anchor Construction Company to have the well reamed or redrilled from the bottom of the 10" casing. The Contractor made inquiries of various drillers who advised against this procedure and recommended drilling a new well. The estimate for the new well was about \$22,000. However, the drillers would not contract for this amount, but preferred to drill at an hourly rate.

Since Anchor Construction Company could do no work on their contract until a final decision was made as to what was to be done with the well, they took their men to another project and suspended all work here. During this period, Mr. Smith suggested that we consider a submersible pump, so the Anchor Construction Company was asked for an estimate for the installation of a submersible pump in lieu of the Peerless Hi-Lift pump that was specified. On February 26 this estimate was received and forwarded to WODC. They considered the estimate too high and recommended that we install the Peerless Hi-Lift pump even though it would not be guaranteed since the submersible pump would not be guaranteed either.

Thus Mr. Sanborn was notified to resume work on his contract March 11, 1957. The Peerless pump was installed with rubber spiders on upper 100' of water column only. This is where the well is straight and plumb.

The $\frac{1}{4}$ " galvanized pipe for the drawdown gauge was installed separately with the low-water cut-off unit attached to it. The pump water column inlet is 656 feet below the pump base. The draw-down gauge inlet is 5 feet below the pump inlet and the low-water cut-off switch is 2 feet above the pump inlet. Then the booster pump was set on blocks and all piping connected as per plan. The concrete base for the booster pump was placed on the compacted fill of the pumphouse rather than placed in unit with the pumphouse floor as shown on the plans. This was done to get the pumping unit into operation sooner.

The pumphouse, a Butler Building was erected and fitted with the electrical control box, heater and lights. Two overhead lights were installed instead of one as shown on the plans. Also, a 110 volt duplex outlet box was installed to facilitate maintenance and repairs when needed. An additional ground wire with lightning arrester was

installed on the pumphouse for the pump control circuit. This was not specified, but complies with the electrical code. An additional 25 foot power pole was installed at the pumphouse to carry electrical power from the Blackhills Power and Light terminal pole, with transformers, to the pumphouse. It also carries the pump control circuit. This pole was necessary since a smaller mast on the building would not carry the weight of the wires.

The insulation of the steel building was quite a problem. The most satisfactory method found was to fit 1" x 2" wood furring strips into the steel frame of the building and stapling the insulation bats to them, then tightening the strips in place further with more 1" x 2" strips and nailing them. Gluing the insulation bottoms to the metal building was not recommended.

The pumping unit was put into operation and found satisfactory after some minor adjustments as long as it could be closely watched. It was found necessary to reduce the delay between starting of the well pump and the booster pump to one second. There is too much pressure built up by the well pump if the booster does not start for safety so a 2 inch safety valve was installed in the line. To give good control of the system it was determined that additional pressure gauges were needed on the low and high pressure sides of the booster pump and these were installed.

The deep well was started with the discharge through the 2 inch bypass. As expected, the water was very muddy. Then it would clear for awhile and become muddy again for awhile. On the first run the well was pumped dry at 656 feet in one and one-half hours. Later tests showed that the flow had increased some, but not sufficiently for the proposed use. The well was drawn down three times and the water cleared a great deal, but not entirely.

The booster pump was started and the pipeline filled and flushed. Then 25 pounds of HTH disinfectant was placed in the pipeline and well and pumped along the line until it showed at each drain and fire hydrant. The disinfectant was left in the line for twenty-four hours, then drained.

All of the switches, pipeline and pumps were tested and met the specifications. A test of the amount of water pumped was made at the upper fire hydrant on the line near the administration building. The flow measured through a 2 inch water meter and timed with a stop watch, showed 51.3 gallons per minute.

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Since there was not sufficient flow in the well at 656 feet, the Contractor was directed to order and install 120 feet more of water column and shaft as provided in the specifications. This material arrived April 22, 1957 and was immediately installed.

The method of procedure was changed for this installation. The northwest dragline was used for lowering the additional pump column. This method was satisfactory except that the brakes on the cable drums had not been used for some time and they did not work smoothly. The pump was held about 4 feet above its base while the $\frac{1}{4}$ " G. I. pipe airline for the drawdown gauge was lowered with the low-water cut-off unit attached. The low-water cut-off and the lower end of the air line are approximately 4 feet above the well pump intake, 772 feet. The pump was lowered into place and all piping reconnected.

On April 25, 1957 the work was started on tests of the deep well pump with the intake at 776 feet. The pump was run for 8 hours continuously. The well drew down to a zero reading on the drawdown gauge, but continued to fill a 55 gallon drum in one minute and ten seconds by stop watch. The water was fairly clear, but showed a trace of oil.. There seemed to be more vibration in the pump when the well was low.

On April 26, 1957 after a discussion with Val Sanborn, the Contractor's Superintendent, concerning Change Order No. 4 and Estimate No. 7, Final Payment, the project was accepted in accordance with the specifications.

CONCLUSION

1. It is my opinion that the project will function satisfactorily throughout, except for a few minor incidents that could not be foreseen during construction of the deep well pump.

2. The following difficulties should be anticipated with the deep well pump: (a) Since part of the well is not cased, rocks and other material from the walls of the bore may sluff off and lodge against the water column causing much trouble when the column is to be pulled for repairs; and (b) Since well is not straight, the water column and shaft was not installed in a straight line. This puts considerable strain on the shaft and bearings as it rotates at 1800 RPM. It can be anticipated that the shaft will unduly wear certain bearings or guides in the water column and will eventually fail, requiring considerable maintenance.

Submitted by: E. J. Feltine Project Supervisor

Dated 1/14/58

Approved by: Earl M. Lemmings Superintendent

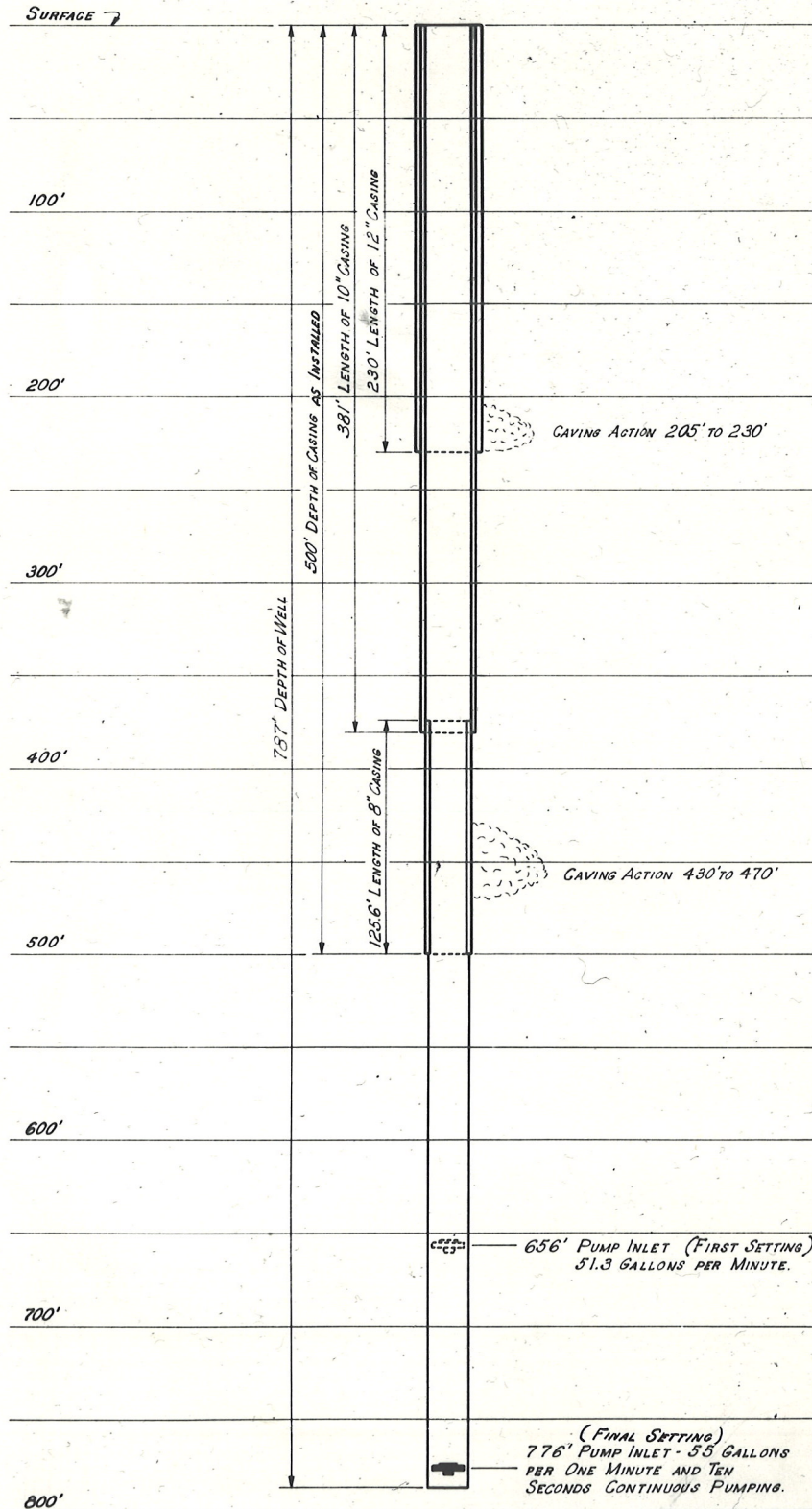
Dated Jan 17, 1958

**WATER WELL
WIND CAVE NATIONAL PARK
SOUTH DAKOTA**

COMPLETED APRIL 1956

INFORMATION FROM NARRATIVE STATEMENT
AND COMPLETION REPORT

DEPTH - FEET BELOW GROUND SURFACE



Wind Cave National Park Water Well
 Drilled by Sioux Drilling Company, Rapid City, S. D. 1956
 Located in Wind Cave Canyon, in SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 6, T. 6 S., R. 6 E.
 Custer County, South Dakota
 Sample set on file at S. D. School of Mines.
 Samples studied by J. P. Gries, 1956.

Minnelusa formation (well starts roughly 150 feet below top of formation)

- 0 - 10 surface soil and gravel. Gravel consists of fragments of Minnelusa dolomite and sandstone, chert and quartz.
- 20 gravel, same but more pink to yellow dolomite
- 30 sandstone, poorly sorted, very calcareous, pink to orange-brown, 2/3; grading to limestone, sandy, same colors, 1/3.
- 40 sandstone, orange to white, poorly sorted, very calcareous, 80%; limestone, as above, 20%.
- 50 sandstone, orange to white, poorly sorted, calcareous
- 70 sandstone, same
- 80 clay, gray to red-brown and hematite red, micaceous
- 90 shale, red-brown to hematite red, micaceous
- 95 shale, same, to silvery gray, micaceous
- 105 shale, dark gray to black
- 110 dolomite, finely crystalline, gray-brown, glassy
- 120 dolomite, same, and with much milky chert
- 130 dolomite, same, to dolomite, buff, finely crystalline, slightly earthy; some is sandy
- 136 dolomite, same
- 140 sample is mostly finely drilled up milky and brown chert with a trace of dolomite
- 160 sample same; trace of sand below 150
- 170 sandstone, fine to medium, yellow to white, calcareous
- 180 sandstone, same
- 190 sandstone, same; some new finely crystalline earthy yellow-brown dolomite
- 200 limestone and dolomite, pink to buff, still much chert
- 210 shale, black, looks petroliferous; caves badly
- 220 dolomite, finely crystalline, hard, gray to brown, mottled red; trace sandstone
- 230 dolomite, same; some sandy; may be some streaks of dolomite sandstone. 12 3/4" set at 232'
- 240 dolomite, finely crystalline, granular, light brown with pinkish cast; faintly porous, trace milky chert and drusy quartz
- 250 detrital material; earthy finely crystalline dolomite, shale, black, chert, chaledony
- 260 dolomite, light cream, fine- to medium crystalline, some earthy, very porous, with spar calcite crystals
- 270 dolomite, same, and dolomite, finely crystalline, earthy, pale pink to pale green; green is almost a silty shale
- 280 sandstone, fine, dolomitic, off-white; chert, white to milky
- 290 dolomite, finely crystalline, glassy, some sandy, light gray, more calcite spar
- 300 dolomite, finely crystalline, pink, very sandy
- 310 dolomite, same, and dolomite, very finely crystalline, gray with embedded frosted quartz grains

- 310 - 320 sandstone, fine to coarse, off-white to faintly yellow, calcareous but
drills to free grains
- 330 dolomite, very finely crystalline, hard, nearly white; some rhombic
dolomite, some sandy dolomite
- 340 dolomite, finely crystalline, glassy to earthy; nearly white to lavender,
to greenish shale; trace red shale?
- 350 dolomite, same; dolomite, silty, lavender; shale, silty lavender to
maroon
- 360 dolomite, finely crystalline to medium crystalline, glassy, nearly white
to faint pinkish-brown
- 370 dolomite, same, and shale, red-brown to maroon; siltstone, maroon
- 380 limestone, fine- to coarsely crystalline, white
- at 380 limestone, very finely crystalline, white to very light brown, trace
milky chert. 10" set at 381'
- 390 limestone, same
- 400 limestone, same; and may be some silty shale and pink calcareous ss
- 410 sandstone, red to orange, with red and maroon flaky shale
- 420 sand, orange; sand, colorless; shale, maroon; coarse fragments detrital
chert
- 430 shale, waxy, maroon to hematite red; trace green; some streaks sandstone
as above
- 440 shale, same, with few coarse frosted quartz grains
- 450 shale, maroon to hematite red
- 460 shale, red to pale green; much new fine to medium white sandstone with
coarse embedded frosted quartz grains
- 470 shale, same; more sand, some with white and light green interstitial
clay
- 472 shale, same, and maybe some new dense to medium crystalline white limestone.
Water and top Pahasapa at 472'
- 480 same as '72, perhaps more limestone 8" at 486' (E-log pick)
- 490 limestone, fine- to medium crystalline (sample mostly maroon shale)
- 500 probably same, sample 95% shale
- 502 limestone, dolomitic, very finely crystalline, white (about 1/3 shale)
- 510 limestone, fine- to medium crystalline, soft, white
- 530 limestone, same, 2/3; dolomite, medium- to coarsely crystalline, glassy,
colorless to white, porous, 1/3
- 540 limestone, fine- to medium crystalline, soft, white, still stained flesh
pink from shale cavings
- 550 dolomite, finely crystalline, white to flesh pink, earthy
- 560 dolomite, same, and dolomite, medium- to coarsely crystalline, colorless
to flesh pink, some intergranular porosity
- 570 dolomite, medium to coarsely crystalline, colorless to flesh pink, some
intergranular porosity
- 572 dolomite, same
- 580 no sample
- 590 limestone, very finely crystalline, white, dense
- 600 dolomite, fine- to medium crystalline, earthy, light brown, vuggy por
- 610 dolomite, finely crystalline, white to coarsely crystalline, pink, pink
is very porous
- 620 dolomite, medium crystalline, glassy, pink to gray-brown
- 630 dolomite, fine- to medium crystalline, white to pink and salmon, no
porosity
- 640 dolomite, same, but much spar calcite

- 640 - 650 dolomite, same and some more coarsely crystalline to rhombic, flesh pink, very porous
- 660 dolomite, finely crystalline, gray to brown, slightly saccharoidal, some
- 670 dolomite, finely crystalline, saccharoidal, light gray-brown some porosity, some hematite red mottlings in the gray
- 680 dolomite, fine- to medium crystalline, pale pink to salmon, glassy, some vuggy porosity
- 690 dolomite, fine- to coarsely crystalline and rhombic, pale pink to nearly white, some vuggy and intergranular porosity
- 700 dolomite, fine- to coarsely crystalline, white to pale pink, some rhombic, much intergranular vuggy porosity
- 720 dolomite, finely crystalline, glassy, nearly white to faintly pink, some coarsely crystalline, rhombic, porous
- 730 dolomite, fine to medium crystalline, some rhombic, light gray-brown to faintly pink.

Englewood formation

- 730 - 740 dolomite, finely crystalline, light brown to pink, vuggy porosity
- 750 dolomite, finely crystalline, ashy, red-brown, argillaceous, some red to orange shale or clay
- 760 dolomite, fine- to medium crystalline, ashy to rhombic, red-brown to maroon and gray; trace porosity, trace maroon shale

Deadwood formation

- 760 - 770 sandstone, colorless to red-brown, quartzitic, poorly sorted; traces of igneous and metamorphic rock fragments
- 780 sandstone, colorless to gray, quartzitic, tight, few fragments igneous or metamorphic rock
- 785 sandstone, colorless to white, trace hematitic stain; fine to very coarse, quartzitic, more metamorphic quartz

Precambrian schists

- 785 - 795 quartz-mica schist, gray to white

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT 7 SPL

COMPLETION REPORT OF CONSTRUCTION PROJECT

REGION Two	AREA Wind Cave National Park	COUNTY Custer	STATE South Dakota
PROJECT OR JOB TITLE Water Supply System for Headquarters Area			PCP NO. U-11-1 & 11-2
LOCATION IN AREA Headquarters Area		MASTER PLAN NO. ---	BUILDING NO. ---
WORKING DRAWING NO. AND TITLE NP-WC-3106-C			
APPROPRIATION TITLE AND SYMBOL 14X1035 Buildings and Utilities			ACCOUNT NO. WICA-XXXX 332.3
CONTRACT NO. 14-10-232-172		DATE WORK STARTED 9-1-56	DATE WORK COMPLETED 4-26-57
NAME OF CONTRACTOR Anchor Construction Company		ADDRESS 614 Standard Oil Bldg., Omaha, Nebraska	

COST ANALYSIS

CONSTRUCTION ITEMS	QTY.	UNIT COST IN PLACE	TOTAL COST IN PLACE
Contract	1st est.	10,878.97	10,878.97
	2nd est.	24,219.98	35,098.95
	3rd est.	20,774.20	55,873.15
	4th est.	15,894.28	71,767.43
	5th est.	15,931.14	87,698.57
	6th est.	5,439.20	93,137.77
	7th est.	1,645.00	94,782.77
Other Direct Expenses			
Telephone & Telegraph			66.47
Buckingham Transportation			2.10
Supplies and Materials			79.47
Facilitating Charges			718.00 718.00
TOTAL			95,648.81 95,648.81

COST AGREE WITH FFD RECORDS
C. D. VAN KIRK, SUPERVISORY ACCT.
REGION TWO OFFICE FFD
DATE FEB 18 1958

SUMMARY OF EXPENDITURES other than contractual:

PERSONAL SERVICES	EQUIPMENT	MATERIALS AND SUPPLIES
		79.47 ind. of contrac

OTHER

Facilitating Services: ~~718.00~~; Other Direct Expenses: \$68.57
718.00

CHANGE ORDERS			
ORIGINAL CONTRACT AMOUNT 90,618.60 90,618.60	FIRST 487.00	SECOND 2,092.50	THIRD 495.00
FINAL CONTRACT AMOUNT 94,782.77 94,782.77	FOURTH 709.00	INCREASE Increase in quantities - 380.67	

THIS PROJECT OR JOB HAS BEEN COMPLETED IN ACCORDANCE WITH
APPROVED DRAWINGS, SPECIFICATIONS, AUTHORIZED CHANGES

SUBMITTED BY (Name and title) E. J. Axline, Project Supervisor	DATE November 22, 1957
APPROVED BY (Name and title) Earl M. Semingsen, Superintendent	DATE November 22, 1957

(ATTACH NARRATIVE STATEMENT, PHOTOGRAPHS, AND "AS BUILT" DRAWINGS TO THIS FORM)

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Narrative Statement

INTRODUCTION

On April 21, 1956 a 790 foot water well, PCP U-13, was completed near the east boundary of Wind Cave National Park. The work was accomplished by the Sioux Drilling Company of Rapid City, South Dakota, under Contract No. 14-10-232-131, for a total sum of \$22,960.00.

The purpose of the well is to supplement the present water supply at Wind Cave National Park. The Park now obtains all water for the Headquarters Area from a spring located some distance away. For a number of years the supply has not been adequate due to drought and the continual increase in demand. This project makes the additional water supply of the well available when the spring supply is low and the public use is high.

This contract provides for an electrically driven deep-well pump to lift the water in the well from the 650 foot level to an electrically driven booster pump. From the booster pump the water flows through about 8100 feet of 4 inch pipe and about 2800 feet of 6 inch pipe to a connection with the water system in place, thence on into the reservoirs. In addition to the above the contract also provided for a branch line to the utility area, five new fire hydrants, an electric pump control circuit from the well to the reservoir, and related items such as check valves, air release valves, etc.

A new agreement was made with the Black Hills Power and Light Company whereby they would install a new overhead power system from the Park carpenter shop to the pumphouse at the well to furnish electricity for the pumps. It was also agreed that the National Park Service would be permitted to install a two wire pump control circuit from the pumphouse to the reservoirs on the power company's poles.

For location of new water supply system, please see contract drawing No. NP-WC-3106C.

For location of Black Hills Power and Light power line in the Park, see drawing attached to the above agreement.

SURVEYS AND PLANS

In the fall of 1955 the Superintendent of Wind Cave National Park started negotiations for a survey of the necessary pipe line from the well to the Headquarters Area. It was found that the Park Engineer was too busy with his regular duties to make the survey, also that there were no engineers available from the Western Division of Design and Construction in San Francisco. With these sources eliminated, the alternate was to contact various professional engineers in this state with the proposal that they contract the necessary survey.

Invitations to Bid were mailed to four engineering companies in this area, only two of which offered a bid. Walker and Gantz of Custer, South Dakota submitted the low bid of \$1,250.00. The contract was awarded to this firm on October 22, 1955. Mr. Gardner Gantz and survey crew completed required survey on November 29, 1955. A recheck of this survey prior to construction showed a few minor errors with some minor changes in alinement required to save trees and generally benefit the Park.

The plans and specifications for this project were prepared in the Western Division of Design and Construction, based on the survey made by Mr. Gardner Gantz.

CONTRACTUAL PROCEDURE

The plans and specifications for this project were mailed from the Western Division of Design and Construction to the interested Park Service offices on July 17, 1956 for distribution to the contractors on their mailing lists. Invitations to Bid were immediately mailed to each prospective bidder.

The bids were opened in the office of the Regional Director, Region Two, Omaha, Nebraska at 3:00 P.M., C.S.T., on August 7, 1956.

Four bids were received. Anchor Construction Company was low with a total bid of \$92,063.00. However, due to shortage of funds, certain items were deleted and the Contract No. 10-14-232-172 was awarded to the Anchor Construction Company, 614 Standard Oil Building, Omaha, Nebraska for \$90,618.60 on August 20, 1956.

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Notice to Proceed was acknowledged by the Contractor on August 31, 1956, making September 1, 1956 as the first day of the contract period and December 29, 1956 as the last day of this period, according to the specifications.

On December 21, 1956 the Contractor asked for an extension of time on this contract amounting to 30 calendar days due to delay in receiving the booster pump and the check valve to be installed in the pumphouse. He has submitted evidence to prove that the delay is due to others over whom he has no control. This evidence was rejected by Regional Counsel on the grounds that delay in receipt of materials was not sufficient cause. However, under Change Orders Nos. 1 through 4 an extension of time was granted in an amount that no liquidated damages were assessed.

The entire project was accepted in accordance with the contract and specifications on June 26, 1957, and Estimate No. 7-- Final Payment was prepared.

CONSTRUCTION

Please refer to Drawing No. NP-WC 3501-C, Plan As Built.

On September 13, 1956 none of the Contractor's personnel or equipment had arrived on the project site, however there had been considerable correspondence concerning materials. The Contracting Officer warned the Contractor that September 15, 1956 was the official starting date for construction and inquired as to his intentions. The Contractor advised that a carload of water pipe had been shipped from Birmingham, Alabama and that the construction superintendent, with a crew, would arrive on the job soon.

On September 18, 1956 a carload of 6 inch cast iron, cement-lined, mechanical joint pipe arrived at Hot Springs, South Dakota. This same day, four of the Contractor's men arrived with a boom-truck, Northwest backhoe and a compressor. They immediately proceeded to haul the pipe to the project.

On September 24, 1956 the Contractor started ditch excavation and laying the 6 inch pipe at Sta. 82 + 24. He continued digging and laying pipe to Sta. 109 + 92 on our revised alignment. Some rock was encountered, requiring blasting, but with the use of mats there was very little throw. The rock in the pipe ditch also required the Contractor to obtain select material for pipe bedding. The Superintendent of Wind Cave National Park arranged for this material from the South Dakota State Park at no expense to the Con-

tractor, however he had it hauled about 8.5 miles to the job site.

While testing this section of pipe line considerable trouble was experienced with the mechanical joints sweating during the test. We found about 30 joints sweating in 2000 feet which was considered too many even though the loss of water was less than permitted in the specifications. With the assistance of the Contractor it was found that the outside bituminous coating was too thick and rough to permit a watertight seal between the gaskets and the pipe. The Contractor agreed to scrape off all extra coating before the joints were made up. This reduced the number of sweating joints to a very few.

Up to November 2, 1956 all pipe had been tested before covering, but at this time a storm foretold of colder weather ahead so it was agreed that in the future the pipe would be tested to 120 psi with air then backfilled in the usual manner and to be tested with water after reaching the pumphouse. The Contractor understood that the line would not be accepted until tested. This would prevent frozen pipe and save filling the pipeline with water several times. All 6 inch pipe was tested when laid.

Due to the rocky material a great deal of select material was required for pipe bedding. The available source within the Park was very small so the Contractor paid for hauling some 350 cubic yards from a pit in State Park about 8.5 miles from the project.

The ditch excavation up and down the steep slopes was accomplished by holding the backhoe with a cable to a tractor. This method was satisfactory and no accident occurred.

On December 11, 1956 virtually all of the pipe had been installed up to the pumphouse and the construction of the pipeline complete except for the drains, air release valves and Type B manholes. The pipeline was to be tested from the pumphouse to the 4" gate valve later, after the installation of the pumps.

The Contractor immediately started work on the base for the deep well pump which arrived December 3, 1957. The footing for the pumphouse was poured shortly after. On December 6, the Contractor opened a crate containing the installation instructions for this pump and determined that the pump guarantee was void unless the pump column was placed in a well that was completely cased, which ours was not. He tried to get more information from the pump company, but could not until December 18, when he notified the Project Supervisor that the pump company had verified the statement on the instructions. WODC

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was immediately notified and asked for recommendations.

On December 27, 1956 the Black Hills Power and Light Company completed their line to the well so that the Contractor could have started installation of the pump circuit at this time, but his men had been laid off for Christmas and this work would not have required the whole crew. The copperweld wire for the pump circuit was not obtained from the freight depot until January 2, 1957 and work was started at once on the pump control circuit.

On January 3 the Contractor informed the Project Supervisor that he must know at once as to what action would be taken on casing the Wind Cave well so that he could install the deep well pump. WDC and Region Two were called and both gave approval of casing the well. However, there was some question as to the straightness of the well, so the Contractor voluntarily probed the well, first with a pipe containing 4 fins of iron 7-5/8" OD x 3'. This probe lodged in the well. Then he tried a 26' pipe with fins 7" OD which went to the bottom. This gave us hopes that 7" OD casing would go in the well. Also, this was the minimum size deemed advisable to allow sufficient water to flow between the casing and the pump column. Change Order No. 2 was written to the Contractor, directing him to install 310' of 7" OD, perforated casing on the bottom of the well where it had not been cased. On January 19, a well driller from Newcastle, Wyoming brought in a small rig. They bailed out about 10' of mud. The mud was very fine and loose, red in color. There was also a strong odor when the bailer was opened. It seemed to be a sulphurous odor.

The next Monday, January 21 the casing was welded and lowered in the well. It went below 570', where the probe had lodged, by about 24' and stuck. It was raised back to the collar of the hole and left. WDC and Region Two were called again to advise them of the situation. WDC recommended that we recall the original well driller to correct the well, but Region Two determined that for legal reasons, this could not be done, and recommended a Directional Survey of the well with a new caliper survey. This would determine if the well could be reamed or if it would have to be redrilled in part or entirely.

Change Order No. 3 was written to the Contractor January 25, 1957 directing him to have the above surveys made of the well at the earliest possible date. The continuous Directional Survey with a Hole Caliper was made by Schlumberger Well Surveying Corp. of Newcastle, Wyoming on January 28, 1957. The results of this survey showed that the bore was as specified in the drilling specifications, but that it had deviated considerably from the vertical, and was not straight.

At this time it was decided that a conference concerning the procedure for correcting the well was required. A conference was arranged to be held in Omaha on February 6 and 7, with Mr. P. E. Smith from WODC, Mr. Robertson of Region Two, Counsels Cook and Mullady, Superintendent Semingsen of Wind Cave National Park and Mr. E. V. Axline, Project Supervisor from WODC. It was decided that a Change Order should be written to Anchor Construction Company to have the well reamed or redrilled from the bottom of the 10" casing. The Contractor made inquiries of various drillers who advised against this procedure and recommended drilling a new well. The estimate for the new well was about \$22,000. However, the drillers would not contract for this amount, but preferred to drill at an hourly rate.

Since Anchor Construction Company could do no work on their contract until a final decision was made as to what was to be done with the well, they took their men to another project and suspended all work here. During this period, Mr. Smith suggested that we consider a submersible pump, so the Anchor Construction Company was asked for an estimate for the installation of a submersible pump in lieu of the Peerless Hi-Lift pump that was specified. On February 26 this estimate was received and forwarded to WODC. They considered the estimate too high and recommended that we install the Peerless Hi-Lift pump even though it would not be guaranteed since the submersible pump would not be guaranteed either.

Thus Mr. Sanborn was notified to resume work on his contract March 11, 1957. The Peerless pump was installed with rubber spiders on upper 100' of water column only. This is where the well is straight and plumb.

The $\frac{1}{4}$ " galvanized pipe for the drawdown gauge was installed separately with the low-water cut-off unit attached to it. The pump water column inlet is 656 feet below the pump base. The draw-down gauge inlet is 5 feet below the pump inlet and the low-water cut-off switch is 2 feet above the pump inlet. Then the booster pump was set on blocks and all piping connected as per plan. The concrete base for the booster pump was placed on the compacted fill of the pumphouse rather than placed in unit with the pumphouse floor as shown on the plans. This was done to get the pumping unit into operation sooner.

The pumphouse, a Butler Building was erected and fitted with the electrical control box, heater and lights. Two overhead lights were installed instead of one as shown on the plans. Also, a 110 volt duplex outlet box was installed to facilitate maintenance and repairs when needed. An additional ground wire with lightning arrester was

installed on the pumphouse for the pump control circuit. This was not specified, but complies with the electrical code. An additional 25 foot power pole was installed at the pumphouse to carry electrical power from the Blackhills Power and Light terminal pole, with transformers, to the pumphouse. It also carries the pump control circuit. This pole was necessary since a smaller mast on the building would not carry the weight of the wires.

The insulation of the steel building was quite a problem. The most satisfactory method found was to fit 1" x 2" wood furring strips into the steel frame of the building and stapling the insulation bats to them, then tightening the strips in place further with more 1" x 2" strips and nailing them. Gluing the insulation bottoms to the metal building was not recommended.

The pumping unit was put into operation and found satisfactory after some minor adjustments as long as it could be closely watched. It was found necessary to reduce the delay between starting of the well pump and the booster pump to one second. There is too much pressure built up by the well pump if the booster does not start for safety so a 2 inch safety valve was installed in the line. To give good control of the system it was determined that additional pressure gauges were needed on the low and high pressure sides of the booster pump and these were installed.

The deep well was started with the discharge through the 2 inch bypass. As expected, the water was very muddy. Then it would clear for awhile and become muddy again for awhile. On the first run the well was pumped dry at 656 feet in one and one-half hours. Later tests showed that the flow had increased some, but not sufficiently for the proposed use. The well was drawn down three times and the water cleared a great deal, but not entirely.

The booster pump was started and the pipeline filled and flushed. Then 25 pounds of HTH disinfectant was placed in the pipeline and well and pumped along the line until it showed at each drain and fire hydrant. The disinfectant was left in the line for twenty-four hours, then drained.

All of the switches, pipeline and pumps were tested and met the specifications. A test of the amount of water pumped was made at the upper fire hydrant on the line near the administration building. The flow measured through a 2 inch water meter and timed with a stop watch, showed 51.3 gallons per minute.

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Since there was not sufficient flow in the well at 656 feet, the Contractor was directed to order and install 120 feet more of water column and shaft as provided in the specifications. This material arrived April 22, 1957 and was immediately installed.

The method of procedure was changed for this installation. The northwest dragline was used for lowering the additional pump column. This method was satisfactory except that the brakes on the cable drums had not been used for some time and they did not work smoothly. The pump was held about 4 feet above its base while the $\frac{1}{4}$ " G. I. pipe airline for the drawdown gauge was lowered with the low-water cut-off unit attached. The low-water cut-off and the lower end of the air line are approximately 4 feet above the well pump intake, 772 feet. The pump was lowered into place and all piping reconnected.

On April 25, 1957 the work was started on tests of the deep well pump with the intake at 776 feet. The pump was run for 8 hours continuously. The well drew down to a zero reading on the drawdown gauge, but continued to fill a 55 gallon drum in one minute and ten seconds by stop watch. The water was fairly clear, but showed a trace of oil.. There seemed to be more vibration in the pump when the well was low.

On April 26, 1957 after a discussion with Val Sanborn, the Contractor's Superintendent, concerning Change Order No. 4 and Estimate No. 7, Final Payment, the project was accepted in accordance with the specifications.

CONCLUSION

1. It is my opinion that the project will function satisfactorily throughout, except for a few minor incidents that could not be foreseen during construction of the deep well pump.

2. The following difficulties should be anticipated with the deep well pump: (a) Since part of the well is not cased, rocks and other material from the walls of the bore may sluff off and lodge against the water column causing much trouble when the column is to be pulled for repairs; and (b) Since well is not straight, the water column and shaft was not installed in a straight line. This puts considerable strain on the shaft and bearings as it rotates at 1800 RPM. It can be anticipated that the shaft will unduly wear certain bearings or guides in the water column and will eventually fail, requiring considerable maintenance.

Submitted by: E. J. Feltine Project Supervisor

Dated 1/14/58

Approved by: Earl M. Lemmings Superintendent

Dated Jan 17, 1958

Gronlund, Eric

To: Steve_Schrempp@nps.gov
Cc: Jeff_Hughes@nps.gov
Subject: FW: Wind cave well deepening and meeting



NPS letter.pdf (94
KB)

Mr. Schrempp:

The record for the well(s) authorized by WR No. 419-2 is anything but clear. The Water Rights Program coded the water source as the Madison Aquifer but it is my understanding that the original well was developed into both the Madison and Deadwood. This is not the type of construction that is allowed under today's well construction standards but was done in the day when this well was drilled. In addition, Water Rights customarily permits by individual water source and not combined sources on the same permit. Never the less, that appears to have occurred with WR No. 419-2.

Then in 1998 the NPS made a request for an additional well. This was granted by the Chief Engineer (see attachment) as long as no additional water was appropriated and the well was constructed into the Deadwood Formation. I believe this was granted for the Deadwood Formation based on the proposed depth stated on NPS's request and the commingled nature of the water sources under the original WR No. 419-2.

Now it appears that the additional well that was subject to the 1998 authorization was completed into the Madison Aquifer instead of the Deadwood.

I next had correspondence with Jeff Hughes a little over a year ago (see email below) regarding this issue. Looking back, I am not certain my email to Jeff was as clear as it should have been.

The Water Rights Program authorized this additional well to be into the Deadwood Formation. Right or wrong, that authorization did not have a time frame to complete this additional well into the Deadwood Formation. Now NPS intends to develop the additional well into the authorized source - the Deadwood. So no further authorization is necessary. However, if this well remains completed into the Madison Aquifer, then water right permitting will be necessary.

This 1998 authorization for the additional well did not impact the original well's development into both formations.

Eric Gronlund
 Water Rights Program, DENR
 605 773-3352

-----Original Message-----

From: Gronlund, Eric
 Sent: Monday, July 16, 2007 11:15 AM
 To: 'Jeff_Hughes@nps.gov'
 Subject: RE: Wind cave well deepening and meeting

A water right permit will need to be obtained if NPS develops into a different water source. Technically, the water right permit should be obtained prior to drilling. However, there is the ability to request to drill a "test well". This is the cased production well that then could not be used until a water right permit is obtained. If this is the avenue NPS wants to take, a written request can be made to Jim Goodman, Water Rights Program, DENR, 523 E Capitol Avenue, Pierre SD.

As far as meeting in mid to late August. It would probably be better for you to throw out a few dates when NPS is available to come up to SD and from there I will check which date

works best. I do know that August 7 thru 10, August 14 and August 27 - 29 will NOT work.

Eric

-----Original Message-----

From: Jeff_Hughes@nps.gov (mailto:Jeff_Hughes@nps.gov)

Sent: Friday, July 13, 2007 9:26 AM

To: Gronlund, Eric

Cc: Dan_McGlothlin@nps.gov

Subject: Wind cave well deepening and meeting

Eric,

Hope the Board meeting went well.

I believe I had mentioned to you earlier that Wind Cave NP was considering deepening the backup well (Well #2) associated with the park water supply under water right 419-2. This well is presently completed in the Madison Aquifer and the water tested in the well has exceeded EPA drinking water standards for arsenic and fluoride in the past.

The park has notified me that they have approval to deepen the well into the Deadwood formation and see if that formation provides better water quality. I recall you telling me that the NPS would need to obtain a new water right for this well because it would be withdrawing water from a different source aquifer.

My question for you is, does the NPS need to apply for a new water right before they begin drilling, or can we wait until after the well is drilled and water samples are analyzed before we apply for a permit? The park has indicated they will seal off the Deadwood formation if it does not provide good quality water, thereby making the new permit moot. If the Deadwood does provide good quality water, they would seal off the Madison aquifer and pump only from the Deadwood.

Please let me know what the State recommends so I can let the park know.

One other item; were you able to see if your staff would be able to meet with the NPS in mid to late August? If so, let me know what dates are acceptable and I'll try to pin people down here and settle on a date.

Thanks Eric. Please let me know if you have any questions.

Jeff

Jeffrey C. Hughes, Hydrologist
National Park Service, Water Resources Division
1201 Oakridge Dr. Suite 250
Fort Collins, CO 80525
(970) 225-3527 (direct)
(970) 225-9965 (fax)
jeff_hughes@nps.gov

Report on an Aquifer Test at Wind Cave National Park, on September 9 – 11, 2008
Jeff Hughes and Paula A. Cutillo, NPS Water Resources Division
December 3, 2008

Jeff Hughes traveled to Wind Cave National Park (WICA) on September 8 – 11, 2008, to oversee the completion of a single-well aquifer test. The objective of the test was to collect the data necessary to derive an estimate of aquifer transmissivity (T) for the Madison aquifer within the park. Transmissivity is the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

The determination of this aquifer property will assist the National Park Service (NPS) and the State of South Dakota, Department of Environment and Natural Resources (DENR) in predicting how the Madison aquifer will respond to pumping proposed in applications to withdraw ground water from the Madison aquifer near WICA. Personnel from the park, DENR, and U.S. Geological Survey (USGS) assisted with the test.

The personnel involved in data collection during the test were:

Jeff Hughes (Hydrologist, NPS)
Steve Schrempp (Facilities Manager, WICA)
Marc Ohms, (Physical Science Technician, WICA)
Ken Buhler (Natural Resource Engineering Specialist, DENR)
Joel Peterson (Hydrologic Technician, USGS)

WICA Well No. 2 was the pumping well for this single-well aquifer test. Well No. 2 was drilled in 2001 to serve as a back-up water supply well to Well No. 1. Well No. 1 is located at the park boundary at the downstream end of Wind Cave Canyon, and Well No. 2 is located just over 550 feet up-canyon or west from Well No. 1 (Figures 1 & 2). According to drilling logs, Well No. 2 is completed and screened entirely within the Madison aquifer.

Background

The aquifer test was designed to pump and monitor water levels continuously in Well No. 2 for approximately 24 hours and then shut off the pump and monitor water levels for another 24 hours as water levels recovered in the well. Well No. 2 had not been pumped for several months prior to this test. Although Well No. 1 had been in constant use, it is unlikely that pumping from Well No. 1 affected the water level in Well No. 2 during this aquifer test; Well No. 2 showed no response to three days of pumping in Well No. 1 during a previous aquifer test (Cutillo and Hughes, 2008).

Pumping schedule – The pump for Well No. 2 was turned on at 1046 MDT on September 9, 2008 and ran continuously for just under 24 hours with two breaks in operation. The first one occurred from approximately 1148 to 1150 MDT and the second from approximately 1213 to 1216 MDT. According to Steve Schrempp, the pump automatically shut down twice because water was discharging onsite instead at the WICA water storage tank located approximately 2.5 miles west and 450 feet upgradient of Well No. 2. The water was discharged onsite because

water from Well No. 2 does not meet Environmental Protection Agency drinking water standards and the untreated water could not be discharged into the WICA water storage tank. Because the pump had less head pressure to work against, the amount of current that the motor drew increased and caused the pump to run much faster than the rate for which it was designed. To solve this, Mr. Schrempp first tried to increase the head pressure on the pump by partially closing the discharge valve, but the pump shut down a second time. He then adjusted the set point on the motor saver for the allowable current to a value slightly above what the pump was actually drawing to keep the motor saver from shutting the pump down. The pump then ran until it was turned off at 1035 MDT on September 10, 2008. Recovery was monitored until 850 MDT on September 11, 2008.

Pumping Rates – Maintaining a constant pumping rate during the aquifer test is critical in calculating a T value. One method used to determine the pumping rate was to record the time it took to pump 100 gal through the water meter (Hersey brand). This water was discharged into a dry draw downgradient of the well and pump house. It is unlikely that the water discharged into the dry draw was able to percolate to the water table of the overlying Minnelusa aquifer in the area of the pumping well, and thereby increase head in the Madison aquifer during the test. This is due in part to interbedded shale layers in the Minnelusa aquifer and the great depth to the Minnelusa aquifer water table. Meter readings showed the following pumping rates for Well No. 2:

Water Meter data					
Date	Time of day (MDT)	Volume pumped (gal)	Time interval (sec)	Pumping rate (gpm)	Remarks
9/9/2008	10:47	100	59.2	101.35	Pump started @ 10:46:07
9/9/2008	10:49	100	60.1	99.83	
9/9/2008	10:52	100	62.3	96.31	
9/9/2008	11:05	100	62.6	95.85	
9/9/2008	11:15	100	62.9	95.39	
9/9/2008	11:40	100	63	95.24	
9/9/2008	12:07	100	63.2	94.94	Pump stopped @ 11:48
9/9/2008	12:09	100	62.7	95.69	Pump started @ 11:50
9/9/2008	12:40	100	63.3	94.79	Pump stopped @ 12:13
9/9/2008	13:00	100	63	95.24	Pump started @ 12:16
9/9/2008	13:55	100	63	95.24	
9/9/2008	15:02	100	62.8	95.54	
9/9/2008	16:00	100	63.1	95.09	
9/9/2008	16:56	100	62.8	95.54	
9/10/2008	8:21	100	62.7	95.69	
9/10/2008	9:32	100	62.7	95.69	
9/10/2008	10:25	100	62.7	95.69	Pump stopped @ 10:35:00 MDT

Estimated water meter start value = 1590 gal
 Final water meter value = 125,148 gal
 Total water pumped = 123,558 gal

To verify the above pumping rates, volumetric measurements were also taken throughout the pumping portion of the test and are presented below:

Volumetric data					
Date	Time of day (MDT)	Volume collected (liters)	Volume collected (gal)	Time interval (sec)	Pumping rate (gpm)
9/9/2008	10:50	410	108.31	60	108.31
9/9/2008	15:20	389	102.77	60	102.77
9/10/2008	9:18	183	48.34	22.4	129.49
9/10/2008	9:21	182	48.08	22.4	128.79
9/10/2008	*	966.5	255.33	120	127.66
9/10/2008	*	173	45.70	21.6	126.95

*Last two volumetric readings occurred just before pump was turned off at 10:35:00 MDT

Three slightly different methods of collecting volumetric measurements were used. For the first two readings on September 9, a 400-gallon plastic tank situated in the back of an NPS pickup was used. The water discharged from the well was diverted into the 400-gallon tank for one minute and then that volume was measured by draining the water from the tank into a calibrated 20-liter bucket. The pumping rate in gallons per minute was calculated by simply determining the total volume collected in the 400-gallon tank.

For the first, second, and fourth measurements collected on September 10, the water discharged from the well was diverted into a 44-gallon plastic trash can and the amount of time it took to fill the 44-gallon trash can was recorded. The volume of water collected in the 44-gallon trash can was measured by pouring it into the calibrated 20-liter bucket. The pumping rate was determined by dividing the volume collected by the time it took to fill the 44-gallon trash can.

For the third measurement on September 10, the discharging water was diverted into the 400-gallon plastic tank for two minutes, and the water was drained into the 44-gallon plastic trash can (volume = 182.5 liters) and the volumes recorded. The pumping rate was calculated by dividing the volume collected by two minutes.

The volumetric measurements listed above show a greater pumping rate than those determined from the water meter. Reasons for this could be gear slippage in the water meter if it is not designed to handle flows at these rates or if it was not calibrated properly when manufactured. Possible errors in the volumetric methods are the inaccuracies associated with measuring the water level in the calibrated bucket while draining the larger containers and recording the proper times that the containers received the water. Recordings from the water meter readings indicate that the pumping rate reached a consistent rate after about the first hour and 20 minutes of pumping. It was generally agreed that the water meter underestimated the pumping rate and total volume pumped during the test and that the volumetric measurements were more reliable. For these reasons, a pumping rate of 115 gpm was used in the aquifer test analyses described below.

Water Levels – Water levels were recorded throughout the pumping and recovery phases of the test. Two separate methods were used to record water level in Well No. 2. Water levels were recorded manually using a 1000-ft electronic well tape (Figure 3, data in Appendix A) and automatically using a Honeywell Model TJE 200 psi, true gage, 0.1% full scale accuracy, non-submersible transducer and a Sutron Satlink datalogger (Figure 4). The USGS was contracted to install and operate the datalogger and pressure transducer. The automated monitoring equipment was set up similar to a USGS standard stream gage set up where the water level in a stream is determined by converting the water pressure above a conduit filled with nitrogen gas to stream stage. In this case, a nitrogen tank was attached to the ¼ inch airline existing in the well and the amount of pressure needed to allow a small amount of gas to emit from the bottom of the airline was recorded by the transducer and datalogger. As water levels in the well changed, the transducer and data logger recorded changes in pressure. These changes in pressure were converted to changes water depth above the airline orifice in the well using the conversion factor of 1 psi = 2.3 ft of water. The initial depth to water from the top of the well casing was set in the datalogger using a reading from the electronic well tape. The datalogger recorded pressure readings every five seconds. Due to the amount of data collected, it is not included in this report, but is available upon request. This setup was removed at the end of the test.

When water levels were changing rapidly, two people recorded the manual measurements: one person used the electronic well tape, and the other person recorded the readings. Manual measurements were taken as quickly as possible immediately after the pump was turned on and turned off. During periods of rapid water-level change, data recorded from the pressure transducer did not agree with the manual measurements. This was likely due to pressure problems related to the relatively small diameter airline. The two methods agree better when water levels were not changing rapidly. Thus, the manual measurements were considered to be more reliable and were used in the analyses below.

Barometric Pressure – Barometric pressure readings were taken throughout the aquifer test with a Thommen Altimeter/Barometer and are presented below:

Date	Time (MDT)	Pressure (inches of Hg)
9/9/2008	9:38	27.31
9/9/2008	10:43	27.30
9/9/2008	13:00	27.32
9/9/2008	16:00	27.32
9/9/2008	17:00	27.31
9/10/2008	8:30	27.32
9/10/2008	10:40	27.33
9/10/2008	12:00	27.30
9/10/2008	15:00	27.32
9/10/2008	16:05	26.83
9/11/2008	8:53	27.40

Barometric pressure remained fairly constant during the test and is assumed to have not significantly affected water levels during the aquifer test.

Results & Discussion

Specific capacity – The table below provides estimates of specific capacity at different times during the aquifer test using pumping rates calculated from the volumetric measurements:

Elapsed Time (min)	Approximate pumping rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)
4	108	92.45	1.17
258	103	181.35	0.56
1398	129	181.80	0.71
1425	127	181.78	0.70

Specific capacity is a useful estimation of the rate at which a well can produce water. The data show that specific capacity varies with the duration of discharge, but that after a sufficient amount of time, the specific capacity of Well No. 2 was about 0.7 gpm/ft.

Casing storage – Casing or wellbore storage typically affects drawdown in the pumped well in the early part of an aquifer test. The time-drawdown plot for this test indicates that the early data likely represent the removal of water stored in the well casing (Figure 6). The ‘critical time’ after which casing storage no longer affects drawdown in the well was estimated to be about 46 to 73 min using the Schafer (1978) method (e.g., Sterrett, 2007, p. 229) with the inside diameter of well casing varying from 7 to 8 5/8 in, outside diameter of pump pipe = 2.5 in, and a specific capacity = 0.56 gpm/ft.

Analysis of pumping data – Analysis of the aquifer test data during the pumping period was complicated by two stoppages in pumping. The first break unfortunately occurred about the time when casing storage was assumed to no longer be contributing to the yield of the well. It is difficult to fit a Theis-type curve to the variable-pumping rate data and so the Cooper-Jacob (1946) straight-line method was manually fit to a semi-log time-drawdown plot to estimate T from late-time pumping data. This method is valid when time is sufficiently large and the radius of the pumping well is sufficiently small. However, it should be noted that several of the other major assumptions made when applying this method are not valid, such as a fully penetrating pumping well and homogeneous and isotropic aquifer properties.

A straight line was fit to the manual data collected after casing storage effects were believed to no longer be a factor (Figure 6). Transmissivity was calculated for this period using the following equation (e.g., Sterrett, 2007, p. 209):

$$T = \frac{2.303Q}{4\pi\Delta s} = 3688 \text{ ft}^2 / \text{day}$$

where Q is the pumping rate (ft^3/day) and Δs is the change in drawdown given by the straight line over one log-cycle time (ft).

As Figure 6 indicates, the time-drawdown curve during pumping can be separated into three stages. The first stage, as noted above, is affected by casing storage. The second stage is a transition between water being withdrawn from casing storage and water being withdrawn from the aquifer. After about 40 min, the slope of time-drawdown plot noticeably decreases. The most likely explanation for this flattened slope is vertical leakage through saturated layers above or below the screened interval of the production well, which brings about quasi-equilibrium conditions in water level.

Analysis of recovery data – Aquifer transmissivity was also estimated from the aquifer test recovery period. Figure 7 shows residual drawdown (s') versus the ratio of the time since pumping started (t) and the time since pumping stopped (t'). Residual drawdown is the difference between the static water level and the depth to water in the well during the recovery period. Again, the data can be separated into early and late-time data; the late-time data likely better represent true aquifer conditions. Transmissivity was calculated from the recovery data using the following equation (e.g., Sterrett, 2007, p. 242):

$$T = \frac{264Q}{\Delta s'} = 2742 \text{ ft}^2 / \text{day}$$

where Q is the pumping rate (gpm) and $\Delta s'$ is the change in residual drawdown over one log-cycle time (ft).

Conclusions

The aquifer test data were affected by casing storage and variable pumping rates, and were perhaps also affected by turbulent flow in the pumping well, partial penetration of the pumping well, and vertical leakage. Given all of the above, however, transmissivity calculated from late-time pumping data and late-time recovery data agreed quite well. The results of this aquifer test therefore indicate that the transmissivity of the Madison aquifer in the area of WICA Well No. 2 is on the order of 3200 ft²/day.

References

- Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well-field history. *Eos, Transactions of the American Geophysical Union* 27:526-34.
- Cuttillo, P.A., and J.C. Hughes, 2008. Report on an Aquifer Test at Wind Cave National Park on October 22 – 25, 2008. Fort Collins, CO: National Park Service, Water Resources Division, 11 pp.
- Schafer, D.C., 1978. Casing storage can affect pumping test data. *Johnson Drillers Journal* Jan./Feb.
- Sterrett, R.J., 2007. *Groundwater and Wells*, Third Edition, Johnson Screens, Bloomington, Minnesota, 812 pp.

Figures

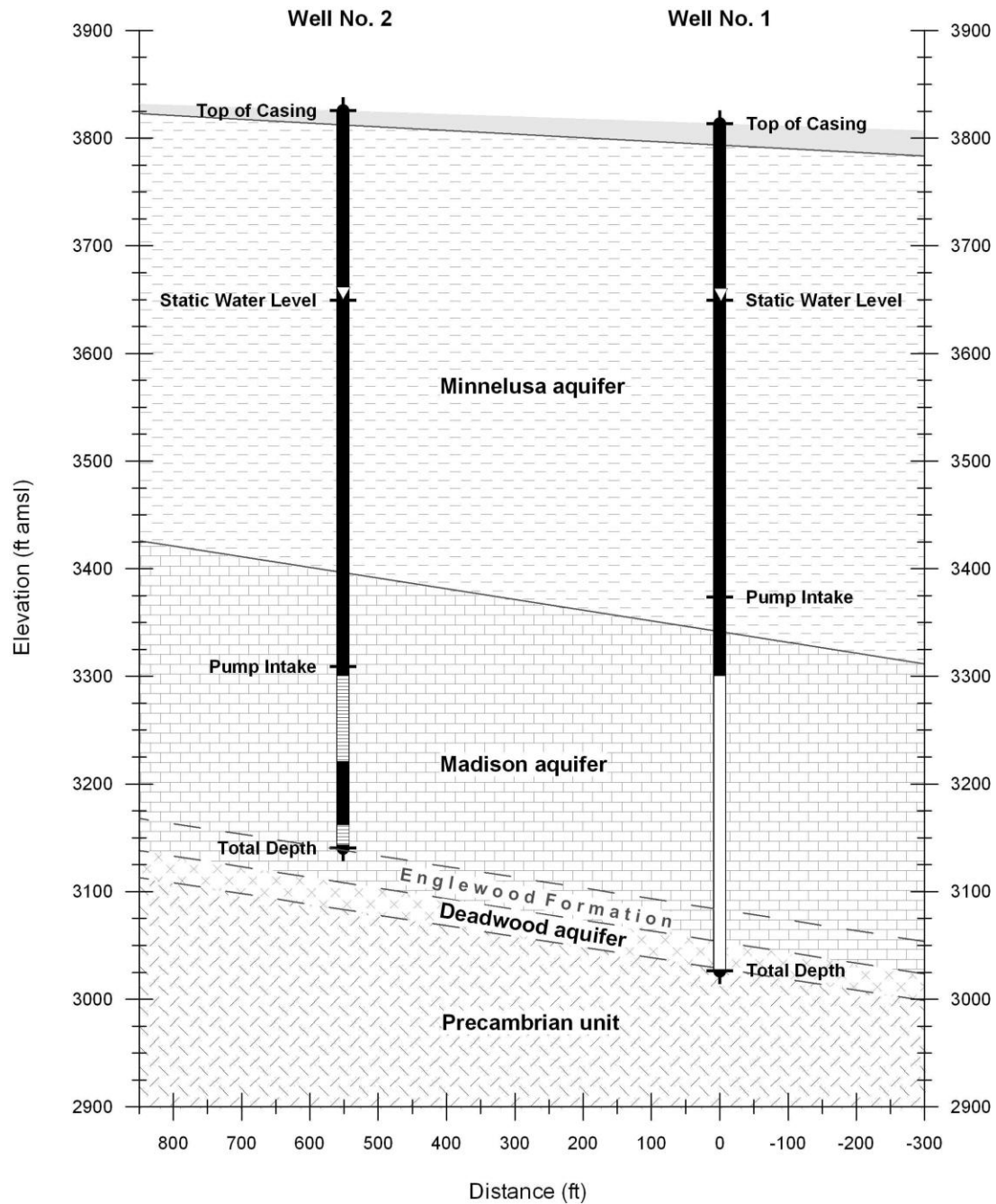


Figure 1. Schematic cross-section of water-supply Wells No. 1 and No. 2 at WICA, constructed from drilling logs and survey data. Land surface elevations were revised from the diagram in Cutillo & Hughes (2008) to represent values from a July 30, 2008 survey.



Figure 2. Well No. 2, the pumphouse, and Total Station setup over the WICA-12 benchmark.



Figure 3. Water level being measured with the electronic well tape in Well No. 2.



Figure 4. Automated data recording set up at Well No. 2.

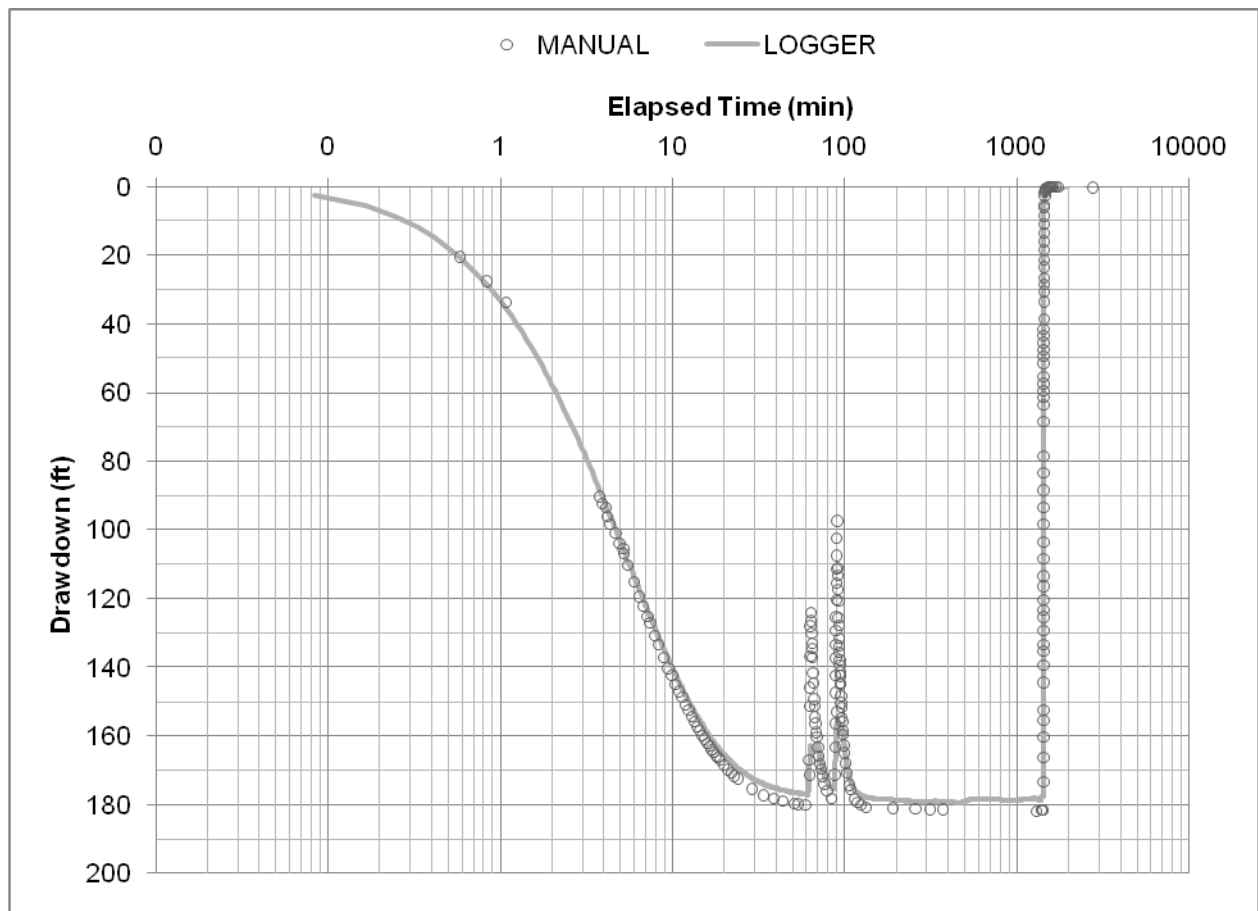


Figure 5. Drawdown vs. time in the pumping well for the pumping and recovery phases of the aquifer test. Manual measurements were made using an electronic well tape and the automated measurements were collected using a transducer and datalogger.

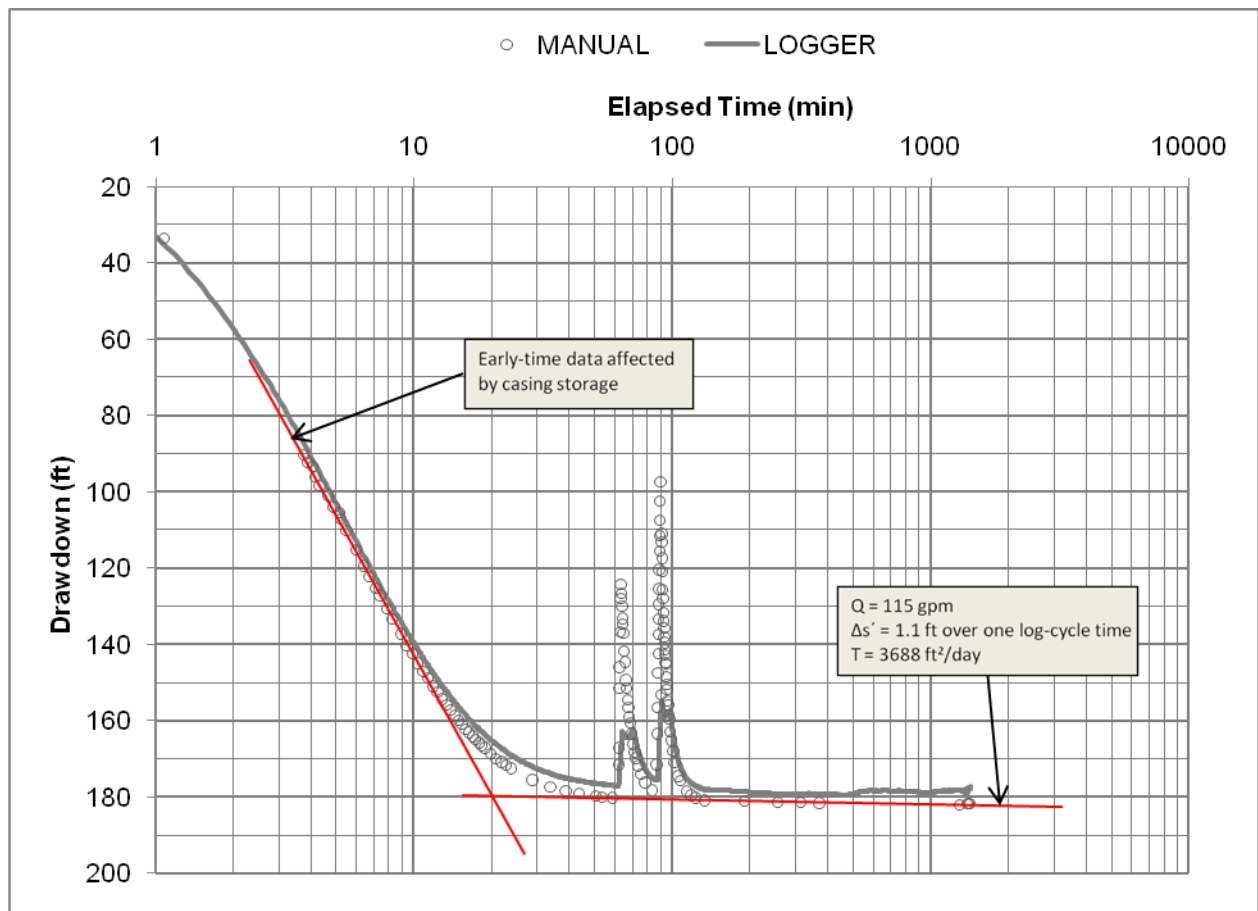


Figure 6. Time-drawdown plot for the pumping phase of the aquifer test. Water stored in the well casing affects the early test data. Transmissivity was determined using the Cooper-Jacob method from the later-time manual data.

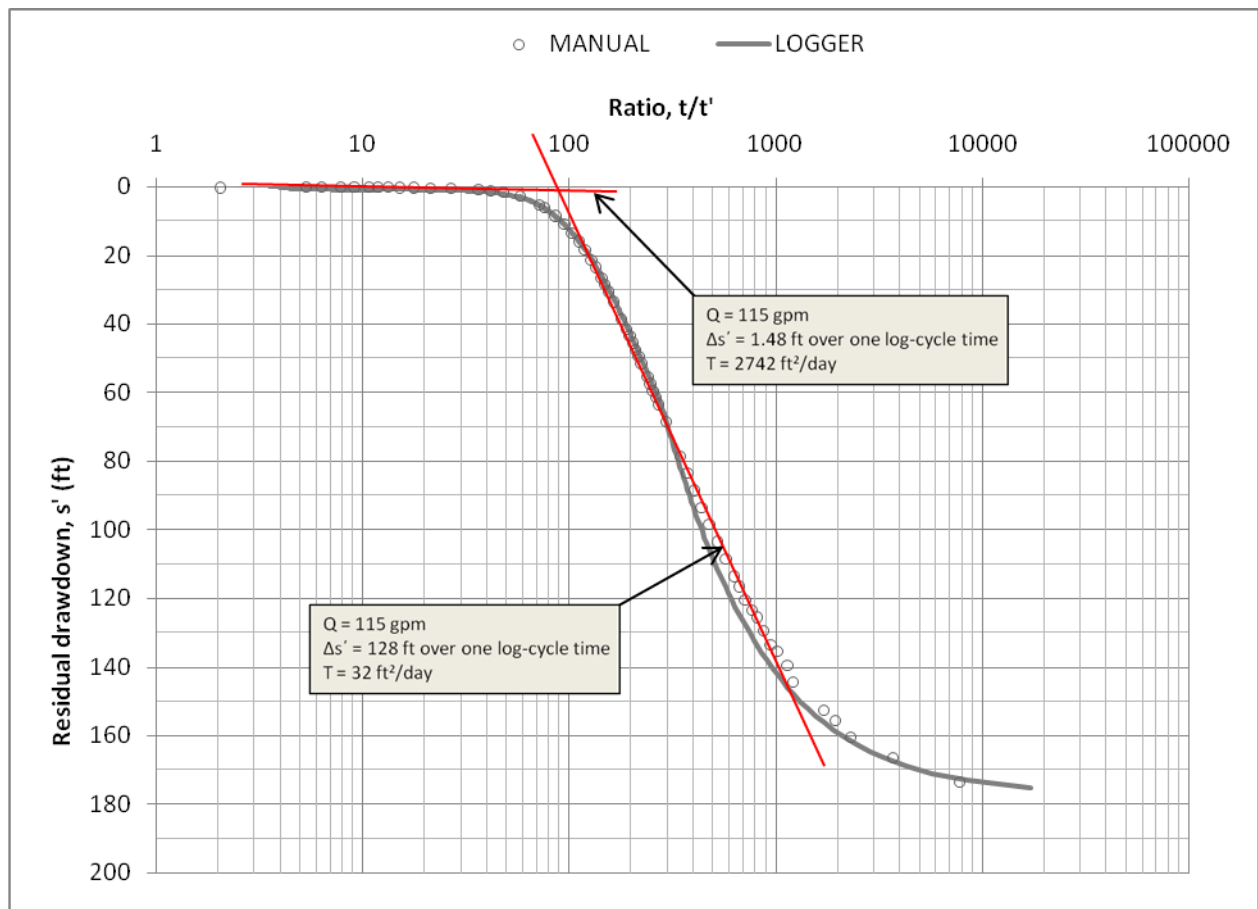


Figure 7. Residual drawdown in the pumping well plotted against the ratio t/t' for the recovery phase of the aquifer test. Note that time during recovery increases to the left on this chart. The change in residual drawdown over one log-cycle for early-time and late-time recovery data were used in the calculation of transmissivity.

Appendix A.

Manual water level measurements from Well No. 2 using the electronic well tape.

Wind Cave National Park

Water Level Measurements in Well No. 2 during single well aquifer test

of September 9 - 11, 2008

Data collected with 1000 foot electronic well tape (USGS)

Data collected by K. Buhler (SD-DENR), J. Petersen (USGS),

J. Hughes (NPS-WRD) and Marc Ohms (WICA)

Data entered by Laura Quattrini and checked by Jeff Hughes on September 12, 2008

Modified on October 27, 2008 by J. Hughes (changed the pump stop/start times)

Note: TOC - Top of Well Casing

DATE	Clock Time (MDT)	Elapsed time (mm:ss)	Depth to Water from TOC (ft)	Remarks
9/9/2008	10:42:15	N/A	176.55	Pre-pumping water level
9/9/2008	10:46:40	00:00	197.00	Pump on @ 10:46
9/9/2008	10:46:55	00:15	204.00	
9/9/2008	10:47:10	00:30	210.20	
9/9/2008	10:49:50	03:10	266.80	
9/9/2008	10:50:00	03:20	269.00	
9/9/2008	10:50:10	03:30	270.00	
9/9/2008	10:50:15	03:35	272.70	
9/9/2008	10:50:25	03:45	274.90	
9/9/2008	10:50:45	04:05	277.50	
9/9/2008	10:51:00	04:20	280.50	
9/9/2008	10:51:15	04:35	282.00	
9/9/2008	10:51:20	04:40	283.60	
9/9/2008	10:51:35	04:55	286.80	
9/9/2008	10:52:05	05:25	291.70	
9/9/2008	10:52:30	05:50	296.00	
9/9/2008	10:52:50	06:10	298.80	
9/9/2008	10:53:15	06:35	301.80	
9/9/2008	10:53:30	06:50	303.70	
9/9/2008	10:54:00	07:20	307.30	
9/9/2008	10:54:20	07:40	310.00	
9/9/2008	10:55:00	08:20	313.80	
9/9/2008	10:55:30	08:50	316.90	
9/9/2008	10:56:00	09:20	319.00	
9/9/2008	10:56:30	09:50	321.50	
9/9/2008	10:57:00	10:20	323.70	
9/9/2008	10:57:30	10:50	325.30	
9/9/2008	10:58:00	11:20	327.50	
9/9/2008	10:58:30	11:50	329.15	
9/9/2008	10:59:00	12:20	330.90	
9/9/2008	10:59:30	12:50	332.35	
9/9/2008	11:00:00	13:20	333.85	

9/9/2008	11:00:30	13:50	335.15	
9/9/2008	11:01:00	14:20	336.50	
9/9/2008	11:01:30	14:50	337.55	
9/9/2008	11:02:00	15:20	338.70	
9/9/2008	11:02:30	15:50	339.60	
9/9/2008	11:03:00	16:20	340.63	
9/9/2008	11:03:30	16:50	341.50	Uncertain of depth to water measurement
9/9/2008	11:04:00	17:20	342.35	
9/9/2008	11:04:30	17:50	343.01	
9/9/2008	11:05:00	18:20	343.70	
9/9/2008	11:06:00	19:20	345.25	
9/9/2008	11:07:00	20:20	346.45	
9/9/2008	11:08:00	21:20	347.40	
9/9/2008	11:09:00	22:20	348.30	
9/9/2008	11:10:00	23:20	349.08	
9/9/2008	11:15:00	28:20	352.05	
9/9/2008	11:20:00	33:20	353.90	
9/9/2008	11:25:00	38:20	354.95	
9/9/2008	11:30:00	43:20	355.65	
9/9/2008	11:37:00	50:20	356.34	
9/9/2008	11:40:00	53:20	356.50	
9/9/2008	11:45:00	58:20	356.75	
9/9/2008	11:48:20	61:40	343.70	Pump off @ approx 11:48, uncertain depth reading
9/9/2008	11:48:30	61:50	348.00	
9/9/2008	11:48:45	62:05	328.00	
9/9/2008	11:48:55	62:15	322.55	
9/9/2008	11:49:15	62:35	313.30	
9/9/2008	11:49:30	62:50	304.60	
9/9/2008	11:49:40	63:00	300.80	
9/9/2008	11:50:10	63:30	303.10	pump back on at 11:50:00
9/9/2008	11:50:25	63:45	306.60	
9/9/2008	11:50:40	64:00	309.70	
9/9/2008	11:50:50	64:10	311.20	
9/9/2008	11:51:00	64:20	313.70	
9/9/2008	11:51:30	64:50	318.30	
9/9/2008	11:52:00	65:20	321.20	
9/9/2008	11:52:30	65:50	325.90	
9/9/2008	11:53:00	66:20	328.00	
9/9/2008	11:53:30	66:50	331.10	
9/9/2008	11:54:00	67:20	333.00	
9/9/2008	11:54:30	67:50	335.60	
9/9/2008	11:55:00	68:20	337.00	
9/9/2008	11:56:00	69:20	340.00	
9/9/2008	11:57:00	70:20	342.60	
9/9/2008	11:58:00	71:20	344.75	
9/9/2008	11:59:00	72:20	346.35	
9/9/2008	12:00:10	73:30	348.35	
9/9/2008	12:02:15	75:35	350.52	
9/9/2008	12:05:00	78:20	352.75	
9/9/2008	12:10:00	83:20	354.80	

9/9/2008	12:13:40	87:00	348.00	pump shut down @ approx 12:13
9/9/2008	12:14:10	87:30	340.00	
9/9/2008	12:14:20	87:40	333.00	
9/9/2008	12:14:35	87:55	324.00	
9/9/2008	12:14:50	88:10	319.00	
9/9/2008	12:15:00	88:20	314.00	
9/9/2008	12:15:08	88:28	310.00	
9/9/2008	12:15:15	88:35	306.00	
9/9/2008	12:15:25	88:45	302.00	
9/9/2008	12:15:35	88:55	297.00	
9/9/2008	12:15:45	89:05	292.00	
9/9/2008	12:15:58	89:18	288.00	
9/9/2008	12:16:08	89:28	284.00	
9/9/2008	12:16:21	89:41	279.00	
9/9/2008	12:16:37	89:57	274.00	
9/9/2008	12:16:57	90:17	329.70	
9/9/2008	12:17:29	90:49	287.60	
9/9/2008	12:17:40	91:00	289.80	
9/9/2008	12:17:55	91:15	294.00	
9/9/2008	12:18:09	91:29	297.40	
9/9/2008	12:18:22	91:42	302.10	
9/9/2008	12:18:45	92:05	304.50	
9/9/2008	12:19:04	92:24	308.20	
9/9/2008	12:19:18	92:38	310.45	
9/9/2008	12:19:33	92:53	312.20	
9/9/2008	12:19:50	93:10	314.50	
9/9/2008	12:20:00	93:20	316.10	
9/9/2008	12:20:15	93:35	318.00	
9/9/2008	12:20:30	93:50	319.20	
9/9/2008	12:20:45	94:05	321.30	
9/9/2008	12:21:00	94:20	321.73	
9/9/2008	12:21:25	94:45	325.00	
9/9/2008	12:21:45	95:05	327.00	
9/9/2008	12:22:00	95:20	328.30	
9/9/2008	12:22:40	96:00	331.40	
9/9/2008	12:23:00	96:20	332.50	
9/9/2008	12:23:35	96:55	335.00	
9/9/2008	12:24:00	97:20	336.20	
9/9/2008	12:25:00	98:20	339.40	
9/9/2008	12:26:00	99:20	341.60	
9/9/2008	12:27:25	100:45	344.60	
9/9/2008	12:28:40	102:00	347.50	
9/9/2008	12:32:25	105:45	351.00	
9/9/2008	12:34:00	107:20	352.30	
9/9/2008	12:40:35	113:55	355.10	
9/9/2008	12:45:10	118:30	356.10	
9/9/2008	12:50:00	123:20	356.75	
9/9/2008	13:00:00	133:20	357.45	
9/9/2008	13:58:00	191:20	357.65	
9/9/2008	15:03:46	257:06	357.90	

9/9/2008	16:01:50	315:10	358.02	
9/9/2008	16:59:20	372:40	358.10	
9/10/2008	8:26:15	1299:35	358.55	
9/10/2008	10:04:00	1397:20	358.35	
9/10/2008	10:17:35	1410:55	358.31	
9/10/2008	10:31:20	1424:40	358.33	
9/10/2008	10:35:11	1428:31	350.00	pump off @ 10:35:00
9/10/2008	10:35:23	1428:43	343.00	
9/10/2008	10:35:37	1428:57	337.00	
9/10/2008	10:35:44	1429:04	332.00	
9/10/2008	10:35:50	1429:10	329.00	
9/10/2008	10:36:10	1429:30	321.00	
9/10/2008	10:36:15	1429:35	316.00	
9/10/2008	10:36:24	1429:44	312.00	
9/10/2008	10:36:30	1429:50	310.00	
9/10/2008	10:36:38	1429:58	306.00	
9/10/2008	10:36:45	1430:05	302.00	
9/10/2008	10:36:51	1430:11	300.00	
9/10/2008	10:37:00	1430:20	297.00	
9/10/2008	10:37:08	1430:28	293.00	
9/10/2008	10:37:16	1430:36	290.00	
9/10/2008	10:37:29	1430:49	285.00	
9/10/2008	10:37:44	1431:04	280.00	
9/10/2008	10:37:59	1431:19	275.00	
9/10/2008	10:38:15	1431:35	270.00	
9/10/2008	10:38:32	1431:52	265.00	
9/10/2008	10:38:49	1432:09	260.00	
9/10/2008	10:39:08	1432:28	255.00	Uncertain time and depth measurements
9/10/2008	10:39:50	1433:10	245.00	
9/10/2008	10:40:16	1433:36	240.00	
9/10/2008	10:40:26	1433:46	238.00	
9/10/2008	10:40:37	1433:57	236.00	
9/10/2008	10:40:47	1434:07	234.00	
9/10/2008	10:40:57	1434:17	232.00	
9/10/2008	10:41:22	1434:42	228.00	
9/10/2008	10:41:34	1434:54	226.00	
9/10/2008	10:41:48	1435:08	224.00	
9/10/2008	10:42:01	1435:21	222.00	
9/10/2008	10:42:16	1435:36	220.00	
9/10/2008	10:42:31	1435:51	218.00	
9/10/2008	10:42:56	1436:16	215.00	
9/10/2008	10:43:40	1437:00	210.00	
9/10/2008	10:44:11	1437:31	207.00	
9/10/2008	10:44:34	1437:54	205.00	
9/10/2008	10:44:58	1438:18	203.00	
9/10/2008	10:45:39	1438:59	200.00	
9/10/2008	10:46:09	1439:29	198.00	
9/10/2008	10:47:01	1440:21	195.00	
9/10/2008	10:47:52	1441:12	192.50	
9/10/2008	10:48:53	1442:13	190.00	

9/10/2008	10:50:09	1443:29	187.50
9/10/2008	10:51:43	1445:03	185.00
9/10/2008	10:54:00	1447:20	182.50
9/10/2008	10:55:00	1448:20	181.70
9/10/2008	11:00:00	1453:20	179.22
9/10/2008	11:05:00	1458:20	178.13
9/10/2008	11:10:00	1463:20	177.60
9/10/2008	11:15:00	1468:20	177.31
9/10/2008	11:30:00	1483:20	176.97
9/10/2008	11:45:00	1498:20	176.85
9/10/2008	12:00:00	1513:20	176.76
9/10/2008	12:15:00	1528:20	176.72
9/10/2008	12:30:00	1543:20	176.69
9/10/2008	12:45:00	1558:20	176.67
9/10/2008	13:00:00	1573:20	176.66
9/10/2008	13:30:00	1603:20	176.65
9/10/2008	14:03:00	1636:20	176.65
9/10/2008	15:01:00	1694:20	176.64
9/10/2008	16:00:00	1753:20	176.65
9/11/2008	8:50:00	2763:20	176.79

Manual water-level data used to calculate aquifer transmissivity and to construct Figure 7:

t, Elapsed time	t', Time since pump stopped	Ratio t/t'	s', Residual drawdown
(min)	(min)		(ft)
1429.10	0.18	7798.6357	173.45
1429.30	0.38	3729.4194	166.45
1429.53	0.62	2318.4755	160.45
1429.65	0.73	1949.7443	155.45
1429.75	0.83	1715.8716	152.45
1430.08	1.17	1225.8733	144.45
1430.17	1.25	1144.2096	139.45
1430.32	1.40	1021.7156	135.45
1430.42	1.50	953.6641	133.45
1430.55	1.63	875.8916	129.45
1430.67	1.75	817.5627	125.45
1430.77	1.85	773.4222	123.45
1430.92	2.00	715.4881	120.45
1431.05	2.13	670.8309	116.45
1431.18	2.27	631.4276	113.45
1431.40	2.48	576.4220	108.45
1431.65	2.73	523.7904	103.45
1431.90	2.98	479.9799	98.45
1432.17	3.25	440.6780	93.45
1432.45	3.53	405.4199	88.45
1432.73	3.82	375.3968	83.45
1433.05	4.13	346.7126	78.45
1433.75	4.83	296.6430	68.45
1434.18	5.27	272.3176	63.45
1434.35	5.43	263.9948	61.45
1434.53	5.62	255.4103	59.45
1434.70	5.78	248.0785	57.45
1434.87	5.95	241.1574	55.45
1435.28	6.37	225.4401	51.45
1435.48	6.57	218.6043	49.45
1435.72	6.80	211.1374	47.45
1435.93	7.02	204.6485	45.45
1436.18	7.27	197.6422	43.45
1436.43	7.52	191.1019	41.45
1436.85	7.93	181.1174	38.45
1437.58	8.67	165.8766	33.45
1438.10	9.18	156.6003	30.45
1438.48	9.57	150.3654	28.45
1438.88	9.97	144.3708	26.45
1439.57	10.65	135.1716	23.45
1440.07	11.15	129.1549	21.45
1440.93	12.02	119.9121	18.45
1441.78	12.87	112.0564	15.95

1442.80	13.88	103.9238	13.45
1444.07	15.15	95.3185	10.95
1445.63	16.72	86.4790	8.45
1447.92	19.00	76.2065	5.95
1448.92	20.00	72.4461	5.15
1453.92	25.00	58.1569	2.67
1458.92	30.00	48.6307	1.58
1463.92	35.00	41.8263	1.05
1468.92	40.00	36.7230	0.76
1483.92	55.00	26.9803	0.42
1498.92	70.00	21.4131	0.30
1513.92	85.00	17.8108	0.21
1528.92	100.00	15.2892	0.17
1543.92	115.00	13.4254	0.14
1558.92	130.00	11.9917	0.12
1573.92	145.00	10.8546	0.11
1603.92	175.00	9.1652	0.10
1636.92	208.00	7.8698	0.10
1694.92	266.00	6.3719	0.09
1753.92	325.00	5.3967	0.10
2763.92	1335.00	2.0703	0.24