Navajo National Monument

Docket No: 1

WELL BETATAKIN RUINS AREA WATER SYSTEM

Preliminary Docket Information

00-00-0000: navajo national monument: summary of docket #1

Navajo National Monument
Summary of Docket #1

June 9, 1939	A 461 foot well was recently completed. A 1400 foot water line with pump and storage tank are under construction. This water is to supply the Custodian's residence.
August 8, 1949	The water system at NAVA was completed as drawn in NM-NAV-6950. There appears to be sufficient flow. If flows become insufficient in the future it may be possible to capture spring flows to augment flow from the well.
September 9, 1949	Statement from A. van V. Dunn (attached). The well was intended to capture water from the spring to be pumped to a storage tank for gravity distribution. Upon drilling, however, an aquifer was intercepted and flows from the bore hole were sufficient to supply the park. At this time registration of groundwater sources is not required but the priority date for this well should be July, 1939.
September 20, 1949	Land Ownership Record, completed by A. van V. Dunn. The Claim is based on cnstruction ow ater system and use of water at Betatakin Runins are of NAVA. Developments consist of a well, pump unit, collecting sump, pump line, and distribution reservoir and water lines.
November 30, 1949	The question is raised as to who actually owns or administers the land upon which the well, springs and park headquarters are located. Also, should the well be claimed as a ground or surface water source?
February 16, 1950	"I am convinced that the drill hole source and the ruins spring source are not in the same water supply channel."
February 24, 1950	Determined that the slow rate at which the bore hole filled with water was indication that the spring was not affecting the flow of the well.
March 13, 1950	Decided that the source of water in the well is most likely ground water.
July 7, 1955	Statement concerning the frequency and duration of overflow from the tunnel. Since December 1953 a small overflow from the tunnel entrance has been observed on occasional visits to that location, and nothing has been found in the monument records to indicate a change in this condition in recent years. This, of course, does not hold true during and immediately after periods of pumping when the water level in the sump is lowered temporarily. A low bulkhead constructed near the tunnel entrance in 1941 increased the water storage capacity of the sump to an estimated 5000 gallons or more. Although there has been no occasion to make frequent checks of the water level in the tunnel, there has been no shortage of water for monument use."

July 20, 1955 — The well intercepts two separate aquifers and is not sealed or cased through the first aquifer. The well is artesian and water flows from the transmission line continuously unless well levels are drawn down due to pumping. There is concern that this is illegal waste of artesian water. It is suggested that the well be cased through the layer of the upper aquifer and that the line be blocked in some way to prevent continued unrestricted flow of water. However, since there has been no apparent drop in yield this remedy is not urgently needed.

July 20, 1960 — Due to increased availability of the park to visitors a new water supply is needed. The natural flow of the spring should not be tapped as the spring is important for interpretation of the ruins - the spring is most probably responsible for the location of the ruins. There are two possibilities - there is a river 1.5 miles away from the monument on Indian Reservation land or another well could be drilled. It is recommended that the USGS study the area before a site for test drilling is decided.

August 1, 1960 — A. van V. Dunn: "Drawing 6950 in that docket (#1) shows that the drill hole and spring are within the Betatakin area, but the Park Service development is otherwise all on the adjacent Indian Reservation. So far as I have been able to determine the Park Service use of Indian land is either covered by such an early permit that I have been unable to find it, or is based on occupancy without permit since before the National Park Service was establised."

March 29, 1962 — Geologist's Report on ground water resources at Betatakin area. Suggests most reliable source would be a well drilled at the extreme southwest boundary of the park.

July 26, 1962 — Well drilling completed by Elmer L. White Drilling Company of Flagstaff, Arizona.

July 13, 1966 — List of five water supply reports at NAVA. Last one mentioned is dated February 10, 1966. "This report concludes that the replacement well (new source of water) is good but the springs in Betatakin Canyon is heavily contaminated. It is recommended that these springs be abandoned as a source.

"Water rights for Navajo National Monument are subject to the Memorandum of Agreement of May 8, 1962 between the Navajo Tribe, Bureau of Indian Affairs and the National Park Service.

"From paragraph 3 of that agreement:

"'While it is understood that the current status of the above described lands in regard to the Navajo Tribe and the Bureau of Indian Affairs shall remain unchanged, and that

such lands shall remain subject to all laws applicable thereto, it is agreed by The Navajo Tribe and Bureau of Indian Arrairs that the above described lands will be devoted primarily to recreational use inconnection with the operation of Navajo National Monument.'"

August 27, 1970 — Water Resource Proposal for Betatakin area. At present there are 350 visitors/day, in 20 years (1990) there are expected to be 750 visitors/day. The following justification for the increased demand is given. "One 750' well on land leased from the Navajo Tribe produces 17 Mgpd which is stored in one 100,000 gal tank. This summer (1970) exceeded the amount of water pumped from the well. We feel by 1973 we will have to increase the pumping capacity of the present well, and an additional water source and storage will have to be developed 10 yrs from now."

December 3, 1973 — Results of Pumping Test conducted November 27 and 28, 1973. "The existing well was drilled in August, 1962, to a depth of 780 feet. The upper ten feet of casing is 8 inches in diameter. The remainder, originally an open hole, ws cased with 6-inch casing on/about 1967. Water is reportedly obtained from the Kayenta formation (660-715 ft.) with a static water level of 541.7 ft. BTC."

December 7, 1973 — Follow-up to previous report. "existing water supply system is operating at 25 prcent efficiency (12.3 gpm) and that the aquifer is capable of yielding up to 50 gpm for ten hours pumping during each day. ... "It is recommended that no action be taken until water demands begin to exceed the delivery rate."

December 17, 1973 — Some preliminary concern that Peabody Coal Mine's water withdrawals are affecting flow of the NAVA supply well.

June 14, 1982 — Registration of Existing Well submitted to State of Arizona as a matter of comity. The State returned the form for correction and completion. The completed form was placed in otherwise empty Docket #2.

05-16-1983: letter to nps from state of arizona regarding the well registration forms

State of Arizona

DEPARTMENT OF WATER RESOURCES

99 E. Virginia Avenue, Phoenix, Arizona 85004



United States of America
National Park Service
P. O. Box 728
Santa Fe, New Mexico 87501

Dear Sirs:

We have reviewed the well registration forms(s) you submitted on your exempt well and return it to you for further review and action.

At issue is the fact that the registration provisions pertain to existing wells as defined under the general instructions on the reverse side of the form. From the information you provided it appears that your well(s) was drilled some time after June 12, 1980 which makes it a new well, by definition, under the law. We have reviewed our new well records and can find no evidence that you filed a Notice of Intention to Drill as required by law in the case of new wells.

At this point, you may wish to consider filing the required notice and associated documents after the fact in order to make your well a matter of record. We enclose the appropriate Notice, Log and Completion Report forms for your convenience. These three forms should be completed as fully as possible and should be filed simultaneously with the Department. Upon receipt we would process them as a filing after the fact but as a matter of record. It would be helpful to you in completing these forms if you can obtain the assistance of whoever drilled your well, particularly in relation to the Driller's Log.

Sincerely,

Richard A. Gessner
Chief, Operations Branch

RAG:et
Enclosures

P.S. You have not indicated the legal description of the location of the well as required in Item 3. Please provide that information in Item 3 by indicating the quarter, quarter, quarter, section, township and range. Sources of assistance in your community may be the U. S. Forest Service, U.S. Soil Conservation Service, County Extension Agent, County Farm Bureau and County Highway Department. These agencies may have maps that will assist you in properly locating your well.

R. A. Gessner

L54
SWR

DEPARTMENT OF WATER RESOURCES
99 EAST VIRGINIA AVENUE
PHOENIX, ARIZONA 85004



REGISTRATION OF EXISTING WELLS

READ INSTRUCTIONS ON BACK OF THIS FORM BEFORE COMPLETING
PRINT OR TYPE — FILE IN DUPLICATE

02

REGISTRATION FEE (CHECK ONE)	
EXEMPT WELL (NO CHARGE)	☐
NON-EXEMPT WELL — $10.00	☐

FOR OFFICE USE ONLY
REGISTRATION NO. 55-
FILE NO. A(39-17)15
FILED (DATE) AT (TIME)
INA
AMA

1. Name of Registrant:
United States of America, Natinal Park Service
P.O. Box 728 (Address) Santa Fe (City) New Mexico (State) 87501 (Zip)

2. File and/or Control Number under previous groundwater law:
(File Number) 35- (Control Number)
Longitude 110°32'35"W; Latitude 36040'38"N

3. a. The well is located within the ____¼ ____¼ ____¼, Section ____, of Township ____N/S, Range ____E/W, G & SRB & M, in the County of Navajo.

b. If in a subdivision: Name of subdivision Navajo National Monument, Lot No. ____, Address Tonalea, Arizona 86044.

4. The principal use(s) of water (Examples: irrigation - stockwater - domestic - municipal - industrial)
municipal and other park uses.

5. If for irrigation use, number of acres irrigated from well N/A.

6. Owner of land on which well is located. If same as Item 1, check this box ☐
Navajo Indian Reservation
(Address) Window Rock (City) Arizona (State) (Zip)

7. Well data (If data not available, write N/A)
a. Depth of Well 860 feet
b. Diameter of casing 6 inches
c. Depth of casing 850 feet
d. Type of casing Steel, T&C, 0.280 inch thickness.
e. Maximum pump capacity 10 gallons per minute.
f. Depth to water ____ feet below land surface.
g. Date well completed March (Month) 20 (Day) 1982 (Year).

8. The place(s) of use of water. If same as Item 3, check this box ☐.
____¼ ____¼ ____¼, Section ____ Township ____ Range ____
____¼ ____¼ ____¼, Section ____ Township ____ Range ____

Attach additional sheet if necessary. Replacement well for AZ0000-339
See Sheet #2

9. DATE 6/11/82 SIGNATURE OF REGISTRANT [signature]
Regional Director, Southwest Region

INSTRUCTIONS FOR COMPLETING REGISTRATION FORM

General Instructions

1. A person who owns an "Existing Well" shall register the well, pursuant to A.R.S. 45-593, by filing this form in duplicate with the Department of Water Resources not later than midnight June 14, 1982. The form must be completed and signed. Failure to do so will constitute a violation of A.R.S. 45-593, and may subject the well owner to injunction and/or civil penalties, pursuant to A.R.S. Title 45, Article 12.

2. An "Existing Well" means, (1) a well which was drilled on or before June 12, 1980 and which is not abandoned or sealed, or (2) a well which was not completed on or before June 12, 1980, but for which a Notice of Intention to Drill was on file with the Arizona Water Commission on or before June 12, 1980.

3. No registration fee is required for Exempt Wells. A $10.00 registration fee must accompany registration forms for all Non-Exempt Wells.

4. An "Exempt Well" means a well having a pump with a maximum capacity of not more than 35 gallons per minute which is used to withdraw groundwater. An Exempt Well may include the non-commercial irrigation of not more than 1 acre of land.

5. A "Non-Exempt Well" means a well that is not an "Exempt Well".

INSTRUCTIONS FOR REGISTRATION QUESTIONS

1. The Registrant must be the owner of the well and may be an individual, public or private corporation, company, partnership, firm, association, society, estate, trust, any other private organization or enterprise, the United States, any state, territory or country or a governmental entity, political subdivision or municipal corporation organized under or subject to the constitution and laws of this State.

2. If you own an existing irrigation well drilled at any time, or any other type of well drilled on or after June 20, 1968, you should have an assigned control and/or file number. Write these numbers in item 2. If you do not know the number, please explain the reason on the form or on an attached sheet.

3. a. Fill in the Section, Township and Range in all cases if it is available.
   b. If the well is in a subdivision and you have this information, give the subdivision name, Lot Number, and Address.

4. Show all purposes for which the water is used.

5. If the well is used for irrigation, give the number of acres irrigated in 1980 from the well.

6. If the owner of the land is an individual, give the last name, first name, middle initial. If the owner of the land is a corporation, partnership, firm, etc., fill in the appropriate title.

7. Complete the section on Well Data with the most accurate information available to you. If the data is not available, write N/A in the blanks.

8. Give the legal description of the place of use of the water. If place of use is in a subdivision and legal description is not available, give the subdivision name, Lot Number and/or address on the blank line.

9. The person in whose name a well is registered shall notify the Department of any change in ownership and shall keep all information on the registration record current and accurate. A form entitled "Change of Well Information/Ownership" is available for this purpose. A blank form will be furnished with the returned duplicate copy of the registration form.

"This notification of a Federal reserved water right claim of the United States is provided in the furtherance of state-Federal comity to advise the state and all others of the United States' claim to the waters in question.

"This notification is not, nor should it be construed as, an acknowledgement of any right or power of the state to limit, adjudicate, or in any other manner determine the rights of the United States to develop and utilize the Federal reserved water resources except as provided by law. Accordingly, this notification is not a waiver of any reserved water rights of the United States nor does it waive, negate or replace any other water rights of the United States."



DEPARTMENT OF WATER RESOURCES
99 EAST VIRGINIA AVENUE
PHOENIX, ARIZONA 85004

RECEIVED
JUN 14 1982
DEPT. OF WATER RESOURCES

REGISTRATION OF EXISTING WELLS

READ INSTRUCTIONS ON BACK OF THIS FORM BEFORE COMPLETING
PRINT OR TYPE — FILE IN DUPLICATE

02

REGISTRATION FEE (CHECK ONE)	
EXEMPT WELL (NO CHARGE)	☐
NON-EXEMPT WELL — $10.00	☐

FOR OFFICE USE ONLY
REGISTRATION NO. 55- 649817
FILE NO. A(39-17)15
FILED 6/14/82 (DATE) AT 9:00 (TIME)
INA
AMA

1. Name of Registrant:
United States of America, National Park Service
P.O. Box 728 (Address) Santa Fe (City) New Mexico (State) 87501 (Zip)

2. File and/or Control Number under previous groundwater law:
AZ - 0000 - 339 (File Number) 35- (Control Number)

3. a. Longitude 110°32'40" W; Latitude 36°40'30" N
The well is located within the ____¼ ____¼ ____¼, Section 15 (Apr),
of Township 39 N N/S, Range 17 E E/W, G & SRB & M, in the
County of Navajo.

b. If in a subdivision: Name of subdivision Navajo National Monument,
Lot No. ____, Address Tonalea, Arizona 86044.

4. The principal use(s) of water (Examples: irrigation - stockwater - domestic - municipal - industrial)
Municipal and other park uses.

5. If for irrigation use, number of acres irrigated from well N/A.

6. Owner of land on which well is located. If same as Item 1, check this box ☒
(Address) (City) (State) (Zip)

7. Well data (If data not available, write N/A)
a. Depth of Well 780 feet
b. Diameter of casing 6 inches
c. Depth of casing 780 feet
d. Type of casing Steel.
e. Maximum pump capacity 22 gallons per minute. at well head
f. Depth to water 541 feet below land surface.
g. Date well completed ____ (Month) ____ (Day) ____ (Year).

8. The place(s) of use of water. If same as Item 3, check this box ☒.
____¼ ____¼ ____¼, Section ____ Township ____ Range ____
____¼ ____¼ ____¼, Section ____ Township ____ Range ____
Attach additional sheet if necessary. See Sheet #2

9. DATE 6/11/82 SIGNATURE OF REGISTRANT [signature]
Regional Director, Southwest Region

"This notification of a Federal reserved water right claim of the United States is provided in the furtherance of state-Federal comity to advise the state and all others of the United States' claim to the waters in question.

"This notification is not, nor should it be construed as, an acknowledgement of any right or power of the state to limit, adjudicate, or in any other manner determine the rights of the United States to develop and utilize the Federal reserved water resources except as provided by law. Accordingly, this notification is not a waiver of any reserved water rights of the United States nor does it waive, negate or replace any other water rights of the United States."

CHANGE OF WELL INFORMATION

Registration No. 55-649817

I request the following information be changed in Well File Number A(39-17)15

_____

_____

_____

_____

_____

_____

Date_____, 19___ _____
Signature of Well Owner

STATEMENT OF CHANGE OF WELL OWNERSHIP

I,_____. state that I am (no longer) the

(new) owner of the well described below:

Township_____ Range _____ Section _____, _____¼ _____¼ _____¼

Registration #55-_____ File No._____

_____	_____
Previous Owner	New Owner
_____	_____
Address	Address
_____	_____
City State Zip	City State Zip

NOTE: ARS 45-593 requires that the Department be notified of change of well ownership and that the well owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within 30 days after changes take place.

NOTE: SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP OR WELL DATA SUCH AS PUMP CAPACITY, ETC.

Land History

09-20-1949: land ownership record

Form NPS-L-1

NITED STATES DEPARTMENT OF THE ERIOR
NATIONAL PARK SERVICE

LAND OWNERSHIP RECORD

State Arizona

Tract No.

County Navajo

Deed No. 2

Civil Subdivision

Area acres

Navajo National Monument
Name of Park or Area

~~Area~~ Claim based on ~~survey of~~ records of Water Resources Branch Date Sept. 20, 1949

Betatakin Ruins
Section of Park or Area

Legal Description: Claim based on construction of water system and use of water.

Method of Acquisition: Appropriation Appropriation or Source of funds:

Cost (if purchased) or estimated value:

Acquired from:

Accepted by Secretary (__) Opinion of Att'y. Gen.-title in U. S. (__) date:

Physical Characteristics: Well, pump unit, collecting sump, pump line, and distribution reservoir and water lines.

Improvements on Land at time of Acquisition:

Existing or outstanding special use permits, reservations, rights, or rights of way:

Report Based on: Records of Water Resources Branch

Prepared by: A. van V. Dunn date: Sept. 20,1949

Map References: NM-NAV-5304.
NM-NAV-6950 in assembly.

Remarks: No filing with State Land Commissioner needed at this date, but a declaration filing may be desirable if State water laws are amended in accordance with trend in other Western States.

25348

Administrative Agreements

MEMORANDUM OF AGREEMENT OF MAY 8, 1962 BETWEEN THE NAVAJO TRIBE, BUREAU OF INDIAN AFFAIRS, AND NATIONAL PARK SERVICE RELATING TO THE RECREATIONAL DEVELOPMENT OF THE NAVAJO NATIONAL MONUMENT

WHEREAS, it is in the public interest to facilitate recreational development of The Navajo National Monument through the construction of administrative, residential, and related facilities on lands adjacent to the existing Betatakin Section of Navajo National Monument and to construct and maintain an access road to the Betatakin Section. In order to accomplish these purposes, a cooperative agreement must be entered into between the Navajo Tribe, the Bureau of Indian Affairs, and the National Park Service.

WHEREAS, under the Act of August 7, 1946 (Public Law 633, 79th Congress) appropriations for the National Park Service are authorized for the administration, protection, improvement and maintenance of areas devoted to recreational use pursuant to cooperative agreements under the jurisdiction of other agencies of the government.

WHEREAS, agreement has been reached among The Navajo Tribe, the Bureau of Indian Affairs, and National Park Service, specifying that legislation will be sought to authorize the inclusion of certain lands within the boundaries of other agencies of the government.

WHEREAS, agreement has been reached among The Navajo Tribe, the Bureau of Indian Affairs, and National Park Service, specifying that legislation will be sought to authorize the inclusion of certain lands within the boundaries of The Navajo Reservation, and providing for the granting of a right-of-way for a new access road to Navajo National Monument.

NOW THEREFORE, The Navajo Tribe, the Bureau of Indian Affairs and National Park Service, do hereby mutually agree as follows:

1. This agreement will be regarded as an interim arrangement to permit the National Park Service to proceed with programmed development of Navajo National Monument pending the enactment of legislation providing a permanent basis and authority for such development.

2. This agreement shall apply to the lands within the proposed road right-of-way as shown on the attached drawing NM-NAV-3000[1/] and to the lands indicated within the proposed boundary on the attached drawing NM-NAV-7102[1/] and which are further described as follows:

Beginning at Corner No. 4 of the existing 160 acre tract set aside as the Betatakin Section of Navajo National Monument, thence north along the west boundary of said area a distance of 1,320 feet, thence west a distance of 1,320 feet, thence south a distance of 3,960 feet, thence east a distance of 2,640 feet, thence north a distance of 1,320 feet, thence east a distance of 1,320 feet, thence north a distance of 1,320 feet to Corner No. 1 of the existing Betatakin Section of Navajo National Monument, thence west along the south boundary of said area to Corner No. 4, the Point of Beginning, enclosing a tract of land of 240 acres, more or less.

3. While it is understood that the current status of the above described lands in regard to The Navajo Tribe and the Bureau of Indian Affairs shall remain unchanged, and that such lands shall remain subject to all laws applicable thereto, it is agreed by The Navajo Tribe and Bureau of Indian Affairs that the above described lands will be devoted primarily to recreational use in connection with the operation of Navajo National Monument.

4. Subject to the availability of funds, the National Park Service may and will undertake the development, construction and maintenance of facilities on the lands referred to in Item 2 above, needed in the proper management of Navajo National Monument as a unit of the National Park System.

5. The National Park Service will assume responsibility for the park facilities of the aforementioned lands and improvements incident thereto.

6. This agreement shall become effective upon approval by the Secretary of the Interior, and shall remain in force and effect until terminated by mutual agreement or until enactment by Congress of legislation inconsistent herewith.

1/ On file in the Washington Office.

7. The National Park Service agrees that in consideration for the execution of this agreement by The Navajo Tribe that it will assist in every manner possible in supporting legislation providing for the conveyance to The Navajo Tribe by the Bureau of Reclamation of a certain area at Antelope Creek, Coconino County, State of Arizona, to be utilized by The Navajo Tribe as a recreational facility.

8. The Navajo Tribe reserves the right, during the term of this agreement, to operate an arts and crafts enterprise with Navajo National Monument, notwithstanding the Maintenance of facilities thereon by the National Park Service.

SUBMITTED:

Date: May 29, 1961 — (SGD) PAUL JONES, THE NAVAJO TRIBE

Date: Sep 21 1961 — (SGD) JAMES F. CANAN, BUREAU OF INDIAN AFFAIRS

Date: Dec. 12, 1961 — (SGD) THOMAS J. ALLEN, NATIONAL PARK SERVICE

RECOMMENDED:

(SGD) JOHN O. CROW, ACTING COMMISSIONER, BUREAU OF INDIAN AFFAIRS — May 8, 1962 (Date)

(SGD) THOMAS J. ALLEN, REGIONAL DIRECTOR, NATIONAL PARK SERVICE — January 16, 1962 (Date)

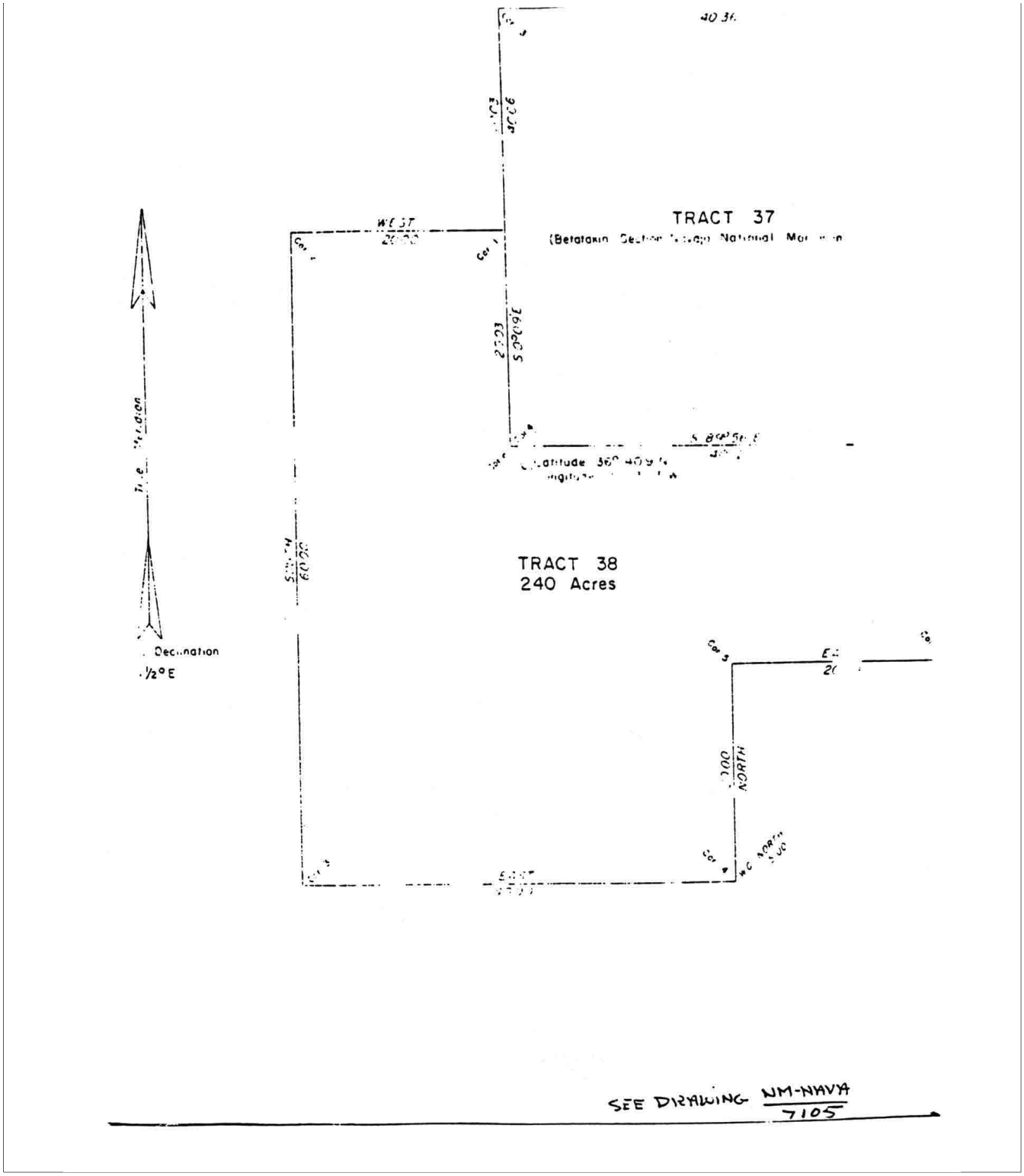
(SGD) CONRAD L. WIRTH, DIRECTOR, NATIONAL PARK SERVICE — May 8, 1962 (Date)

APPROVED: By Secretary Udall by his memorandum of January 8, 1962 to Director, National Park Service.

(Copy of Secretary Udall's memorandum of January 8, 1962, attached)1/ (Date) — SECRETARY OF THE INTERIOR

1/ On file in the Washington Office.

06-00-1962: memorandum of agreement of may 8, 1962 between the navajo tribe, blm, and nps relating to the recreational develo



Supporting Hydro Data

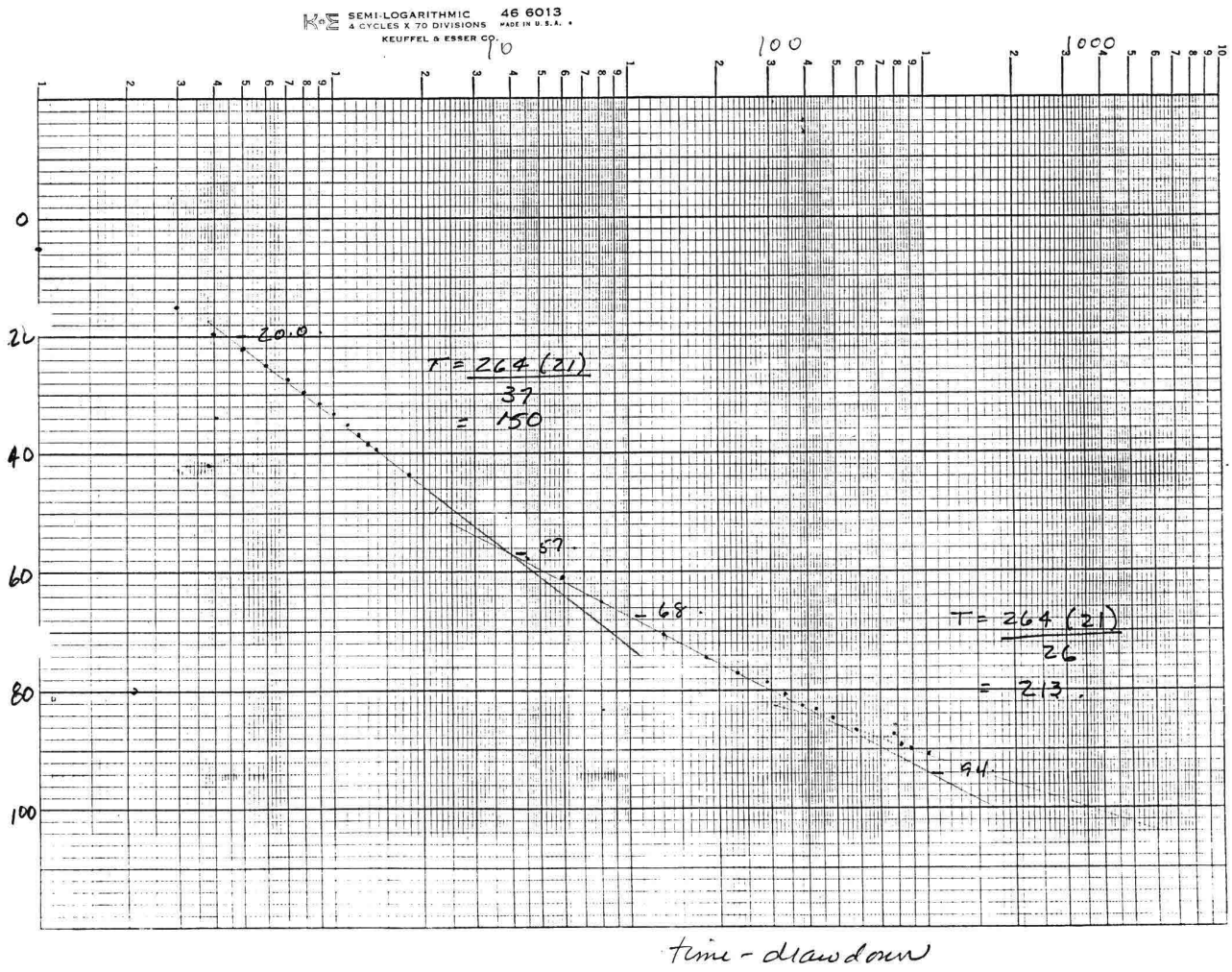
Location: Betatakin Well, Navajo National Monument, Arizona
Date: April 22 and 23, 1981
Observer: Garland Moore

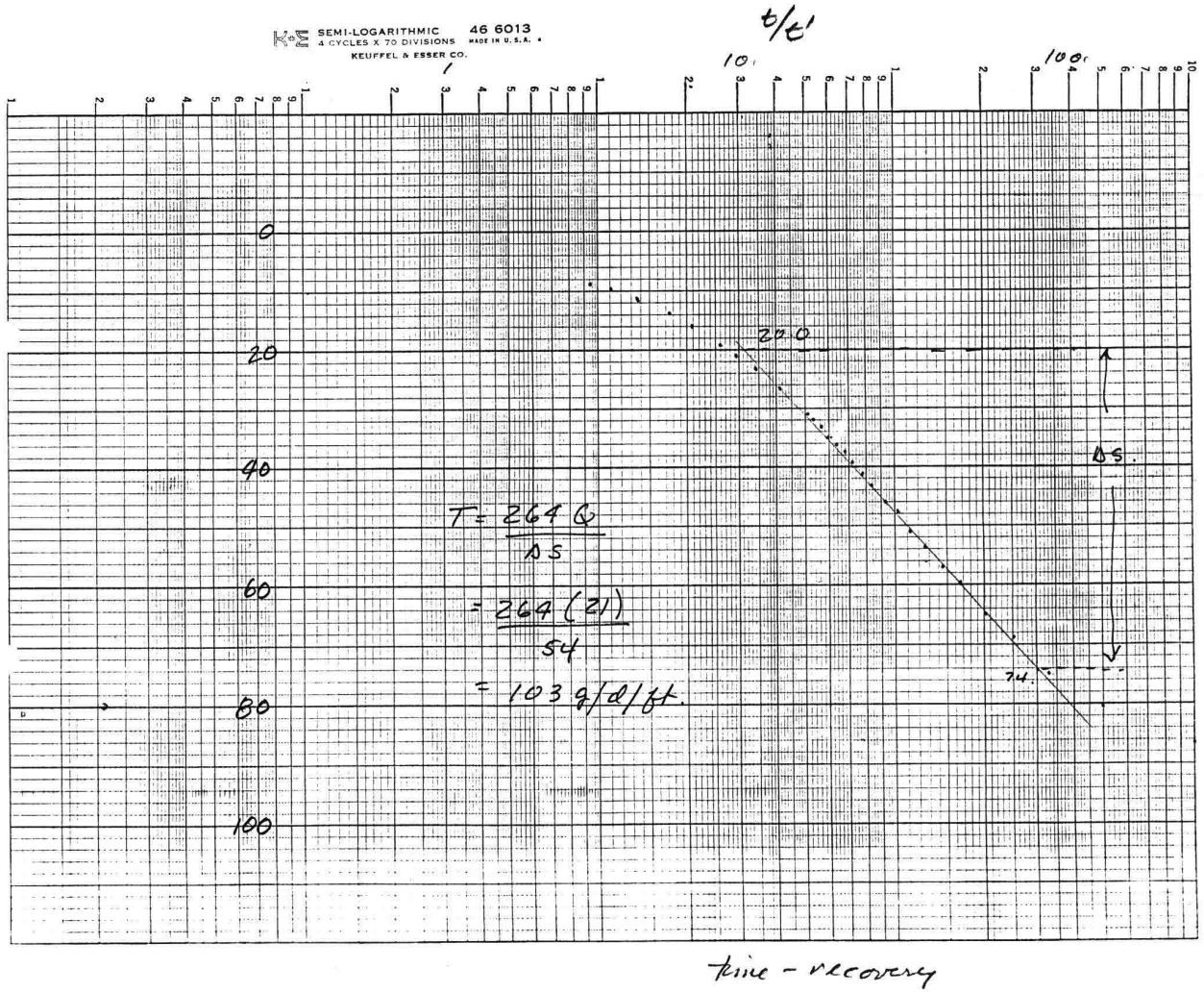
TIME-DRAWDOWN DATA

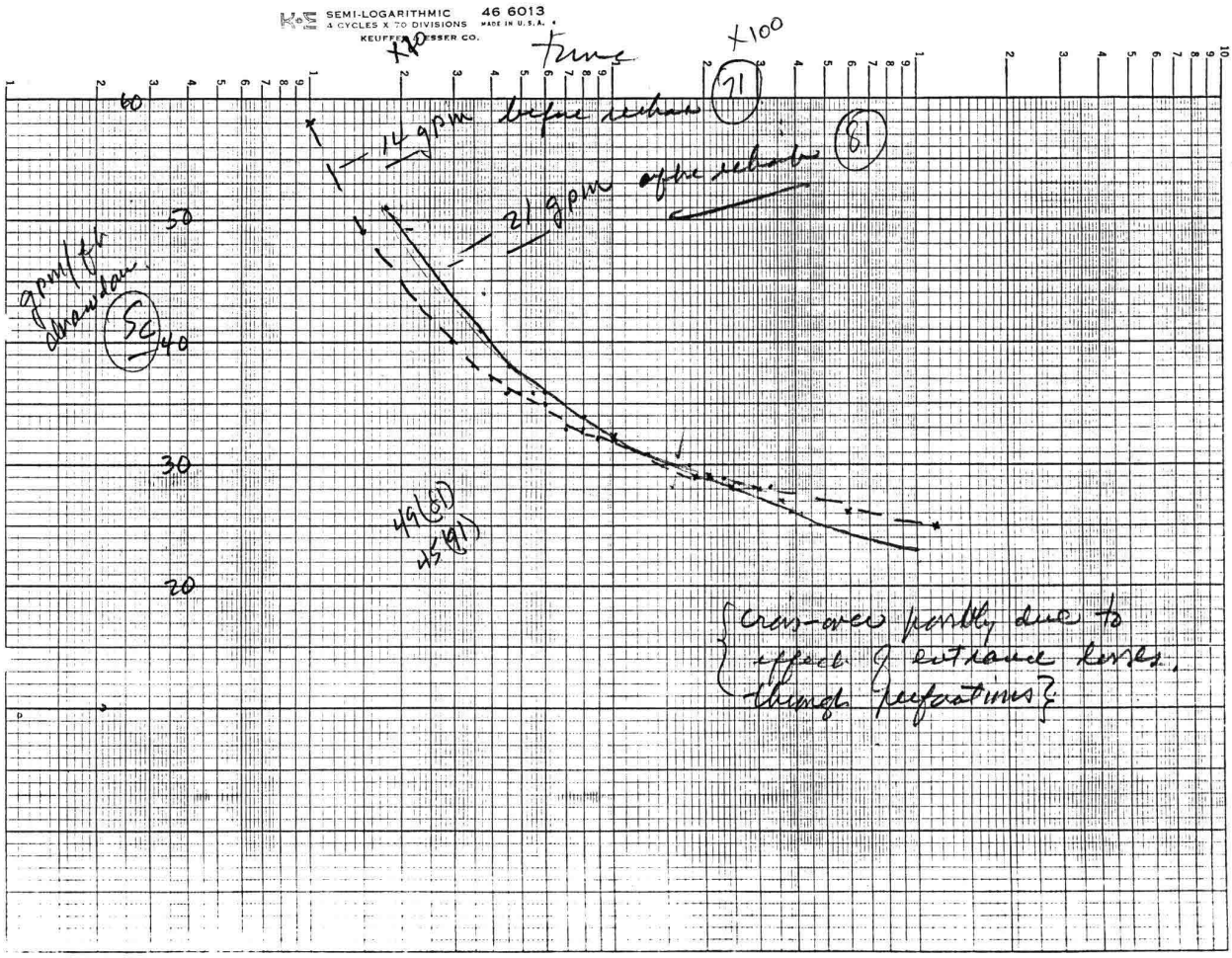
Clock Time (hour)	Pumping Time (min)	Water Level BTC (feet)	Drawdown (feet)	Specific Capacity	Remarks
1259	0	541.38	-	-	SWL
1300	1	546.67	5.29	-	
	3	556.57	15.19	-	
	4	560.86	19.48	-	
	5	563.44	22.06	-	
	6	566.31	24.93	-	
	7	568.88	27.50	-	
	8	571.25	29.87	-	
	9	573.02	31.64	-	
	10	574.88	33.50	-	
	11	576.61	35.23	-	
	12	577.96	36.58	-	
	13	579.48	38.10	-	
	14	581.00	39.62	-	
	18	584.90	43.52	.51	Q=22.2 gpm
1338	38	-	-	-	Q=22.2 gpm
1345	45	599.05	57.67	.38	Q=22.2 gpm
1400	60	602.25	60.87	.36	
1420	80	606.15	64.77	.34	
1510	130	611.96	70.58	.31	Q=22.2 gpm
1600	180	615.57	74.19	.30	Q=22.2 gpm
1650	230	618.13	76.75	.29	Q=22.2 gpm
1749	289	620.50	79.12	.28	Q=22.2 gpm
1830	330	621.98	80.60	.28	Q=22.2 gpm
1920	380	623.44	82.16	.26	Q=21.2 gpm
2010	430	624.71	83.33	.26	Q=21.5 gpm
2100	480	625.98	84.60	.25	Q=21.5 gpm
2240	580	627.63	86.25		
0020	680	628.94	87.56		
0225	805	630.48	89.10		
0340	885	630.94	89.56		
0540	1000	632.17	90.79	.23	Q=20.6 gpm

TIME-RECOVERY DATA

Clock Time (hour)	Time since started (t)	Pump (min) Stopped (t')	t/t'	Depth to Water (BTC ft)	Residual Drawdown (ft)
0540	1000	0	-	632.17	90.79
	1001	1	1001	627.63	86.25
	1002	2	501	621.71	80.33
	1003	3	334	616.09	74.71
	1004	4	251	609.94	68.56
	1005	5	201	606.17	64.79
	1006	6	168	601.19	59.81
	1007	7	144	598.38	57.00
	1008	8	126	595.09	53.71
	1009	9	112	592.09	50.71
0550	1010	10	101	589.17	47.79
	1011	11	92.9	586.96	45.58
	1012	12	84.3	584.50	43.12
	1013	13	77.9	582.38	41.00
	1014	14	72.4	580.65	39.27
	1015	15	67.7	578.94	37.56
	1016	16	63.5	577.46	36.08
	1017	17	59.8	576.09	34.71
	1018	18	56.6	574.71	33.33
	1019	19	53.6	573.65	32.27
0600	1020	20	51.0	572.44	31.06
0605	1025	25	41.0	567.73	26.35
0610	1030	30	34.3	564.65	23.27
0615	1035	35	29.6	562.23	20.85
0620	1040	40	26.0	560.27	18.89
0630	1050	50	21.0	557.34	15.96
0640	1060	60	17.7	555.34	13.96
0650	1070	70	15.3	-	
0700	1080	80	13.5	552.52	11.14
0720	1100	100	11.0	551.25	9.87
0740	1120	120	9.33	550.13	8.75


K&E SEMI-LOGARITHMIC 46 6013
4 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
10
100
1000
0
20
40
60
80
100
20.0
T = 264 (21) / 37 = 150
57
68
T = 264 (21) / 26 = 213
94
time - drawdown


K&E SEMI-LOGARITHMIC 46 6013
4 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
t/t'
0
20
40
60
80
100
20.0
Δs.
74.
T = 264 Q / Δs
= 264 (21) / 54
= 103 g/d/ft.
time - recovery


SEMI-LOGARITHMIC 46 6013
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
X10
time
X100
71
8
14 gpm before recharge
21 gpm after recharge
gpm/ft drawdown
50
40
30
20
49(81)
45(91)
Cross-overs partly due to effects of entrance losses, through perforations?

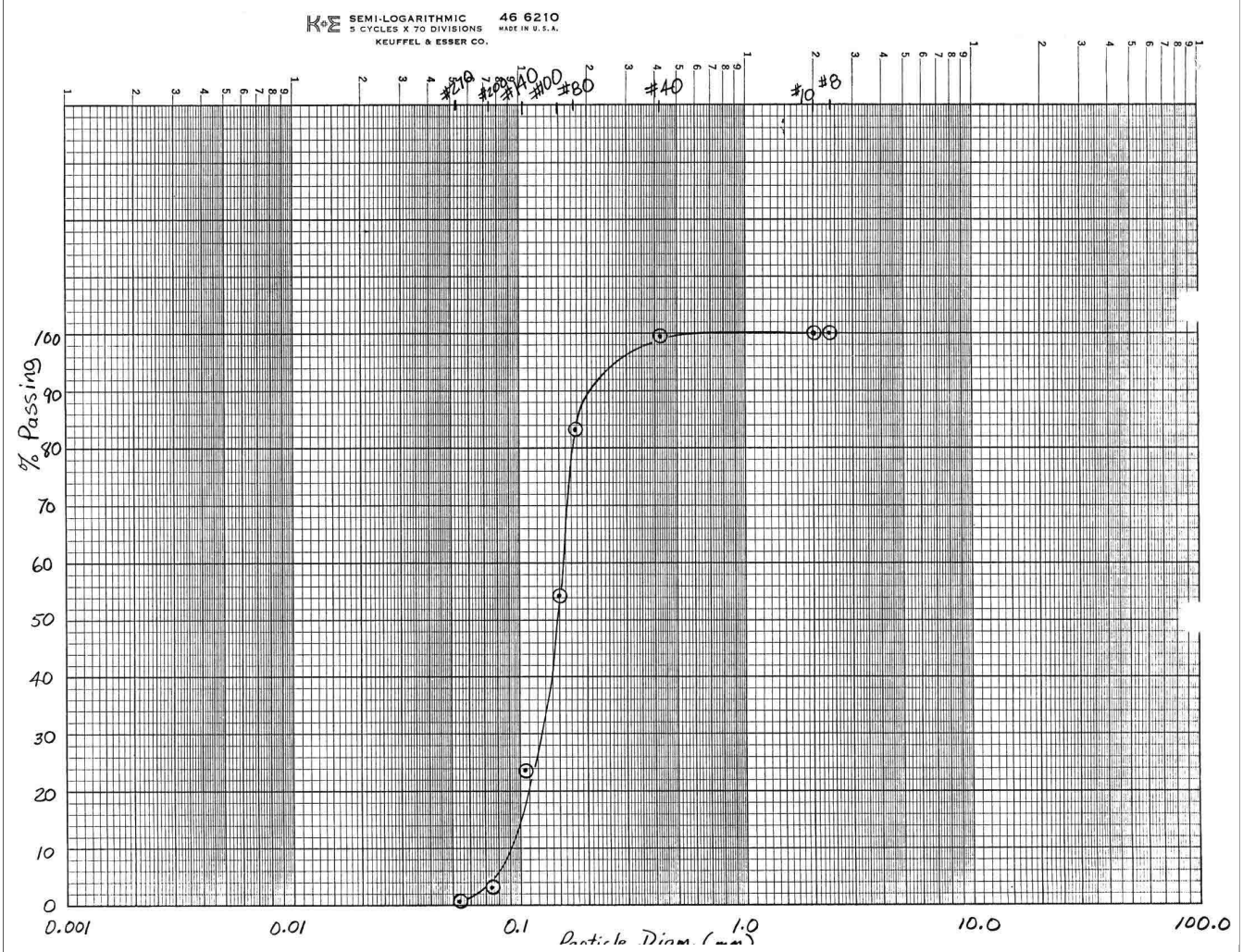
Gradation Analysis

Test by : Mark Bliss Date : Dec. 2, 1977

Sample : N.P.S. Keet Seel Navajo Nat'L Monument

Total wt. of quartered Sample = 230.9 gms

Sieve No.	Opening mm	wt. Retained	Cum. Wt. Retained	Cum. wt. Passing	% Passing
# 8	2.38	0	0	230.9	100
# 10	2.00	0	0	230.9	100
# 40	0.420	0.6	0.6	230.3	99.7
# 80	0.177	38.2	38.8	192.1	83.2
# 100	0.149	67.0	105.8	125.1	54.2
# 140	0.105	70.0	175.8	55.1	23.9
#200	0.074	47.8	223.6	7.3	3.2
#270	0.053	5.8	229.4	1.5	0.6
Passing #270		1.5	230.9	0	0


K&E SEMI-LOGARITHMIC 46 6210
5 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.
#200 #140 #100 #80 #40 #10 #8
% Passing
100
90
80
70
60
50
40
30
20
10
0
0.001
0.01
0.1
1.0
10.0
100.0

10-04-1976: table of mineral analysis for mckittrick canyon

AREA Navajo Nat'l Monument

SOURCE McKittrick Canyon

DATE	10-4-76
Arsenic (As)	0.005
Barium (Ba)	<0.03
Cadmium (Cd)	0.018
Chromium (Cr) Hex +6	<0.008
Cyanide (Cn)	<0.03
Lead (Pb)	<0.025
Antimony (Sb)	
Silver (Ag)	<0.002
Zinc (Zn)	0.012
Copper (Cu)	0.024
Phenols	<0.001
Alkalinity	160.0
Mercury (Hg)	<0.001
CCE	
ABS	<0.005
Selenium (Se)	<0.005
Gross Alpha	
Gross Beta	
Nitrite	0.005
Phosphorus	
Total filterable residue	
Nitrate	0.540
Total filterable residue	
Non-filterable residue	0.018
Total filterable and non-filterable	
Organic phosphate	0.523
Total organic phosphate	0.523
Turbidity	36

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Natl M.										
SOURCE McKittrick Canyon										
DATE	10-9-76									
Silica ($Si O_2$)	6.20									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.008									
Calcium (Ca)	435.71									
Magnesium (Mg)	69.2856									
Sodium (Na)	23.529									
Potassium (K)										
Bicarbonate (HCO_3)	160.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	1,187.5									
Chloride (Cl)	4.35									
Fluoride (F)	0.1									
Nitrate (NO_3)	0.09									
Dissolved Solids: Calculated	2,386.0									
Residue on evaporation at 180°C										
Hardness as Ca Co3	1,256.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance µ Unhos @ 25°C	2,000									
Ph	7.70									
Boron										

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

NATIONAL PARK SERVICE

AREA NAVA										
SOURCE UNIDENTIFIED										
DATE	12-16-74									
Silica (SiO_2)	13.4									
Iron (Fe)	.072									
Manganese (Mn)	<.008									
Calcium (Ca)	23.51									
Magnesium (Mg)	7.761									
Sodium (Na)	7.753									
Potassium (K)										
Bicarbonate (HCO_3)										
Carbonate (CO_3)										
Sulfate (SO_4)	9.0									
Chloride (Cl)	35									
Fluoride (F)	.41									
Nitrate (NO_3)	10.10									
Dissolved Solids: Calculated	122									
Residue on evaporation at 180°C										
Hardness as Ca Co3	102									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance Unhos @ 25°C	196									
Ph	7.90									
Boron										

12-16-1974: table of mineral analysis for unidentified

AREA NAVA

SOURCE UNIDENTIFIED

DATE	12-16-74
Arsenic (As)	.029
Barium (Ba)	<.030
Cadmium (Cd)	<.002
Chromium (Cr)	<.008
Cyanide (Cn)	NIL
Lead (Pb)	<.030
Antimony (Sb)	
Silver (Ag)	<.002
Zinc (Zn)	.135
Copper (Cu)	.037
Phenols	<.004
Alkalinity	
Mercury (Hg)	<.001
CCE	
ABS	
Selenium (Se)	.015
Gross Alpha	
Gross Beta	

COLOR	2
TURBIDITY	8
ACIDITY	NIL
SURFACTANTS	.036
ALKALINITY	113.2
PHOSPHORUS	.32

10-04-1976: table of mineral analysis for keet seal spring, special composite

AREA Navajo Natl'l Monument

SOURCE Keet Seal Spring, Special composite

DATE	10-4-76
Arsenic (As)	0.004
Barium (Ba)	<0.03
Cadmium (Cd)	<0.002
Chromium (Cr) Keet 6	<0.008
Cyanide (Cn)	<0.03
Lead (Pb)	<0.025
Antimony (Sb)	
Silver (Ag)	<0.002
Zinc (Zn)	<0.003
Copper (Cu)	<0.005
Phenols	<0.001
Alkalinity	105.0
Mercury (Hg)	<0.001
CCE	
ABS	<0.005
Selenium (Se)	<0.005
Gross Alpha	
Gross Beta	
Nitrite	0.004
Phosphorus: Total filterable (dissolved) and non-filterable phosphate	0.330
Total filterable and non-filterable ortho phosphate	<0.003
Total filterable and non-filterable organic phosphate	<0.327
Total organic phosphate	0.055
Turbidity	2

10-04-1976: quality of water reports - chemical analysis, keet seal spring, special composite

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Nat'l M.										
SOURCE Keet Seal Spring Special composite										
DATE	10-4-76									
Silica ($Si O_2$)	4.00									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.008									
Calcium (Ca)	37.14									
Magnesium (Mg)	2.857									
Sodium (Na)	3.824									
Potassium (K)										
Bicarbonate (HCO_3)	105.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	3.00									
Chloride (Cl)	0.97									
Fluoride (F)	<0.1									
Nitrate (NO_3)	0.01									
Dissolved Solids: Calculated	170									
Residue on evaporation at 180°C										
Hardness as Ca Co3	96.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance ¹ Unhos @ 25°C	1150									
Ph	7.58									
Boron										

10-04-1976: table of mineral analysis for mckittrick canyon

AREA Navajo Nat'l Monument

SOURCE McKittrick Canyon

DATE	10-4-76
Arsenic (As)	0.005
Barium (Ba)	<0.03
Cadmium (Cd)	0.018
Chromium (Cr) Hex+6	<0.008
Cyanide (Cn)	<0.03
Lead (Pb)	<0.025
Antimony (Sb)	
Silver (Ag)	<0.002
Zinc (Zn)	0.012
Copper (Cu)	0.024
Phenols	<0.001
Alkalinity	160.0
Mercury (Hg)	<0.001
CCE	
ABS	<0.005
Selenium (Se)	<0.005
Gross Alpha	
Gross Beta	
Nitrite	0.005
Phosphorus:	
Total filterable (dissolved) and non-filterable	
Total filterable and non-filterable	0.540
ortho phosphate	0.018
Total filterable and non-filterable	
Organic phosphate	0.523
Total organic phosphate	0.523
Turbidity	36

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Natl'l M.										
SOURCE McKittrick Canyon										
DATE	10-4-76									
Silica (SiO_2)	6.20									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.008									
Calcium (Ca)	435.71									
Magnesium (Mg)	69.2856									
Sodium (Na)	23.529									
Potassium (K)										
Bicarbonate (HCO_3)	160.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	1,187.5									
Chloride (Cl)	4.35									
Fluoride (F)	0.1									
Nitrate (NO_3)	0.09									
Dissolved Solids: Calculated	2,386.0									
Residue on evaporation at 180°C										
Hardness as Ca Co3	1,256.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance Micromhos @ 25°C	2,000									
pH	7.70									
Boron										

10-04-1976: table of mineral analysis for inscription house

AREA	Navajo Nat'l Monument
SOURCE	Inscription House
DATE	10-4-76
Arsenic (As)	<0.002
Barium (Ba)	<0.030
Cadmium (Cd)	<0.002
Chromium (Cr) hex +6	<0.008
Cyanide (Cn)	<0.03
Lead (Pb)	<0.025
Antimony (Sb)	
Silver (Ag)	<0.002
Zinc (Zn)	<0.003
Copper (Cu)	<0.005
Phenols	<0.001
Alkalinity	118.0
Mercury (Hg)	<0.001
CCE	
ABS	<0.005
Selenium (Se)	<0.005
Gross Alpha	
Gross Beta	
Nitrite	0.008
Phosphorus:	
Total filterable (dissolved)	
non-filterable (particulate)	0.046
Total filterable and non-filterable	
ortho phosphate	<0.003
Total filterable non-filterable	
organic phosphate	<0.043
Total organic phosphate	<0.043
Turbidity	4%

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Natl'l M.										
SOURCE Inscription House										
DATE	10-4-76									
Silica ($Si O_2$)	2.00									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.038									
Calcium (Ca)	47.14									
Magnesium (Mg)	11.4386									
Sodium (Na)	13.676									
Potassium (K)										
Bicarbonate (HCO_3)	118.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	16.80									
Chloride (Cl)	2.11									
Fluoride (F)	<0.1									
Nitrate (NO_3)	0.26									
Dissolved Solids: Calculated	246									
Residue on evaporation at 180°C										
Hardness as Ca Co3	176.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance micro Unhos @ 25°C	100,000									
Ph	8.13									
Boron										

10-04-1976: quality of water reports - chemical analysis, inscription house

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

NATIONAL PARK SERVICE

AREA NAVA										
SOURCE UNIDENTIFIED										
DATE	12-16-74									
Silica (SiO_2)	13.4									
Iron (Fe)	.072									
Manganese (Mn)	<.008									
Calcium (Ca)	23.51									
Magnesium (Mg)	7.761									
Sodium (Na)	7.253									
Potassium (K)										
Bicarbonate (HCO_3)										
Carbonate (CO_3)										
Sulfate (SO_4)	9.0									
Chloride (Cl)	35									
Fluoride (F)	.41									
Nitrate (NO_3)	10.10									
Dissolved Solids: Calculated	122									
Residue on evaporation at 180°C										
Hardness as Ca Co3	102									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance Unhos @ 25°C	106									
Ph	7.90									
Boron										

12-16-1974: quality of water reports - chemical analysis, unidentified

AREA NAVA

SOURCE UNIDENTIFIED

DATE	12-16-74
Arsenic (As)	.029
Barium (Ba)	<.030
Cadmium (Cd)	<.002
Chromium (Cr)	<.008
Cyanide (Cn)	NIL
Lead (Pb)	<.030
Antimony (Sb)	
Silver (Ag)	<.002
Zinc (Zn)	.135
Copper (Cu)	.037
Phenols	<.004
Alkalinity	
Mercury (Hg)	<.001
CCE	
ABS	
Selenium (Se)	.015
Gross Alpha	
Gross Beta	
COLOR	2
TURBIDITY	8
ACIDITY	NIL
SURFACTANTS	.036
ALKALINITY	113.2
PHOSPHORUS	.32

12-16-1974: table of mineral analysis for unidentified

AREA Navajo Nat'l Monument

SOURCE Inscription House

DATE	10-4-76
Arsenic (As)	<0.002
Barium (Ba)	<0.030
Cadmium (Cd)	<0.002
Chromium (Cr) Hex +6	<0.008
Cyanide (Cn)	<0.03
Lead (Pb)	<0.025
Antimony (Sb)	
Silver (Ag)	<0.002
Zinc (Zn)	<0.003
Copper (Cu)	<0.005
Phenols	<0.001
Alkalinity	118.0
Mercury (Hg)	<0.001
CCE	
ABS	<0.005
Selenium (Se)	<0.005
Gross Alpha	
Gross Beta	
Nitrite	0.008
Phosphorus:	
Total filterable (dissolved)	
non-filterable phosphate	0.046
Total filterable and non-filterable	
ortho phosphate	<0.003
Total filterable + non-filterable	
organic phosphate	<0.093
Total organic + inorganic	<0.093
Turbidity	4

10-04-1976: table of mineral analysis for inscription house

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Nat'l Mo.										
SOURCE Inscription House										
DATE	10-4-76									
Silica ($Si O_2$)	2.00									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.008									
Calcium (Ca)	47.14									
Magnesium (Mg)	11.4296									
Sodium (Na)	13.676									
Potassium (K)										
Bicarbonate (HCO_3)	113.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	16.80									
Chloride (Cl)	2.71									
Fluoride (F)	<0.1									
Nitrate (NO_3)	0.26									
Dissolved Solids: Calculated	246									
Residue on evaporation at 180°C										
Hardness as Ca Co3	176.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance micro Unhos @ 25°C	100.000									
Ph	8.13									
Boron										

10-04-1976: quality of water reports - chemical analysis, inscription house

QUALITY OF WATER REPORTS - CHEMICAL ANALYSIS

ALL AREAS - SOUTHWEST REGION, NATIONAL PARK SERVICE

AREA Navajo Nat'l M.										
SOURCE Keet Seal Spring Special composite										
DATE	10-4-76									
Silica (SiO_2)	1.00									
Iron (Fe)	<0.01									
Manganese (Mn)	<0.009									
Calcium (Ca)	37.14									
Magnesium (Mg)	2.8571									
Sodium (Na)	3.824									
Potassium (K)										
Bicarbonate (HCO_3)	105.0									
Carbonate (CO_3)	0									
Sulfate (SO_4)	3.00									
Chloride (Cl)	0.97									
Fluoride (F)	<0.1									
Nitrate (NO_3)	0.01									
Dissolved Solids: Calculated	170									
Residue on evaporation at 180°C										
Hardness as Ca Co3	96.0									
Non-carbonate Hardness										
Percent Sodium % Na										
Sodium Adsorption Ratio										
Specific Conductance Micromhos @ 25°C	1,150									
pH	7.58									
Boron										

10-04-1976: quality of water reports - chemical analysis, keet seal spring, special composite

AREA Navajo Nat'l Monument

SOURCE Keet Seal Spring, Special composite

DATE	10-4-76												
Arsenic (As)	0.004												
Barium (Ba)	<0.03												
Cadmium (Cd)	<0.002												
Chromium (Cr) Hex+6	<0.008												
Cyanide (Cn)	<0.03												
Lead (Pb)	<0.025												
Antimony (Sb)													
Silver (Ag)	<0.002												
Zinc (Zn)	<0.003												
Copper (Cu)	<0.005												
Phenols	<0.001												
Alkalinity	105.0												
Mercury (Hg)	<0.001												
CCE													
ABS	<0.005												
Selenium (Se)	<0.005												
Gross Alpha	-												
Gross Beta													
Nitrite	0.004												
Phosphorus:													
Total filterable (dissolved) and non-filterable													
Total filterable and non-filterable	0.330												
Total filterable and non-filterable ortho phosphate	<0.003												
Total filterable and non-filterable organic phosphate	<0.327												
Total organic phosphate	0.055												
Turbidity	2												

10-04-1976: table of mineral analysis for keet seel, special compostie

L54(SWR)OM

NOV 8 1976

Memorandum

To: Superintendent, Navajo

From: Hydraulic Engineer, Water Resources, SWR

Subject: Chemical Analysis - Inscription House & Keet Seal

Enclosed are the results of the chemical analysis for surface water near the wash at Inscription House and the spring source near Keet Seal areas.

The analysis for Inscription House area indicates that possibly an error was made by the laboratory in reporting the specific conductance at 100,000 umho/cm^3. A more realistic but still high figure would be about 1000 umho/cm^3. In addition the Turbidity measurements are excessively high at 46JT units. We will conduct a follow-up analysis for Turbidity in the near future.

The water analysis for Keet Seal spring is within the maximum recommended levels for EPA's drinking water standard. Should you have any questions please call.

WATER & BOURBON DO MIX

[SIGNED]

Garland Moore

Enclosures

cc:
Chief, Division of Natural Resources, WASO (Atten: Vic Berte') w/enclosure
Mitchell, PHS Officer, SWR w/enclosure
General Supt., Navajo Lands Group w/enclosure
Moore, SWR w/enclosure

ENVIRONMENTAL CONSULTANTS, INC.
391 NEWMAN AVE. · P.O. BOX 37 · CLARKSVILLE, INDIANA 47130 · TEL.(812) 282-8481

Date- 4 October 1976

From- Mr. Gary Moore
U.S. Department of the Interior
National Park Service
Southwest Regional Office
1100 Old Santa Fe Trail
Post Office Box 728
Santa Fe, New Mexico 87501

Sample Description-
Navajo National Monument
Inscription House
E.C.I. #7516

P. O. No.- PX 7029-6-01048

Job No.- 7612-02

Alkyl benzene sulfonates	<0.005 mg/l	Manganese	<0.008 mg/l
Arsenic	<0.002 mg/l	Mercury	<0.001 mg/l
Barium	<0.030 mg/l	Nitrate	0.26 mg/l
Bicarbonate, as $CaCO_3$	118.0 mg/l	Nitrite	0.008 mg/l
Cadmium	<0.002 mg/l	pH	8.13
Calcium	47.14 mg/l	Phenols	<0.001 mg/l
Carbonate, as $CaCO_3$	0 mg/l	Phosphorus:	
Chloride	2.41 mg/l	Total filterable (dissolved) and non-filterable phosphate	0.046 mg/l
Chromium, hexavalent	<0.008 mg/l	Total filterable and non-filterable ortho phosphate	<0.003 mg/l
Copper	<0.005 mg/l	Total filterable and non-filterable organic phosphate	<0.043 mg/l
Cyanide	<0.03 mg/l	Total organic phosphate	<0.043 mg/l
Fluoride	<0.1 mg/l	Selenium	<0.005 mg/l
Iron	<0.01 mg/l	Silica, as SiO_2	2.00 mg/l
Lead	<0.025 mg/l		
Magnesium	11.4286 mg/l		

Remarks:

Analyses Reviewed By Robert E. Fuchs
Robert E. Fuchs

10-04-1976: quality water tests - mineral analysis for inscription house, conducted by environmental consultants, inc.; job no. 7612

ENVIRONMENTAL CONSULTANTS, INC.

391 NEWMAN AVE. · P. O. BOX 37 · CLARKSVILLE, INDIANA 47130 · TEL. (812) 282-8481

From: Mr. Gary Moore
U.S. Department of the Interior
National Park Service
Southwest Regional Office
1100 Old Santa Fe Trail
Post Office Box 728
Santa Fe, New Mexico 87501

Date: 4 October 1976

Sample Description:
Navajo National Monument
Inscription House
E.C.I. #7516

P. O. No.: PX 7029-6-01048

Job No.: 7612-02

Silver	<0.002	mg/l
Sodium	13.676	mg/l
Specific conductance	100,000	µmho/cm
Sulfate	16.80	mg/l
Total alkalinity	118.0	mg/l
Total dissolved solids	246	mg/l
Total hardness, as $CaCO_3$	176.0	mg/l
Turbidity	46	J.T.U.
Zinc	<0.003	mg/l

Remarks:

Analyses Reviewed By: Robert E. Fuchs
Robert E. Fuchs

10-04-1976: quality water tests - mineral analysis for keet seal spring, special composite; conducted by environmental consultants

ENVIRONMENTAL CONSULTANTS, INC.

391 NEWMAN AVE. · P. O. BOX 37 · CLARKSVILLE, INDIANA 47130 · TEL.(812) 282-8481

Date- 4 October 1976

From- Mr. Gary Moore
U.S. Department of the Interior
National Park Service
Southwest Regional Office
1100 Old Santa Fe Trail
Post Office Box 728
Santa Fe, New Mexico 87501

Sample Description-
Navajo National Monument
Keet Seal Spring, Special composite
E.C.I. #7515

P. O. No.- PX 7029-6-01048

Job No.- 7612-02

Alkyl benzene sulfonates	<0.005 mg/l	Manganese	<0.008 mg/l
Arsenic	0.004 mg/l	Mercury	<0.001 mg/l
Barium	<0.03 mg/l	Nitrate	0.01 mg/l
Bicarbonate, as $CaCO_3$	105.0 mg/l	Nitrite	0.004 mg/l
Cadmium	<0.002 mg/l	pH	7.58
Calcium	37.14 mg/l	Phenols	<0.001 mg/l
Carbonate, as $CaCO_3$	0 mg/l	Phosphorus:	
Chloride	0.97 mg/l	Total filterable (dissolved) and non-filterable phosphate	0.330 mg/l
Chromium, hexavalent	<0.008 mg/l	Total filterable and non-filterable ortho phosphate	<0.003 mg/l
Copper	<0.005 mg/l	Total filterable and non-filterable organic phosphate	<0.327 mg/l
Cyanide	<0.03 mg/l	Total organic phosphate	0.055 mg/l
Fluoride	<0.1 mg/l	Selenium	<0.005 mg/l
Iron	<0.01 mg/l	Silica, as SiO_2	1.00 mg/l
Lead	<0.025 mg/l		
Magnesium	2.8571 mg/l		

Remarks:

Analyses Reviewed By Robert E. Fuchs
Robert E. Fuchs

10-04-1976: quality water tests - mineral analysis for keet seal spring, special composite; conducted by environmental consultants

ENVIRONMENTAL CONSULTANTS, INC.

391 NEWMAN AVE. · P.O. BOX 37 · CLARKSVILLE, INDIANA 47130 · TEL. (812) 282-8481

Date- 4 October 1976

From- Mr. Gary Moore
U.S. Department of the Interior
National Park Service
Southwest Regional Office
1100 Old Santa Fe Trail
Post Office Box 728
Santa Fe, New Mexico 87501

Sample Description-
Navajo National Monument
Keet Seal Spring, Special composite
E.C.I. #7515

P.O. No.- PX 7029-6-0148

Job No.- 7612-02

Silver	<0.002	mg/l
Sodium	3.824	mg/l
Specific conductance	1,150	μmho/cm
Sulfate	3.00	mg/l
Total alkalinity	105.0	mg/l
Total dissolved solids	170	mg/l
Total hardness, as $CaCO_3$	96.0	mg/l
Turbidity	2	J.T.U.
Zinc	<0.003	mg/l

Remarks:

Anziyses Reviewed By Robert E. Fuchs
Robert E. Fuchs

10-04-1976: quality water tests - mineral analysis for unmarked sample; conducted by environmental consultants, inc.; job no. 742

ENVIRONMENTAL CONSULTANTS, INC.

391 NEWMAN AVE. · P.O. BOX 37 · CLARKSVILLE, INDIANA 47130 · TEL.(812) 282-8481

Date- 30 August 1974

From- National Park Service
Southwest Region

Attn: G. Moore

Sample Description- water

sample unmarked
Navajo Nat Mon

P. O. No.- PX 7000-4-0349 amended

Job No.- 7427 (our sample #1909)

PARAMETER	RESULTS
Color	2-Pt. color units ✓
Sp. Cond.	106 µmhos
Turbidity	8 J.T.U.
Acidity	0
Hardness	102 mg/l
Sulfate	9 mg/l ✓
Chloride	35 mg/l ✓
Cyanide	0 ✓
Fluoride	0.41 mg/l ✓
Arsenic	0.029 mg/l ✓
Barium	<0.03 mg/l ✓
Cadmium	<0.002 mg/l ✓
Calcium	23.51 mg/l ✓
Chromium	<0.008 mg/l ✓
Copper	0.037 mg/l ✓
Iron	0.072 mg/l ✓
Lead	<0.030 mg/l ✓
Magnesium	7.761 mg/l ✓
Zinc	0.135 mg/l ✓
Phenols	<0.004 mg/l ✓ .001
MBAS	0.036 mg/l
Manganese	<0.008 mg/l ✓
Mercury	<0.001 mg/l ✓
Silver	<0.002 mg/l ✓
Sodium	7.753 mg/l ✓
Nitrate	10.1 mg/l ✓
Alkalinity	113.2 mg/l
pH	7.90 mg/l
Phosphorus	0.325 mg/l
Silica	13.4 mg/l
Dissolved Solids	122 mg/l
Selenium	Not Complete

Remarks:

Analyses Reviewed By David W. Whitfield

David W. Whitfield

Drawdown Data 1-2

(Before tape corrections)

		541.38		SWL.
1300	1	546.67	5.29	5.29
	2	—		
	3	556.57	9.90	
	4	560.86	4.29	
	5	563.44	2.58	
	6	566.34	2.87	
	7	568.88	2.54	
	8	571.25	3.37	
	9	573.02	1.77	
	10	574.88	1.86	
	11	576.64	1.73	
	12	577.96	1.35	
	13	579.48	1.52	
	14	581.00	1.52	
	15	—		
	16	—		
	17	—		
	18	584.90	43.52	
	20	—		
	38	592.97	50.79	
	42	—		
	45	599.05	57.67	
	60	602.25	60.87	
	100	606.15	64.77	
	150	601.96	~~5.81~~ 70.58	1'/8.60 min
	200	615.59	~~3.63~~ 74.19	1'/13.85

Drawdown Data (2-2)

1650	~~250~~ 230	618.48	~~1/19.53~~	76.75
1749	~~300~~ 289	620.50	~~1/24.89~~	79.12
1830	~~350~~ 330	621.98	~~1/29.70~~	80.60
1920	~~400~~ 380	623.44	~~1/34.25~~	82.06
2010	~~450~~ 430	624.74	~~1/39.37~~	83.33
2100	~~500~~ 480	625.98	~~1/39.37~~	84.60
2240	~~600~~ 580	627.63	~~1/60.60~~	86.25
0020	~~700~~ 680	628.97 1.31	~~1/76.73~~	87.56
0225	~~825~~ 805	630.48 1.54	~~1/84.17~~	89.10
0340	~~900~~ 885	630.94 0.46	~~1/163~~	89.56
0540	1000	632.99	~~1/61~~	90.79

~~SOLE~~ RECOVERY DAT ~~A~~

(1-2)

	t' time since recovery began	t time since pump stopped	t/t'	Depth to water	Residual drawdown
0540	0	1000		640.00'	90.79
	1	1001	1001	635.46	86.25
	2	1002	501	629.54	80.33
	3	1003	334	623.92	74.71
	4	1004	251	617.77	68.56
	5	1005	201	614.00	64.79
	6	1006	168	609.02	59.81
	7	1007	144	606.21	57.00
	8	1008	126	602.92	53.71
	9	1009	112	599.92	50.71
	10	1010	101	597.00	47.79
	11	1011	92.9	594.79	45.58
	12	1012	84.3	592.33	43.12
	13	1013	77.9	590.21	41.00
	14	1014	72.4	588.48	39.27
	15	1015	67.7	586.77	37.56
	16	1016	63.5	585.29	36.08
	17	1017	59.8	583.92	34.33
	18	1018	56.6	582.54	33.33
	19	1019	53.6	581.48	32.27
0600	20	1020	51.0	580.27	31.06
0605	25	1025	41.0	575.56	26.35
0610	30	1030	34.3	572.48	23.27
0615	35	1035	29.6	570.06	20.85
0620	40	1040	26.0	568.10	18.89
0630	50	1050	21.0	565.17	15.96
0640	60	1060	17.7	563.17	13.96

Recovery Betatakine Well NAVA.

0540	0	
	1	635 + 5½
	2	630 − 5½
	3	625 − 13
	4	620 − 26¾
	5	615 − 12"
610	6	610 − 1"
606	7	605 + 14½
	8	605 − 25
600	9	600 − 1"
597	10	595 + 24"
595	11	595 − 2½"
592	12	590 + 28
590	13	590 + 2½
591.5	14	590 − 18¼
587	15	585 + 21¼
585	16	585 + 3½
584	17	585 − 13"
573	18	585 − 29½
581.5	19	580 + 17¾
0600	20	580 + 3¼
0605	25	575 + 6¾
0610	30	575 − 30¼
0615	35	570 + 0¾"
0620	40	570 − 22¾
0630	50	565 + 2"
0640	60	565 − 22"
0650	70	SKIP.
0700	80	560 + 4½ 560.38
0720	100	560 − 11 559.08
0740	120	560 − 24½ 557.96

10' − 2'2"
All tape readings must be reduced by 7' 10" (short tape)

560
574.8

1.92
2.46 .27
2.04
2.52 1.90

2/

	Time Clock	Min since pump started	Depth to water		
600'	1338	(38)	600' 0"	}	
	1342	(42)	———	}	65 sec./2⁴ gal.
607'	1345	45.	6057 22½	}	1ft/5min.
610'	1400	60	610 + 1"	}	1ft/5min.
614'	1420	~~100~~ 80	615 – 12¼	}	1ft/8.3 min
620'	1510	~~150~~ 130	620 – 2½"	}	1ft/14.3 min
623.5	1600	~~200~~ 180	625 – 19¼"	}	70sec/24gal EC 260 @11°C.
626..	1650	~~250~~ 230	625 + 11½	}	65 sec/24 gal
628+	1749	~~300~~ 289	630 – 20	}	1ft/20 min 61 sec/24 gal water v. clr.
629.7'	1830	~~350~~ 330	630 – 2¼".	}	1ft/30 min 65sec/24gal.
631.5	1920	~~400~~ 380	630 + 15¼"		1ft/25 min 65sec/24gal
632.5	2010	~~450~~ 430	630 + 30½		1ft/33 min 68sec/24 gal
633.5	2100	~~500~~ 480	✓635 – 14¼"		1ft/50 min 67sec/24 gal
	2150	~~550~~ 530	SKIP.		1ft/50 min 67sec/24 gal
	2240	~~600~~ 580	635 + 5½"		
	0020	~~700~~ 680	635 + 21¼" ✓✓		
(0225)	0225	~~825~~ 805	640 – 20¼		
	0340	~~900~~ 880	640 – 14¾		
	0540	1000	640 00		

Drawdown 70sec/24gal

6/9/79
6/13/94
7.83

1974

	C Tent	RV.	P.	V.C. / ~~NPH~~
J	0	0	0	0
F	0	0	0	0
M	61	35	175	1050
A	201	113	350	2257
M	862	490	920	2885
J	766	532	850	3887
J	892	744	1100	4226
A	1013	825	1864	7458
S	596	673	1100	5488
O	280	392	600	2300
N	47	39	75	664
D	1	9	10	411
	4719	3852	7044	30626.

Visitation (Betatakin Area) at NAVA.
Tent + Rec. Veh. stay est @ 12 hr ea
Picnic @ 2 hr each.
V.C. @ 1 hr. each.

Water demand

Picnic	2 gallons per visitor	47190	
V.C.	1 gallon per visitor	38520	
Campers.	Tent 10 gpv	14088	
	R.V. 10 gpv	30626	
		130,424	

6 homes x 2.5 = 15 x 100 = 1500 x 365
= 547,500

1975

	Cu Tent	RV.	P.	V.C. / NRU.
J	0	0	0	276
F	0	0	0	304
M	15	17	100	1149
A	78	24	150	1353
M	802	298	350	3239
J	953	751	475	4870
J	1029	1414	500	7860
A	1187	617	475	8662
S	520	601	350	3720
O	153	251	250	1292
N	10	15	50	543
D	0	5	0	410

1976/

	C Tents	RV.	P.	V.C. / NRU
J	3	2	20	359
F	4	6	30	303
M	12	10	2	819
A	94	111	600	2259
M	687	586	350	3416
J	1026	1148	480	5267
J	926	930	500	3468
A	1224	1071	650	5210
S	387	564	450	2865
O	97	159	200	1806
N	31	11	50	547
D	15	14	20	647

1977/

	Tents	RV.	P.	V.C./NRU.
J	3	5	0	300
F	6	23	—	583
M	50	30	—	1046
A	140	160	—	2910
M	786	566	—	2979
J	796	1046	—	3920
J	1056	1057	—	5508
A	943	1177	—	5567
S	389	690	300	2844
O	634	595	704	2711
N	11	10	16	768
D	0	24	20	437

1978/

	C : Tenn	Rv.	P.	V.C. / NRU
J	2	22	5	276
F	0	10	0	250
M	87	84	43	1378
A	277	159	112	1545
M	357	707	150	3377
J	1771	1489	1060	5705
J	1097	1322	578	5880
A	934	1096	100	5457
S	520	945	230	3497
O	397	627	150	2127
N	32	66	60	843
D	6	7	0	403

1979/

	C Tests	RV.	P.	V.C. / NRU
J	0	0	—	209
F	4	12	10	361
M	46	57	32	1182
A	113	243	119	3050
M	870	696	229	4423
J	1129	1020	201	4779
J	943	975	285	5385
A	1148	1212	140	5372
S	558	533	178	3770
O	191	296	125	2593
N	4	3	28	700
D	2	0	0	349

1980

	Tests	RV.	P.	V.C.' NRU
J	2	2	0	327
F	0	9	10	476
M	0	10	40	1392
A	46	99	468	2772
M	613	636	450	4459
J	1209	888	167	5907
J	1267	1086	198	6894
A	1116	871	248	7440
S	611	615	78	3983
O	260	371	58	2675
N	30	85	77	1133
D	2	5	27	704

1981 / CG

	Tent.	RV.	P.	V.C. / NRU
J	0	2	0	715
F	0	8	47	674
M	29	55	33	1201
A				
M				
J				
J				
A				
S				
O				
N				
D.				

BETATAKIN WELL NO. 2, NAVAJO NM

DATE/73	TIME (HR.)	METER READING	OPERATING TIME (MIN.)	WATER PUMPED	AVG. Q	WATER LEVEL	DRAW DOWN	REMARKS
12-3	1500	1,045,320				539.4		On Pump
			960	10,400	10.8		29.8	
12-4	0700	1,055,720				569.2		Off Pump
12-7	0700	1,055,720				539.4		On Pump
			540	6,910	12.8		29.8	
12-7	1600	1,062,630				569.2		Off Pump
12-10	1600	1,062,630				539.3		On Pump
			900	10,390	11.5		19.8	
12-11	0700	1,073,020				559.1		Off Pump
12-14	0630	1,073,020				539.2		On Pump
			530	6,110	11.5		30.2	
12-14	1520	1,079,130				569.4		Off Pump

NAVAJO NATIONAL MONUMENT

Constant Discharge - Variable Drawdown
Date: November 27 and 28, 1973
Observers: Garland Moore and Luis Garcia
Temperature: Water 56°F; Air 50°F

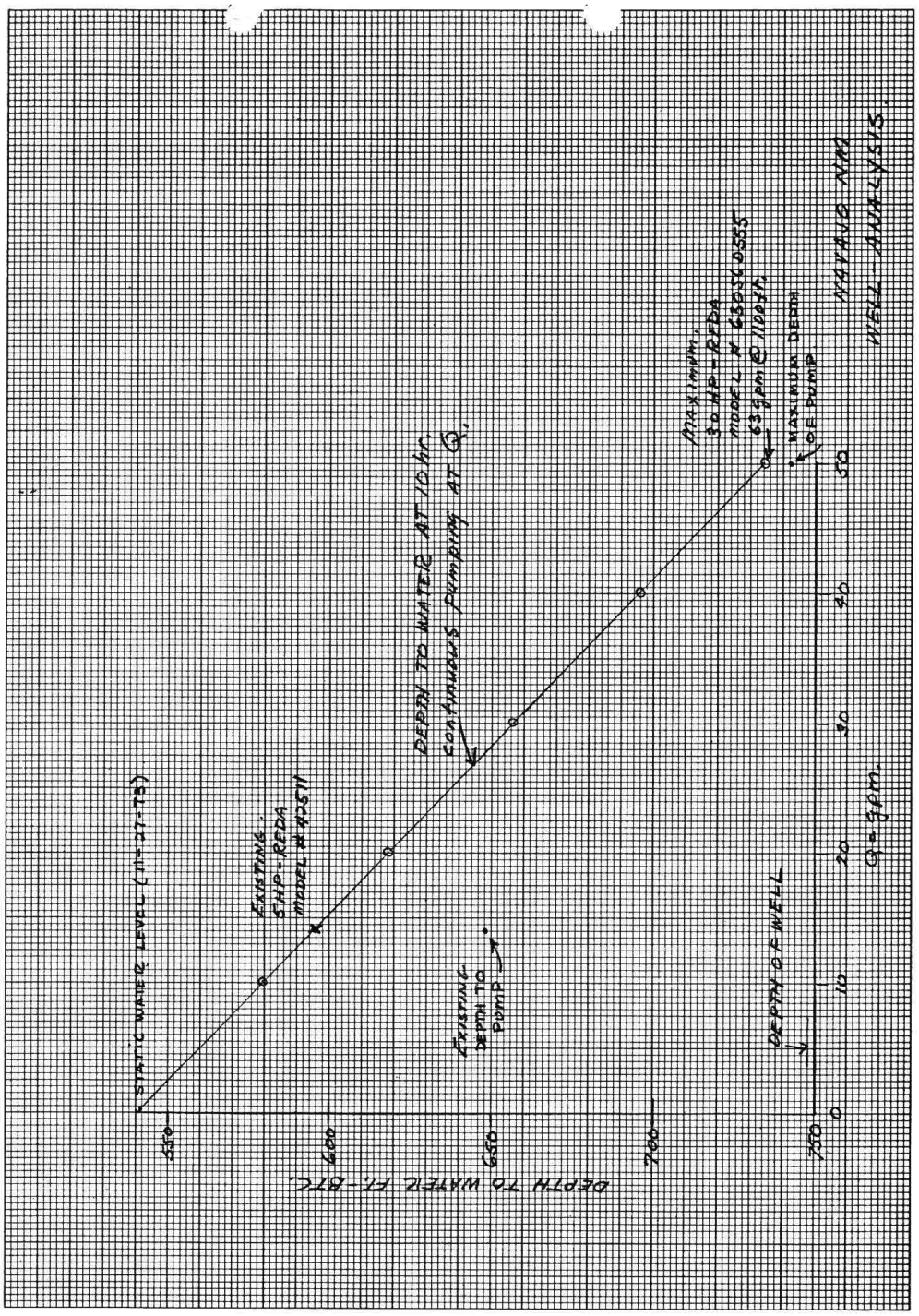
Clock Time (Hr.)	Pumping Time (Min.)	Meter Readings	Avg. Q.	Depth To Water	Draw Down (Ft.)	Spec. Cap.	Remarks
1100	0.0	1024649		541.7	-		SWL Pump on.
	.5			544.6	2.9		
	1.5			549.9	8.2		
	2.5			552.7	11.0		
	3.0	4708					
	5.0	4716	13.4	558.8	17.1	0.78	
	8.0			563.7	22.0		
	10.0	4790	14.1	566.2	24.5	0.58	
	15.0	4863	14.3	570.6	28.9	0.49	
1120	20.0	4938	14.5	573.8	32.1	0.45	
	25.0	5009	14.4	575.8	34.1	0.42	
	30.0	5080	14.4	577.7	36.0	0.40	
	35.0	5154	14.4	579.9	38.2	0.38	EC=210 @ 56°F
	40.0	5226	14.4	580.4	38.7	0.37	
	45.0	5298	14.4	581.3	39.6	0.36	
	50.0	5369	14.4	581.8	40.1	0.36	
	55.0	5439	14.4	582.2	40.5	0.36	
	60.0	5510	14.4	582.8	41.1	0.35	
	70.0	5652	14.3	584.4	42.7	0.33	
	80.0	5795	14.3	585.4	43.7	0.33	
	90.0	5938	14.3	586.3	44.6	0.32	
1240	100.0	6081	14.3	587.0	45.3	0.32	
1403	183.	7254	14.2	590.3	48.6	0.29	
1425	205.	7568	14.2	590.9	49.2	0.29	
1502	242.	8080	14.2	591.9	50.2	0.28	EC=205 @ 58°F
1527	267.			592.3	50.6		
1543	283.			592.4	50.7		
1600	300.	8900	14.2	593.0	51.3	0.28	
1700	360.	1029740	14.1	593.6	51.9	0.27	
2100	600.	1033138	14.1	596.0	54.3	0.26	
2200	660.	3392	13.2	596.5	54.8	0.24	
0620	1160.	1041067	14.2	598.7	57.0	0.25	Pump off.

NAVAJO NATIONAL MONUMENT

Recovery Data
Date: November 27 and 28, 1973
Observers: Garland Moore, Luis Garcia

Pumping Time (Min.)	Time Pump Stopped (Min.)	t/t'	Depth to Water (Ft.)	Recovery (Ft.)	Remarks
1160	0		598.7	0	Pump Stopped
1161	1	1161	593.7	5.0	
1162	2	581	589.2	9.5	
1163	3	388	585.4	13.3	
1164	4	291	582.2	16.5	
1165	5	233	579.6	19.1	
1166	6	194	577.0	21.7	
1167	7	163	575.0	23.7	
1168	8	146	573.1	25.6	
1169	9	130	571.3	26.4	
1170	10	117	569.9	28.8	
1175	15	78	564.1	34.6	
1180	20	59	560.3	38.4	
1190	30	40	555.8	42.9	
1200	40	30	553.4	45.3	
1210	50	24	551.9	46.8	
1220	60	20	550.7	48.0	
1231	71	17	549.9	48.8	
1240	80	16	549.2	49.5	

11-27-1973: graph of well analysis



Type Analysis

Arizona County Navajo

e-Longitude Location or other identification

National Park Service, Navajo Mar... Date Drilled 7/29/52 Source (Type)

Tonalea, Ariz. - 86044

9.4 Temp.(°C)

s as $CaCO_3$: Total 106

NCH 0

1 S.A.R. 0.1 0.4

15 T/of

(%pl at 20°C)

c Source (WDF) Navajo S.S.

ng Intervals 555' to 753'

evel 528'

d after Pumping(Time) 1 hr.

12 G.M.

f Collection At well head

unce Clear

Public Supply

ed by H. Timmons

ks: On separate enclosure

Checked By

Completed

Transmitted

tory No. 66892

Date 9/17/49 Time

Depth (ft) 780 Diam.(in)

Specific Conductance (micromhos at 25°C): T R KCl 224

	mg/L	me/L
Silica (SiO_2) f vol o.d.	14	
Calcium (Ca) me/L T vol T	37	
Magnesium (Mg) vol range reading	3.3	
Sodium (Na) vol range reading		
Potassium (K) vol range reading		
Na+K (Calculated) (8.5)	8.5	
Iron (Fe) f vol dissolved: o.d. 0.00 (0.0)	0.00	
Total: o.d. 0.720 (1.7)	1.4	
TOTAL CATIONS		

	mg/L	me/L
Bicarb (HCO_3) T vol T Carbon... (CO_3) Net	131 0	
Sulfate (SO_4) vol f T	3.4	
Chloride (Cl) vol T $AgNO_3$ or $Hg(NO_3)_2$	2.2	
Fluoride (F) vol f o.d. 1,000 - 0 =	0.3	
Nitrate (NO_3) f vol o.d. (3.8)	3.8	0.06
Boron (B) f vol o.d.		
Dissolved solids: Sum of Constituents (144)	144	
Residue on Evaporation at 180°C (137) vol 135 dish	139	1.2
TOTAL ANIONS		

02-17-1969: water lab tests for chemical analysis

G.W. Type Analysis A-1, no Fe soln. USGS CHEMICAL ANALYSIS Account 20NP Project 34

State Arizona County Navajo Location Navajo National Monument 37N.17E.19.

Latitude-Longitude Well No. 1 Date Collected 3-7-68

Owner Nat'l. Park Service Date Drilled 8/22/62 Source Drilled Depth (ft) 780 Diam. (in)

pH..... 7.7 Temp. (°C) 10

Hardness as $CaCO_3$: Total, mg/L 108

Noncarbonate, mg/L. 0

Color.. 5 Sodium-adsorption ratio..... 0.2

%Na.... 9 Tons per acre ft...

Density, g/ml at 20°C

W.B.F. Navajo ss

Producing Intervals 588 to 650

W.L. 600' below

Sampled after Pumping (Time) 7 hrs.

Id 14 GM

Point of Collection Navajo Nat'l. Mon. Visitor Center

Appearance

Use Dom., Public Supply

Collected by Kevin McKibbin

Remarks:

Chemist RLL, SWM, EP Checked By EFW

Date Completed 4/23/68

Date Transmitted

Laboratory No. G63600

Specific Conductance, micromhos at 25°C 237

Concentrations in milligrams per liter (mg/L)

Silica (SiO_2).....	15	Bicarbonate (HCO_3).....	136
		Carbonate (CO_3).....	0
Calcium (Ca).....	38		
		Sulfate (SO_4).....	3.8
Magnesium (Mg).....	3.2		
		Chloride (Cl).....	3.2
Sodium (Na).....	5.4		
		Fluoride (F).....	0.00
Potassium (K).....	2.0		
		Nitrate (NO_3).....	1.7
Na+K (Calculated).....			
Dissolved Iron (Fe)....	0.00	Boron (B).....	0.56
Total Iron (Fe).....	0.05	Dissolved Solids: Sum of Constituents.....	140
		Residue on Evaporation at 180°C.....	139

Provisional records, subject to revision.

03-07-1968: usgs chemical analysis, type a-1, no fe soln., well no. 1

Geological Survey — Experimental ( ) qw-gw (1966)

UNITED STATES DEPARTMENT OF THE INTERIOR — Ground Water Analysis

Water Resources Division

State Ariz. (01) County Navajo (3 4) Latitude (5 10 11) Longitude (12 18) Seq. No. (19) Date coll. D 04 Y 21 6 (20 27)

Well No. (Replacement)

Local well No. a Navajo Nat'l. Mon. 10 mi. E of Shonto, Ariz. Owner b NPS, Navajo Nat'l. Mon., Tonalea, Ariz. Collected by Kevin McKibbin Chief Park Ranger Lab. Anal. A-1 No Fe soln. Project No. 20 NPS-C

WSP Wingate (?) Appearance Wc Clear Wa _____ Lab. No. 61499 Sampling depth (26 29) Type c Pumped

Kx10⁶ (232) T 25 R KC1/510 (31 35) 232

pH 8.2 (36 38) Temperature °F Approx. 55-60 (39 41) 58

f 1.2 — 10 ml (16) Abs 2.307 (42 44) 16

	ppm	epm
Ca — 50 ml (38) (45 49)	38	1.90
Mg — 10 ml (4.1) (50 53)	4.1	0.34
Cations (Ca, Mg)		
Na — odil ml (5.1) (54 58)	5.1	0.22
K — 1:10 ml (1.6) (59 61)	1.6	0.04
Cations (Ca, Mg, Na, K)		2.50

HCO_3 6.90 — 50 ml — (138) (62 65) 138 — 2.26

6.90 / 2.00 / 6.70 / 6.8

CO_3 — 50 ml (0) (66 67) 0 — 0.00

	ppm	epm
SO_4 odil (3.8) — ml 0.20 / 0.00 / 0.26 / .07 / 0.19 — f ml (68 72)	3.8	0.08
Cl 100 ml (3.5) — mg — $Mg \cdot AgNO_3$ 0.5 — 5.50 / 0.03 / 0.80 / 1.10 / 0.70 (73 78)	3.5	2.10
Source of data d 79 — Card Q 80 Q		
F 10 ml Abs 1.455 (0.0) (26 28)	0.0	0.00
NO_3 10 ml Abs 0.127 (2.3) f=1.16 (29 32)	2.3	0.04
PO_4 f Abs — Abs % — HPO_4 % H_2PO_4 (33 35)		
Total anions		2.48
B 1.40 f — 1:2 ml (0.04) Abs 0.026 (36 38)	0.04	
Al — ml — Abs (Al + Fe) (39 41)		

Remarks and explanation on other side

	ppm	epm
Fe f 1.92 — ml (6.01) Total 25 ml Abs 0.006 (42 45)	0.01	
Dissol. ml Abs		
Mn f ml Total ml Abs (46 49)		
Dissol. ml Abs		
Cu ml (50 52)		
Pb ml (53 54)		
Zn ml (55 57)		
Subtotal cations (Al, Fe, Mn, Cu, Pb, Zn)		
Subtotal cations (Ca, Mg, Na, K)		
Total cations		
Dissolved solids (142) Residue at 180° ml (58)	142	
Dish No. Calculated (142) (64)	142	
Hardness 5.60 / Ca, Mg 0.00 / 5.60 — 50 ml (112) (70)	112	
Noncarbonate (0) (74)	0	
Color (1) 78-79	1	Card R 80

.5 107

Provisional records subject to revision

04-21-1967: ground water analysis, well no. (replacement), lab no. 961499

C61499

State | County | Lat. | Long. | Seq. No. | Date | Samp. depth | c

Remarks:

Location: T38N R17E (survey map pending)
Source: Drilled well
DD: Aug. 1967
Depth: 753'
Producing intervals from: 555 to 715
WL: static 555'
Yield: pump 19 gpm
PC: Visitor Center
Use: Dom., Ps, Stock

Br _____ ml (26–28)

I _____ ml (29–31)

Alk. as $CaCO_3$ (32–35)

Free CO_2 (36–38)

SAR (0.2)' 0.2 (39–41)

RSC (42–44)

Organics

MBAS (ABS) _____ ml (45–47)

(48–50)

(51–54)

Radiochemical

Alpha (pc/l) (55–57)

Beta (pc/l) (58–60)

Ra (pc/l) (61–63)

U (ug/l) (64–66)

Other data (67-79)[e]

Dissolved Solids---ml 200 pt 46
44.5119
44.4836
0.0283'

a Master card A (21-34)
b Master card A (52-66)
c Type:
1. Pumped 4. Spigot
2. Bucket 5. Bailer
3. Forest 6. Special
d Source of data:
1. USGS 5. Industrial
2. UPHS 6. Private
3. State Health 7. [illegible]tional
4. State

e Indicate constituent and card colu[illegible]

Card S

Chemist LEWIS ALARY Checked by E. F. WILLIAMS

Date began _____ Date transmitted _____

Punched by _____ Verified _____

[illegible]tional records, subject to revision.

04-21-1967: ground water analysis, well no. (replacement), lab no. 961499, page 2cont

State | County | Lat. | Long. | Seq. No. | Date | Samp. depth | c

Remarks:

Source: drilled
DD: July 1962
WL: static 555' below LS
PC: visitor center
Use: Ps

Br _____ ml (26-28)

I _____ ml (29-31)

Alk. as $CaCO_3$ (32-35)

Free CO_2 (36-38)

SAR 0.3 / 0.3 (39-41)

RSC (42-44)

Organics

MBAS (ABS) _____ ml (45-47)

(48-50)

(51-54)

Radiochemical

Alpha (pc/l) (55-57)

Beta (pc/l) (58-60)

Ra (pc/l) (61-63)

U (ug/l) (64-66)

Other data (67-79)[e]

Provisional records, subject to revision

APR 13 1966

Chemist JOE O'NEILL Checked by 5/4/66 KO

Date began _____ Date transmitted _____

Punched by 5386 Verified 5-8816

a Master card A (21-34)
b Master card A (52-66)
c Type:
1. Pumped 4. Spigot
2. Bucket 5. Bailer
3. Forest 6. Special
d Source of data:
1. USGS 5. Industrial
2. UPHS 6. Private
3. State Health 7. Educational
4. State

e Indicate constituent and card columns.

Card S 80 S

04-21-1967: ground water analysis, lab no. 58816, second page

05-06-1965: u.s. geological survey analytical notes, type a-1

G.W. Type Analysis A-1 **U.S. GEOLOGICAL SURVEY ANALYTICAL NOTES** Project NPS Collector B.D. Martin

State Arizona County Navajo City (at or near) Navajo National Monument, Tonalea, 10 mi. north of Shonto.

Latitude-Longitude _____ Well No. _____ Date Collected May 6, 1965

Owner U.S.N.P.S., Navajo National Monument, Tonalea, Arizona Date Drilled July, 1962 Cased to _____ Depth (ft.) 780 Diam.(in) _____

pH 7.9 7.9 Temp.(°F) _____

Hardness as $CaCO_3$ Total (113) 113

Noncarbonate (0) 0

Color (4) 4 S.A.R. (0.2) 0.2

%Na (9) 9 T/at (0.20) 0.20

Density (g/ml) _____

W.B.F. Kayenta

Producing Intervals _____

W.L. 535 ft.

Sampled after Pumping(Time) Two weeks

Yield 16 gpm.

Point of Collection Res. No. 1.

Appearance Clear

Use Public Supply

Remarks: Pumpset at 680 ft.

Chemist KO Checked By [illegible]

Date Completed JUN 7 1965

Date Transmitted _____

Laboratory No. 67003

Spec. Cond. (micromhos at 25°C): T 235 R KCl 343 R Sample 1450 (247) 240

	PPM	EPM
Silica f 50.8 vol 10 o.d. 0.310	(16) 16	
Calcium 6.82 / 2.82 / 4.00 vol 50 EPM TH _____	(40) 40	2.26 / 2.00
Magnesium 17.25 / 11.60 / 5.65 vol 50	(3.2) 3.2	0.26
Sodium vol 50 0-10 range 32.3 6.9	(5.2) 5.2	0.23
Potassium vol 50 0-10 range 16.2	(1.6) 1.6	0.04
Na+K (Calculated)		
Iron f 1.92 vol 25 In sol.: o.d. _____ Total: o.d. 0.321	(0.67) 0.67	
TOTAL CATIONS		2.53

	PPM	EPM
Bicarbonate 7.10 / 0.00 / 7.10 vol 50	(142) 142	2.33
Carbonate	(0) 0	0.00
Sulfate 0.28 / 0.00 / 0.28 / 0.07 / 0.21 vol 10 <5	(4.2) 4.2	0.09
Chloride 4.48 / 3.70 / 0.78 / 0.06 / 0.72 vol 100 $AgNO_3$ 0.5	(3.6) 3.6	0.10
Fluoride vol 10 o.d. 1.489	(0.1) 0.1	0.01
Nitrate f 11.5 vol 10 o.d. 0.165	(1.9) 1.9	0.03
Boron f 1.61 vol 1 o.d. 0.017	(0.02) 0.02	
Sum of Constituents	(146) 146	
Residue on Evaporation at 180°C vol 250 dish X-145	(147) 147	
TOTAL ANIONS		2.56

Provisional records, subject to revision

11-22-1965: ground water analysis, lab no. 58816

ological Survey — UNITED STATES DEPARTMENT OF THE INTERIOR — Water Resources Division

Experimental form: qw-gw (1966) — Ground Water Analysis

State Ariz. (02) County Navajo — Latitude ° ' " N, S — Longitude ° ' " — Seq. No. — Date coll. M D Y: 11 22 65

SE¼ sec.19 T37N R17E

Local well No.[a] 37.17.19.400 — Owner[b] NPS, Tonalea, Ariz. — Collected by Peter Bennett — Lab. Anal. A-1 -Fe soln. +TOTAL Fe — Project No. NPS

Navajo Nat'l. Monument, Arizona

WBF Navajo & Kayenta — Appearance Wc Clear Wa ____ — Lab. No. 58816 — Sampling depth 0780 — Type[c] Pumped (1)

Kx10⁶ 2.9 T 353 R — KC1/700 (208) 208 — pH 8.2 (8.2) — Temperature °F 64 (064)

Si f 51.2 10 ml (15) 15 — Abs .301

	ppm	epm
Ca 2.85 0.00 2.85 — 50 ml (28)	28	1.40
Mg — ml (3.6)	3.6	0.30
Subtotal cations (Ca, Mg)		1.70
Na 0-50 odil 19.6 ml (6.8)	6.8	0.30
K 0-10 odil 53.3 ml (5.3)	5.3	0.14
Subtotal cations (Ca, Mg, Na, K)		2.14
HCO_3 16.70 10.80 5.90 — 50 ml (118)	118	1.93
CO_3 — 50 ml (0)	0	0.00

	ppm	epm
SO_4 odil ml (4.2)	4.2	0.09
f ml 0.28 0.08 0.20 −.07 0.21		
Cl 100 ml (3.5)	3.5	
.5 mg Mg · $AgNO_3$ 3.16 2.40 0.76 −.06 0.70 — Bl 0.06 0.00 0.06		0.10
Source of data d 79 — Card Q 80 Q		
F 10 ml .0011 — Abs 1.468 (0.1)	0.1	0.01
NO_3 f=11.6 10 ml — Abs .170 (2.0)	2.0	0.03
PO_4 f — Abs — Abs — %		
HPO_4 — % H_2PO_4 —		
Total anions		2.16
B 1.40 f 1 ml — Abs .015 (0.02)	0.02	
Al ml — Abs (Al + Fe)		

Remarks and explanation on other side

Provisional records, subject to revision.

	ppm	epm
Fe f 1.92 ml (0.03)	0.03	
Total 25 ml Abs .018		
Dissol. ml Abs		
Mn f ml		
Total ml Abs		
Dissol. ml Abs		
Cu ml		
Pb ml		
Zn ml		
Subtotal cations (Al, Fe, Mn, Cu, Pb, Zn)		
Subtotal cations (Ca, Mg, Na, K)		
Total cations		

Dissolved solids 51.5362 (122) 122

Residue at 180° 51.5119 200 ml 0.0243

Dish No. N-20 — Calculated (127) 127

Hardness 9.15 — Ca, Mg 4.90 4.25 — 50 ml (85) 85

Noncarbonate 0 (0)

Color 0 78-79 0 — Card R 80 R

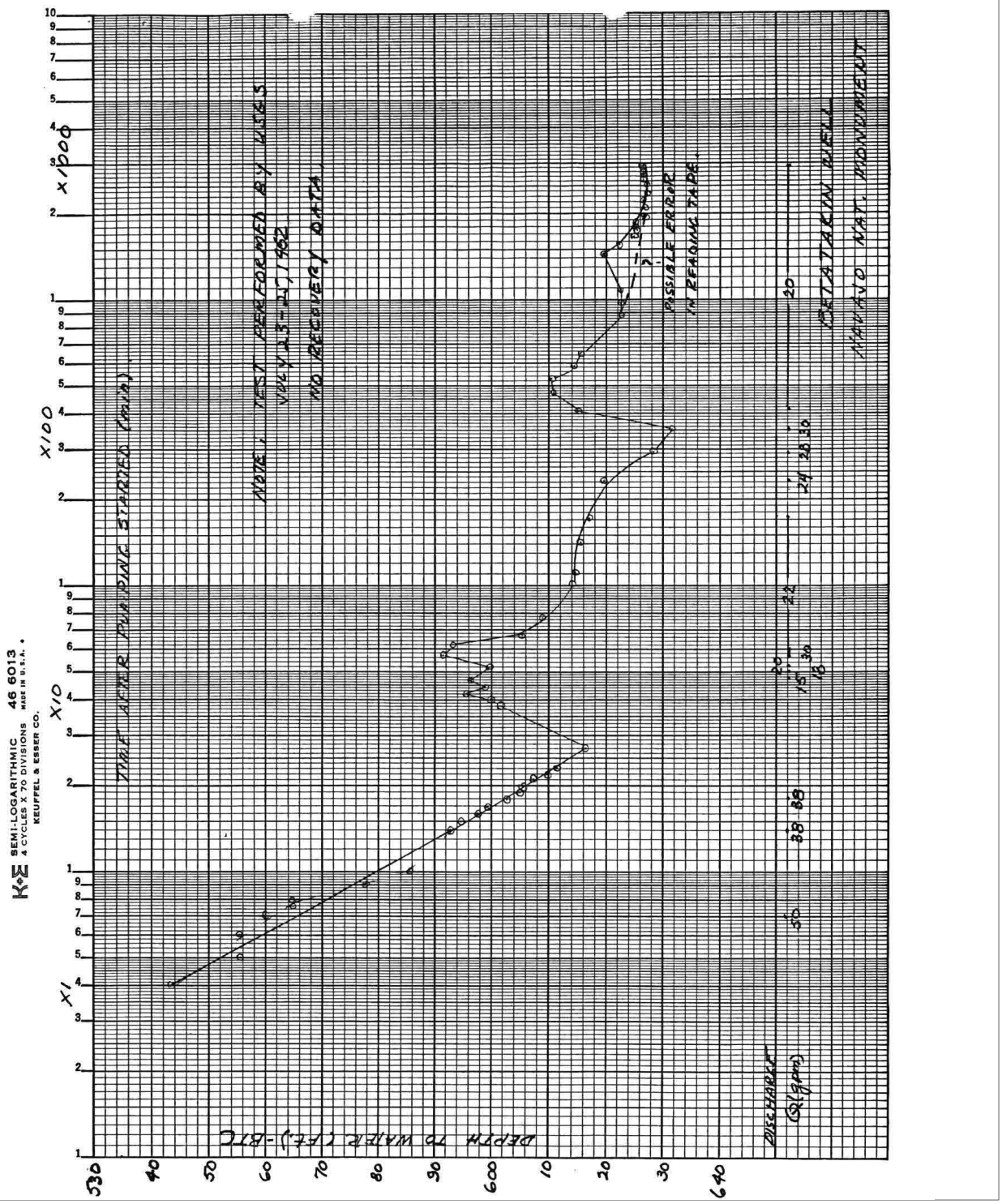
NAVAJO NATIONAL MONUMENT

Date: July 23, 24, 25, 1962
Observers: USGS, Flagstaff Office
Location: Betatakin Ruins

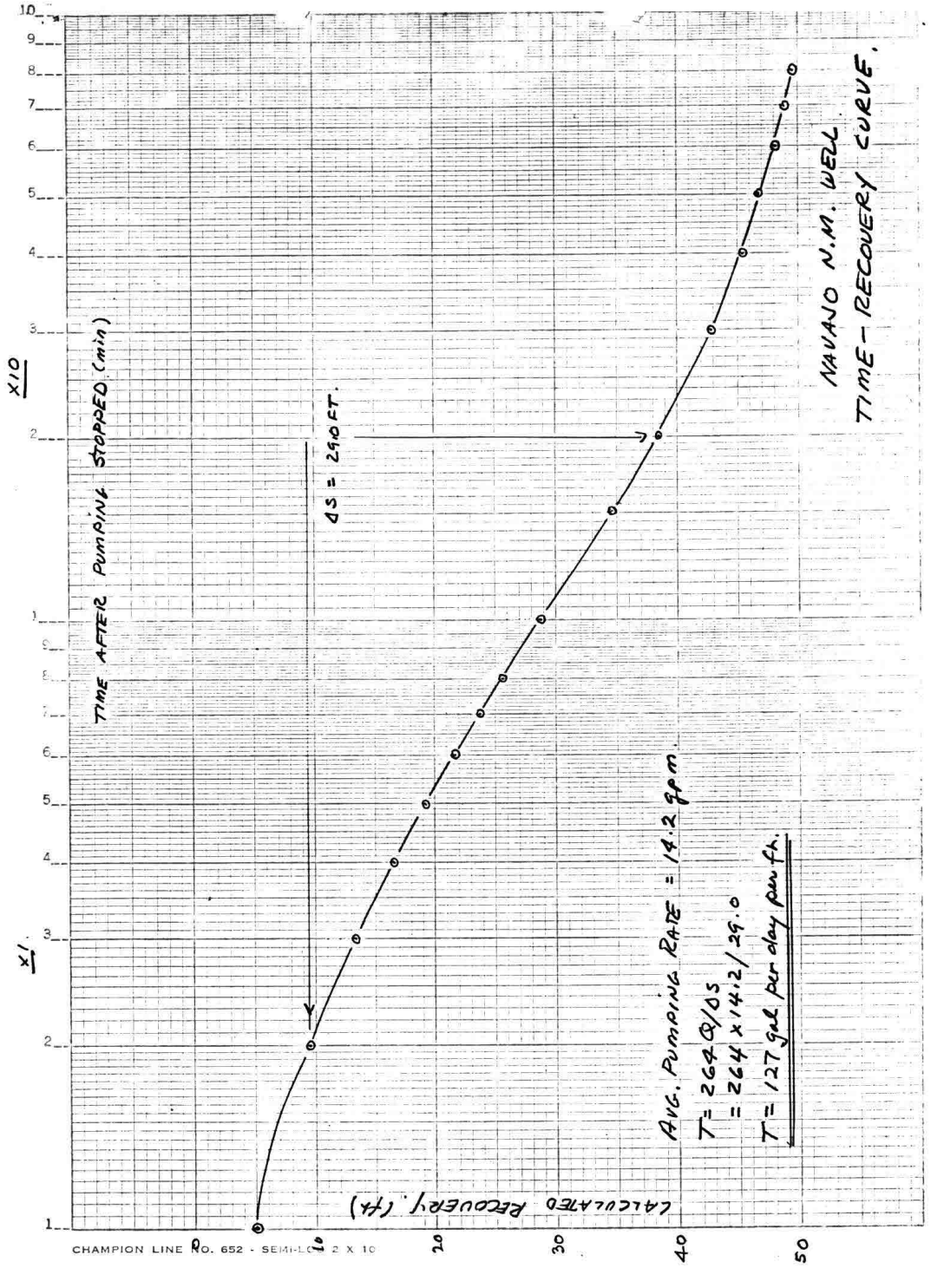
Clock Time (Hr.)	Pumping Time (Min.)	Q (gpm)	Depth to Water (Ft.)	Drawdown (Ft.)	Spec. Cap.	Remarks
1508	0		534.7	0		SWL
	4		543.3	8.6		
	5		555.5	20.8		
	6		555.3	20.6		
	7	50	559.9	25.2	1.98	
	8		564.3	29.6		
	9		577.8	43.1		
	10		585.6	50.9		
1522	14	38	592.8	58.1	0.65	Reduce discharge
	15		594.5	59.8		
	16		597.7	63.0		
	17		599.2	64.5		
1526	18	38	602.7	68.0	0.56	
	19		605.0	70.3		
	20		605.7	71.0		
	21		607.8	73.1		
	22		609.8	75.1		
	23		611.3	76.6		
	27		618.1	83.4		
1546	38	15	601.9	67.2	0.22	Reduce discharge
1548	40	18	599.8	65.1	0.28	Adjust discharge
1550	42	20	595.5	60.8	0.33	Adjust discharge
	44		598.8	64.1		
1555	47	30	596.1	61.4	0.49	Adjust discharge
	52		599.7	65.0		
	57	22	591.7	57.0	0.39	
	62	22	593.2	58.5	0.38	
	67	22	605.7	71.0	0.31	
	77	22	608.8	74.1	0.30	
	102	22	614.0	79.3	0.28	
	112	22	614.5	79.8	0.28	
	142	22	615.7	81.0	0.27	
	172	22	617.2	82.5	0.27	
	232	24	619.8	85.1	0.28	
	292	28	628.4	93.7	0.30	
2100	352	30	631.7	97.0	0.31	Cut discharge
2200	412	20	615.2	80.5	0.25	
2300	472	20	610.8	76.1	0.27	
2400	532	20	610.2	75.5	0.27	
0100	592	20	614.5	79.8	0.25	July 24, 1962
0200	652	20	615.6	80.9	0.25	

Clock Time (Hr.)	Pumping Time (Min.)	Q (gpm)	Depth to Water (Ft.)	Drawdown (Ft.)	Spec. Cap.	Remarks
0600	892	20	622.9	88.2	0.23	
0700	952	20	622.5	87.8	0.23	
0900	1072	20	622.4	87.7	0.23	
1000	1132	20	621.2	86.5	0.23	Possible tape error
1100	1192	20	621.3	86.6	0.23	Possible tape error
1200	1252	20	621.5	86.8	0.23	Possible tape error
1508	1440	20	619.4	84.7	0.24	Possible tape error
1708	1560	20	622.2	87.5	0.23	
1908	1680	20	625.0	90.3	0.22	
2008	1740	20	625.7	91.0	0.22	
2108	1800	20	625.3	90.6	0.22	
2208	1860	20	625.1	90.4	0.22	
2308	1920	20	626.9	92.2	0.22	
0008	1960	20	626.7	92.0	0.22	July 25, 1962
0208	2100	20	626.7	92.0	0.22	
0408	2220	20	626.2	91.5	0.22	
0608	2340	20	627.9	93.2	0.21	
0708	2400	20	627.7	93.0	0.22	
0808	2460	20	627.6	92.9	0.22	
0908	2520	20	627.7	93.0	0.22	
1108	2640	20	626.2	91.5	0.22	
1208	2700	20	626.2	91.5	0.22	
1308	2760	20	626.1	91.4	0.22	
1408	2820	20	626.2	91.5	0.22	
1508	2880	20	626.1	91.4	0.22	Pump off

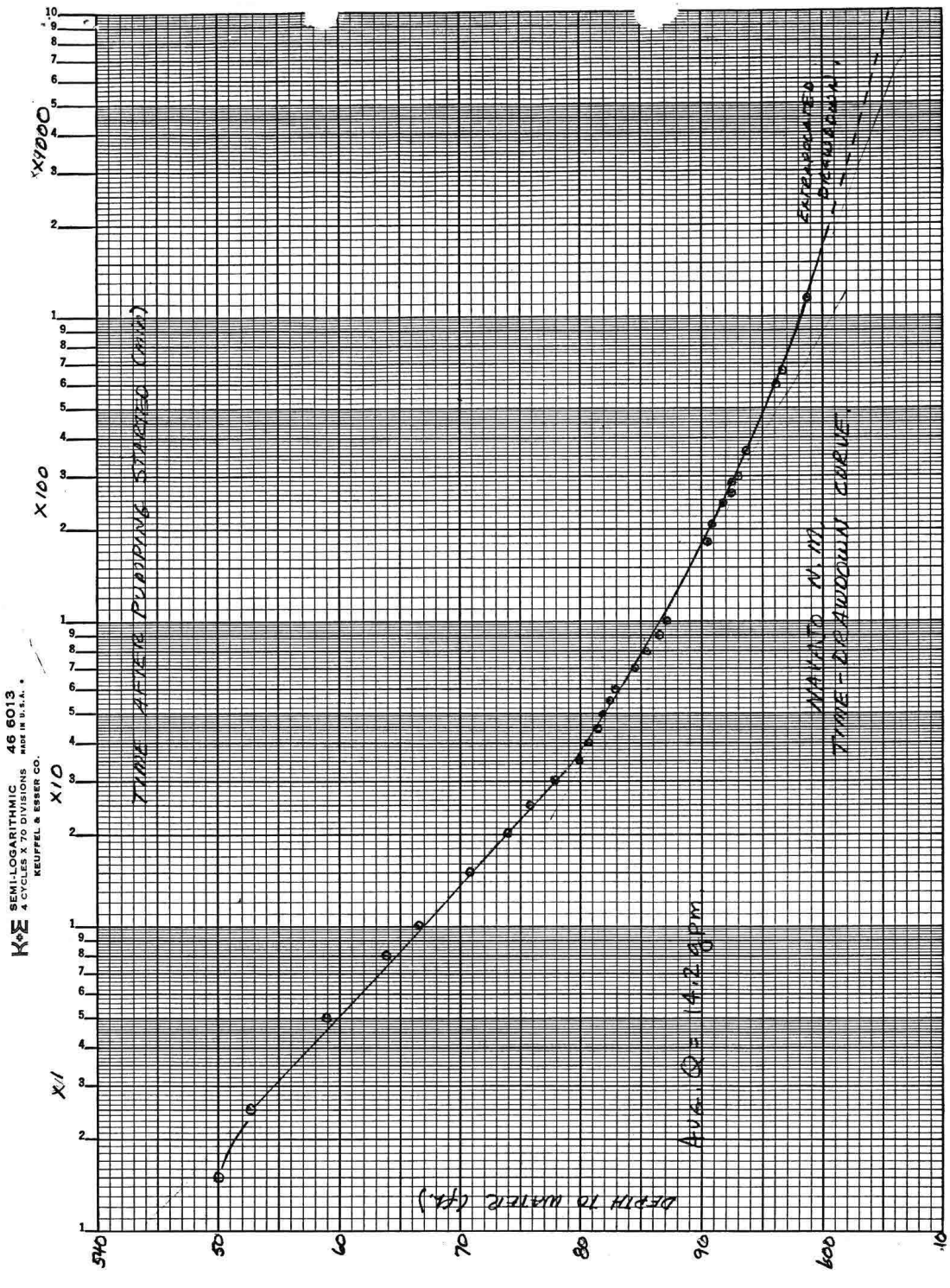
No Recovery Data


TIME ACTUAL PUMPING STARTED (MST)
NOTE: TEST PERFORMED BY USGS
VOLUNTEER
NO RECOVERY DATA
DEPTH TO WATER (FEET) - BTC
DISCHARGE (GPM)
BETATAKIN WELL
UNNAMED NAT. MONUMENT
POSSIBLE ERROR IN READING TAPE
SEMI-LOGARITHMIC 46 6013
4 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

00-00-0000: graph of time-recovery curve after pumping has started



00-00-0000: graph of time-recovery curve after pumping has started



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WELL SCHEDULE — BETATAKIN RUIN NAVAJO NATL MON HEADQUARTERS

Date 7-26-62, 19.62 Field No.
Recorded by J.P.A. Office No.
Source of Data PUMP TEST 7 OBSERVATION

1. Location: State ARIZ. County NAVAJO
Map ¼ ¼ sec. T N S R E W
2. Owner: NATL PARK SERVICE Address RED LAKE
Tenant Address TONALEA
Driller Address
3. Topography
4. Elevation ft. above below
5. Type: Dug, drilled, driven, bored, jetted 7 19 62
6. Depth: Rept. 780 ft. Meas. ft.
7. Casing: Diam. in. to in., Type
Depth ft. Finish
8. Chief Aquifer NAVAJO SS From 535 ft. to 780 ft.
Others
9. Water Level 535±3 ft. rept. (Meas.) 7-20-19 62 above (below) 43.
which is ft above below surface
10. Pump: Type Capacity G.M.
Power: Kind Horsepower
Yield: Flow G.M., Pump 20 G.M., Meas. Rept. Est.
Drawdown 277.7 ft. after 72 hours pumping 20. AVE. G.M.
12. Use: Dom, Stock, PS, RR, Ind, Im, Obs. WL RECOVERED TO 539' AFTER 3 HRS —
Adequacy, permanence Good
13. Quality: Good S. Pet. Cal 2.10. Temp. 57 °F
Taste, odor, color Sample No (Yes)
Unfit for
14. Remarks: (Log, Analysis, etc.) JA 0-660
JK 660-780
BACKFILLED TO 753 FEET

USGS-WRD Form GW

ANALYTICAL STATEMENT

COUNTY Navajo
LAB NO. 49997

Quad 40-1.80-4.70

Location NE of Shonto, Ariz. Betetakin Ruins

Source (type of well) Drilled
Owner Park Service, Navajo Nat. Mon., Tonelea, Ariz.
Date drld 7-20-62 Cased to 10 ft
Depth 780' Diam 8"
Wtr Bearing Navajo SS
Water level 555 ft below LS
Sampled after pumping hrs
Yield 20 GPM (Meas XXXX) pump
Ft of well Discharge pipe
Appearance Clear
Temp (°F) 57 Use Dom., Ps., Stock
Collector Elg
Chemist E. F. Williams
Date completed Aug. 7, 1962
Checked by R. L. Lepp
Date transmitted AUG 20 1962

Date of collection July 25, 1962

Ignition Loss Color
Dissolved Solids:
Residue at 180°C
Calculated (Sum) 135
Tons per Acre Foot 0.18
Hardness as $CaCO_3$ 103
Non-carbonate Hardness 0
% Na 11 SAR 0.2 pH 7.4
Specific Conductance (micromhos at 25°C) 220

Water strata from 555' to 715'

Sample taken at end of 48 hr. pump test.

	epm	ppm
SiO_2		19
Fe		
Ca	1.70	34
Mg	0.36	4.4
Na		
K		
Na+K	0.25	5.8
HCO_3	2.10	128
CO_3	0.00	0
SO_4	0.07	3.6
Cl	0.10	3.4
F	0.01	0.1
NO_3	0.03	1.7
	2.51	

BETATAKIN RUINS - NAVAJO PARK NATL. MON.

DRILLERS LOG - ELMER WHITE

0 - 7 - SOIL
7 - 85 - NAVAJO S.S.
@ 65' LOST DRILLING WATER
85' - 195 - NAVAJO S.S.
195' 500 - " "
@ 535' 2 GP.M.
500 - 660 - NAVAJO S.S.
660 - 715 - KAYENTA
STOPPED DRILLING AT 715' RAN BAIL
TEST FOR 1 hr. 45 MIN.
46' d.d. - 18 GPM.
715 - 745 - THIN LAYERS S.S. & SHALE.
745 - 752 - RED SHALE
752 - 780 - SANDY RED SHALE & SANDSTONE (HARD)
T.D. 780'

PAGE 1

48 hr. Pump Test

BETATKIN RUINS – NAVAJO NATL. MON.

E.L.C.

DATE – TIME –		W.L. ELEV. –	DISCHARGE –	REMARKS
7-23-62 – 3:08	P.M. °	535' 4"	534.7 (SWL)	627 – 11" / 535 – 4" / 92' – 7" @
3:12	4	544' – 9"	543.3	
3:13	5	556' – 6"	555.5	20 GPM
3:14	6	556' – 8"	555.3	for
3:15	7	560' – 1"	559.9 50 g.p.m.	
3:15.30	7½	565' – 9"	564.3	
3:16	8	569' – 9"	524.3	
3:17	9	578' – 2"	577.8	
3:18	10	586' – 5"	585.6	
3:22	14	593' – 2"	592.8 38 g.p.m. Cut down Discharge	
3:23	15	595' – 6"	594.5	
3:24	16	598' – 3"	597.7	
3:25	17	600' – 10"	599.2	
3:26	18	603' – 4"	602.7 38 g.p.m.	
3:27	19	605' – 0"	605.0	
3:28	20	606' – 3"	605.7	
3:29	21	608' – 2"	607.8	
3:30	22	610' – 2"	609.8	
3:31	23	612' – 8"	611.3	
3:35	27	619' – 11"	618.1 15 GPM	Cut Discharge
3:46	38	602' – 1"	601.9	
3:48	40	600' – 2"	18 g.p.m. 599.8	" "
3:50	42	599' – 6"	20 g.p.m. 595.5	
3:52	44	599' – 2"	598.8	

pg 2.

DATE	TIME		W.L.	ELEV.	DISCHARGE		REMARKS
7-23-62	3:55	PM	47	597'-11"	596.1	30 gpm.	Note drop
	4:00		SV	600'-3"	599.7		
	4:05		57	592'-3"	591.7	22 gpm.	See dams
	4:10		62	594'-10"	593.2	"	on Canyon
	4:15		67	606'-4"	605.7	"	above weir.
	4:25		77	609'-2"	608.8	"	
	4:50		102	614'-0"	614.0	"	
	5:00		112	615'-5½"	614.5	"	
	5:30		142	616'-3½"	615.7		
	6:00		172	618'-9½"	617.2		
	7:00		232	620'-2"	619.8	gpm.	
	8:00		292	629'-7"	628.4	28 gpm.	
	9:00		352	632'-3"	631.7	30 gpm.	Cut Discharge
	10:00		412	616'-10"	615.2	20 gpm.	
	11:00		472	611'-2"	610.8		
	12:00	mid.	532	611"-8"	610.2		
7-24-62	1:00	A.M.	592	615'-6"	614.5		
	2:00		652	616'-5"	615.6		
	6:00		892	623'-1"	622.9		
	7:00		952	623'-6"	622.5		
	9:00		1072	623'-7"	622.4		
	10:00		1132	622'-10"	621.2		
	11:00		1192	622'-8"	621.3		
	12:00	Noon	1252	622'-6"	621.5		
(24hrs)	3:08	PM	1440	620'-7"	619.4		

3

DATE	TIME		WL. ELEV.	DISCHARGE	REMARKS.
7-24-62	5:08	P.M. 1560	623'- 9½"	622.2 20 gpm.	NOTE WL. DROP!
	7:08	1680	625'- 0"	625.0	(SEE DATA ON CANYON NEAR WELL)
	8:08	1740	626'- 3"	625.7	
	9:08	1800	626'- 8"	625.3	
	10:08	1860	626'- 11"	625.1	
	11:08	1920	627'- 1"	626.9	
7-25-62	12:08	A.M. 1980	627'- 3"	626.7	
	2:08	A.M. 2100	627'- 4"	626.7	
	4:04	2220	627'- 9½"	626.2	
	6:08	2340	628'- 1"	627.9	
	7:08	2400	628'- 4"	627.7	
	8:08	2460	628 - 4½"	627.6	
	9:08	2520	628'- 2½"	627.7	
	11:08	2640	627'- 10⅜"	626.2	
	12:08	P.M. 2700	627'- 10"	626.2	
	1:08	2760	627'- 11"	626.1	
	2:08	2820	627- 10"	626.2	
	3:08	2880	627- 11"	626.1	PUMP OFF

627.11
333.3
294.7

628
535
93

535
93
178

APPENDIX

NAVAJO NATIONAL MONUMENT

CHEMICAL ANALYSIS

Concentrations expressed in milligrams per liter (mg/l)

Constituents	1962	1965
Dissolved solids	135	147
Hardness (as $CaCO_3$)	103	113
SiO_2	19	16
Ca	34	40
Mg	4.4	3.2
HCO_3	128	142
Cl	3.4	3.6
F	0.1	0.1
NO_3	1.7	1.9
%Na	11	9
pH	7.4	7.9
Spec. Cond.	220	---
Na & K	5.8	---
CO_3	0	0
SO_4	3.6	4.2
Na	---	5.2
K	---	1.6
Fe	---	0.67
Color	---	4

*** ***

Other Supporting Information

United States Department of the Interior
NATIONAL PARK SERVICE
SOUTHWEST REGION
P.O. BOX 728
SANTA FE, NEW MEXICO 87504-0728

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

A5427(SWR-ONR)

DEC 30 1988

Memorandum

To: Chief, Water Resources Division, Fort Collins, Colorado

From: Acting Associate Regional Director, Park Operations, Southwest Region

Subject: Water supply well at Navajo National Monument

The memorandum from Mr. Owen Williams of your office, dated November 17, 1988, provided an excellent summary on the issue of the above subject and presented a number of important questions for us to ponder. We are still in the process of evaluating this issue. Your summary has been most helpful to us. We will keep you informed of our progress.

cc:
Associate Director, Natural Resources, WASO-470
Superintendent, Navajo

11-17-1988: memorandum to regional chief scientist, southwest region from chief, wrb regarding draft memorandum for solicitor's

United States Department of the Interior
NATIONAL PARK SERVICE
WATER RESOURCES DIVISION
301 SOUTH HOWES ST., ROOM 335
FT. COLLINS, COLORADO 80521

IN REPLY REFER TO:

November 17, 1988

L54(479)
SWR/NAVA Water Rights

Memorandum

To: Regional Chief Scientist, Southwest Region

From: Chief, Water Rights Branch

Subject: Draft Memoradum for Solicitor's Opinion on Well at Navajo National Monument

As discussed in our meeting on October 12, 1988, attached is a draft memorandum requesting an opinion from the Regional Solicitor's Office on several questions regarding the well at Navajo National Monument. Please review this and contact me at (303) 221-8301 with your comments or suggestions.

Attachment

United States Department of the Interior
NATIONAL PARK SERVICE
WATER RESOURCES DIVISION
301 SOUTH HOWES ST., ROOM 335
FT. COLLINS, COLORADO 80521

IN REPLY REFER TO:

November 17, 1988

L54(479)
SWR/NAVA Water Rights

Memorandum

To: Regional Solicitor, Southwest Region

From: Chief, Water Rights Branch

Subject: Water Supply Well at Navajo National Monument

This memorandum requests your opinion and advice regarding a well serving Navajo National Monument (NAVA).

Navajo National Monument was created by Proclamation No. 873 of March 20, 1909, to preserve "prehistoric cliff dwellings, pueblo and other ruins and relics." The boundaries were reduced by Proclamation No. 1186 on March 14, 1912, to three small units: Inscription House Ruin, Keet Seel Ruin and Betatakin Ruin (copies of proclamations are attached). All three units are contained entirely within the boundaries of the Navajo Indian Reservation in Arizona. The visitor center and other National Park Service (NPS) facilities are on a 246 acre tract of land adjacent to the Betatakin Ruin unit of NAVA. This tract is under Navajo Nation jurisdiction, administered through a Memorandum of Agreement (MOA) between the Navajo Nation and the NPS dated May 8, 1962 (copy attached).

The National Park Service first constructed a well to serve the Betatakin Section of NAVA in 1939. The well was located just within the southwest boundary of the monument. Water was piped to an NPS residence and utility area outside the boundary near the present monument headquarters and visitor center.

Anticipated increases in visitation demanded that a new, higher capacity and more reliable source of water be developed. In July 1962 the NPS drilled a replacement well yielding up to 22 gallons per minute (based on pump capacity). This well was granted Registration No. 55-649817 by the State of Arizona under Registration of an Existing Well made by the NPS on June 11, 1982 (copy attached). The registration, erroneously, states that the NPS owns the land on which the well is located. The well is actually located in the headquarters area, on Navajo Nation land described in 1962 MOA.

While the MOA does not specifically address water rights, it does state that the status of the land "in regard to The Navajo Tribe and the Bureau of Indian Affairs shall remain unchanged, and that such lands shall remain subject to all laws applicable thereto." The agreement goes on to state "it is agreed by The Navajo Tribe and Bureau of Indian Affairs that the above described lands will be devoted primarily to recreational use in connection with the operation of Navajo National Monument." The agreement also indicates that the NPS will acquire this tract of land as funds become available.

Attached is a copy of the Navajo Nation Water Code which the Navajo Nation, unsolicited, sent to the National Park Service. Under the Code, the Navajo Nation claims the right to all surface and ground waters which flow over, under, or through Navajo lands or which affect waters which do so. If this broad claim is valid, the water currently supplying NAVA would, in our view, belong to the Navajo Nation.

Although the 1962 well was drilled with the intention of serving NPS facilities, it has become the custom of certain individuals from the Navajo Nation to also use its water. They collect the water in large drums and haul it away in pickup trucks. There apparently exists no formal agreement allowing this practice.

The concerns of the NPS are two-fold. First, although flow from the well is adequate for the present, the NPS is concerned that flows will not be sufficient to meet future park needs if either visitation or use of the well as a private water supply increases. The second concern is the liability of the Park Service if individuals from the Navajo Nation become ill as a result of using the well water.

The following questions have been raised and we would appreciate your opinion and advice concerning them:

1. Who, if anyone, holds the water right for this well?

2. Is the NPS Registration No. 55-649817 with the State of Arizona of any force or effect?

3. Is the NPS subject to the Navajo Nation water code in its use of this well?

4. Can the NPS curtail use of this well for purposes other than administration of NAVA?

5. What would be the legal/institutional consequences of such an action by the NPS?

6. If the NPS used water developed within the boundaries of NAVA would such use be subject to the water law of the State of Arizona, the Navajo water code, or both?

7. Does the NPS incur liability of any kind by not taking definitive action to curtail unofficial use of the well?

8. Is there legal/institutional merit to officially delivering water to individual Native Americans?

9. What consequences could arise from such an action in view of the jurisdictional questions raised in 2 and 6 above?

10. If NAVA seeks to develop additional water supplies (wells) on Navajo Nation lands, will the NPS be subject to the Navajo Nation water code, Arizona water law, or both?

11. What control over future NPS use of such a well could be legitimately exercised by the Navajo Nation?

Thank you for your assistance. If you have any questions please contact me at (303) 221-8301.

Attachments

cc: NAVA - Superintendent
SWR - Fletcher, Yarborough

19 September 1988

Owen,

Navajo NM was created by Proclamation (No. 873) of March 20, 1909. It reserved "all prehistoric cliff dwellings, pueblo and other ruins and relics of prehistoric peoples, situated upon the Navajo Indian Reservation, Arizona, between the parallels of latitude thirty-six degrees thirty minutes North, and thirty-seven degrees North, and between longitude one hundred and ten degrees West and one hundred and ten degrees forty-five minutes West..." This encompased a very large area and, on March 14, 1912, the boundaries were reduced by Proclamation No. 1186 to three small units: Inscription House Ruin, Keet Seel Ruin and Betatakin Ruin. The well supplying water to the Reservation is associated with the Betatakin Ruin Unit. This well is not within NPS boundaries but, rather, on land owned by the Reservation.

The dockets indicate that a well was drilled in early summer, 1939. Water was pumped from the well, through a tunnel, to a storage tank. The artesian well, however, flowed to a small degree almost continuously without pumping. For many years there was some question as to whether the well constituted an underground or spring water source because the well intercepted two aquifers and was not lined through the upper one. When drilled, the well was intended to intercept flow to springs in the area but it was later determined that the well source was independent of the springs.

In 1960 there was concern that the park's increased availability to visitors due to road improvements would necessitate the need for another water supply. That same year, A. van V. Dunn questioned the right of the NPS to use the Indian Reservation land on which most of its developments were located. "So far as I have been able to determine the Park Service use of Indian land is either covered by such an early permit that I have been unable to find it, or is based on occupancy without permit since before the National Park Service was established."

In 1962 the USGS studied the geology of the area and recommended that the most probable source for adequate supply of acceptable quality water would be a well drilled in the extreme southwest corner of the monument. On July 26 the Elmer L. White Drilling Company completed a new well.

A July 13, 1966 memo reveals the following information:

> Water rights for Navajo National Monument are subject to the Memorandum of Agreement of May 8, 1962 between the Navajo Tribe, Bureau of Indian Affairs and the National Park Service.
>
> From paragraph 3 of that agreement:
>
> "While it is understood that the current status of the above described lands in regard to the Navajo Tribe and the Bureau of Indian Affairs shall remain unchanged, and that such lands shall remain subject to all laws applicable thereto, it is agreed by The Navajo Tribe and Bureau of Indian Affairs that the above described lands will be devoted primarily to recreational use in connection with the operation of Navajo National Monument."

The docket does not contain a copy of this Memorandum of Agreement.

The United States of America registered an existing well with the State of Arizona in June, 1982. The well was registered for "municipal and park purposes" and appears to be the well now in use, drilled in 1962 to a depth of 780 feet. The priority date of this well, though not claimed in the well registration would be 1939 because the 1962 well replaced the 1939 well.

Navajo Nation Water Code

101 "... the Navajo Nation hereby asserts its sovereign authority over all actions taken within the territorial jurisdiction of the Navajo Nation which will affect the use of water within the Navajo Nation."

102 "... it shall be unlawful for any person within the territorial jurisdiction of the Navajo Nation, ..., to impound, divert, withdraw, otherwise make any use of, or take any action of whatever kind affecting the use of water within the territorial jurisdiction of the Navajo Nation unless the applicable provisions of this Code and regulations and determinations made hereunder have been complied with. No right to use water, from whatever source, shall be recognized, except use rights obtained under and subject to this Code."

103 "... the United States holds the legal title to those waters solely as trustee for the Navajo Nation."

104 Water belonging to Navajo Nation includes "... any waters which, in the course of nature or as the result of artificial works or artificial streamflow enhancement or weather modification methods, flow into or otherwise enhance" waters reserved to the Navajo Nation. Also includes

"all surface and groundwaters which are contained within hydrologic systems located exclusively within the lands of the Navajo Tribe of Indians." And "all groundwaters located beneath the surface of the lands held in trust by the United States of America for the Navajo Tribe of Indians."

202 After August 2, 1984 must obtain a permit under Navajo Water Code. Can get permit form from:

Division of Water Resources
P.O. Box 308
Window Rock (Navajo Nation), Arizona 86515
~~Arizona~~ (602) 729-5281 through 5284

301 Resources Committee ~~may~~ with Tribal Council may "enter into administrative agreements, exchange information, and otherwise cooperate with governmental agencies both on and off the Navajo Nation lands, for appropriate purposes including the administration of interstate streams and groundwaters"

307 "Reasonable charges may be imposed by regulations of the Resources Committee for the use of the waters of the Navajo Nation. Such charges shall not apply to domestic uses, stockwatering uses, fish and wildlife uses and irrigated agriculture uses."

501 b "In taking any action under this Code which may impose substantial economic hardship on persons or entities presently using water, or which threatens degradation of other economic, cultural, religious, historic, aesthetic, natural or environmental values . . ." weight of economic burden, etc.

601 Inventory of existing uses shall be completed within two years after enactment of Code

602 To continue use w/in Nation, must file a Description of Use within one year of effective date of Code. "Individuals or groups making use of a well or other water source operated by another need not file a Description of Use unless the operator fails to do so."

605 Description of Use will serve as interim permit for existing uses. Actual permit may still be denied and use discontinued.

607 list of basins with list of filed Descriptions of Use and Applications for Permit ~~are~~ to be prepared w/in two years.

705 "No water permit issued hereunder shall be construed as creating or recognizing any right other than Navajo Nation permission to use water, nor shall any water use permit ripen into any interest other than such . . ."

902 5 years consecutive non-use → loss by non-use unless there is sufficient cause for non-use

903 "No right to use or otherwise affect the quantity, level, flow, pressure, quality, or temperature of water may be acquired by adverse possession, prescription, estoppel or acquiescence."

07-16-1981: memorandum to general superintendent, navajo lands group from associate regional director, park operations, swr re

RECEIVED
NATIONAL PARK SERVICE
WASHINGTON OFFICE
JUL 21 12 23 PM '81

JAY
BOB
VICKI
LINDA
File in NAVAHO NM Wtr Rgts Corrs file

L54(SWR)OM

JUL 16 1981

Memorandum

To: General Superintendent, Navajo Lands Group

From: Associate Regional Director, Park Operations, SWR

Subject: Keet Seel Water Supply System

In response to your request for assistance, this office has reviewed the alternatives to insure a continued water supply for the Keet Seel area.

After consultation with various disciplines within the Regional Office, the most viable alternative is to divert spring water by gravity flow to a storage tank located across the creek. Two problems may develop (see enclosed sketch).

1. A 600-gallon storage reservoir, pump with pad, and unspecified length of 2-inch PVC flexible line may be located on Navajo Nation property. Obtaining advance permission from the Navajo Nation to encroach on their land is recommended.

2. In order to gravity flow water from the main spring to the storage reservoir, it may be necessary to install a vertical pipe from the spring outlet to an unspecified height to take advantage of existing natural shut-in spring pressures. In doing so, the risk is that we may encourage hydro-fracturing of rock formation and cause the spring to re-issue from some other location or to entirely disappear.

The feasibility of this alternative will be checked during a field survey scheduled for the week of July 26, 1981.

Other alternatives reviewed with accompanying comments are:

1. Continue to haul water - Practical, to be used in the interim until the permanent water supply system has been constructed and is operational.

2. Well and/or well points - A well was constructed several years ago but experienced a sanding problem. In addition, by necessity the well must be located within the flood plain zone and is subject to swamping by annual flood events.

3. Turkey Spring - A reasonable alternative if the spring is perennial and the difference in head between the spring and hogan storage tank allows for gravity flow. This alternative will be field checked.

4. Infiltration System - This alternative was adopted but the intake system was washed out during a recent flood event.

5. Cistern System - Roof runoff is a feasible alternative if the water is used for utility purposes only.

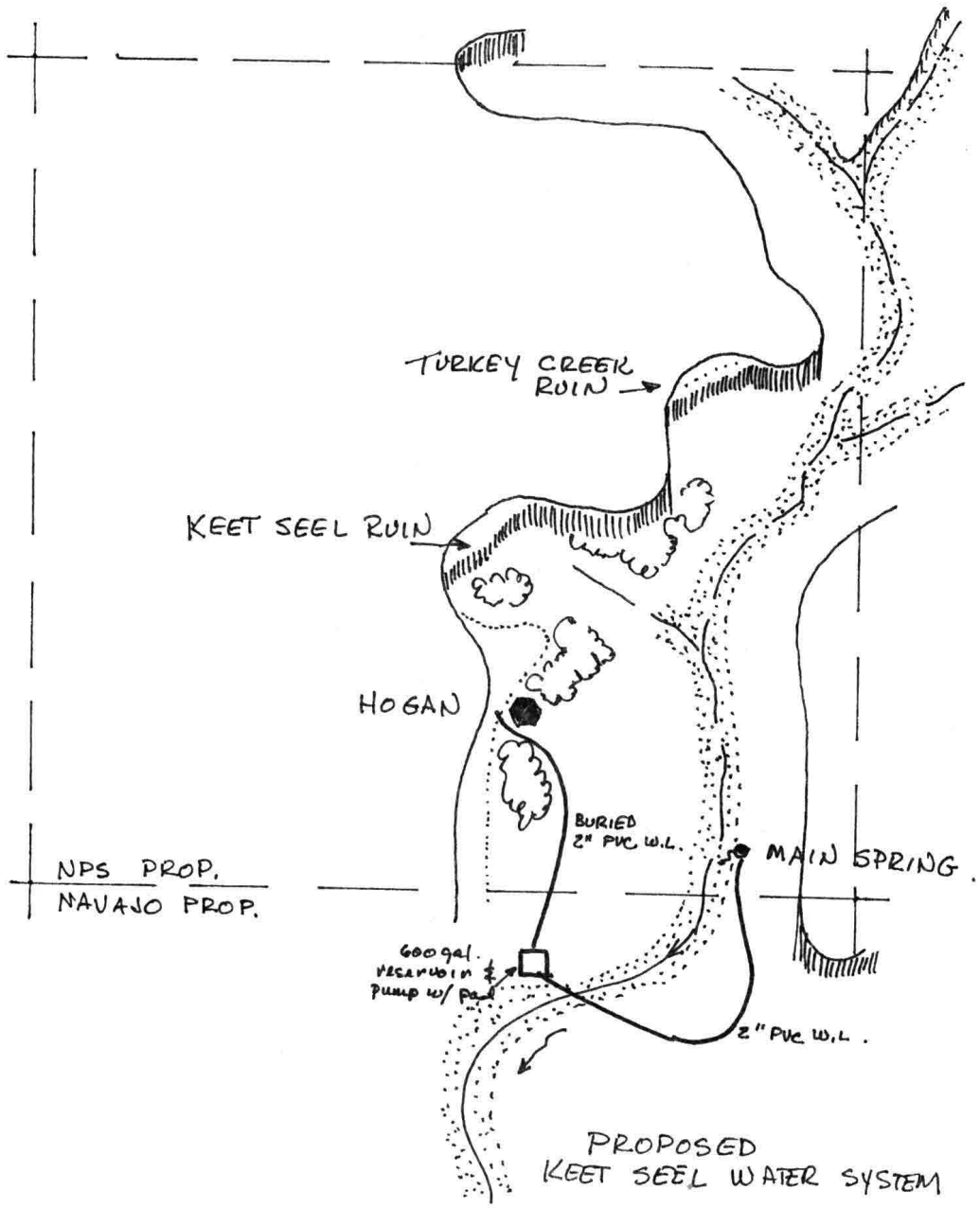
In addition to the above we are also investigating the feasibility of locating the new Betatakin well near the present maintenance area or, as suggested by Superintendent Miller, within the former residential area near the corral.

Should you have any questions, please contact Garland Moore at FTS 476-6368.

Jack Neckels

Enclosure

bcc:
Chief, Water Resources Division, WASO/497 w/copy of enclosure
Moore, OM, SWR w/c of enclosure


TURKEY CREEK RUIN
KEET SEEL RUIN
HOGAN
BURIED 2" PVC W.L.
MAIN SPRING
NPS PROP.
NAVAJO PROP.
600 gal. reservoir & pump w/ pad
2" PVC W.L.
PROPOSED
KEET SEEL WATER SYSTEM

RECEIVED
NATIONAL PARK SERVICE
INTERPRETATION OFFICE
AUG 16 8 12 AM '79

Amy;
Please file in
NAVAJO N.M.
Water Rights Corres. File

L54(SWR)OM

AUG 13 1979

Memorandum

To: General Superintendent, Navajo Lands Group

From: Associate Regional Director, Park Operations, SWR

Subject: Water Resources Investigations

The status of all water resources and water rights activities in each of the parks within the Group is as follows:

El Morro

The monument's "Declaration of Owner of Underground Water Right" was accepted for filing by the State of New Mexico on January 18, 1977 and has been assigned Declaration No. Miscl. 32-5.

The above declaration claims a total of 13-acre feet of water per annum for municipal purposes with a priority date of 1906. The usual disclaimer clauses are included.

Additional work to be done, and is reflected in this Region's long-range program, includes:

1) Water Resources Management Plan
2) Quantification of Reserved Water Rights
3) Water Resources/Water Rights Study

Aztec Ruins

Project for drilling of observation wells authorized by Account #7075-70001-585 has been completed on July 15, 1979. Four observation wells were drilled to depths varying from 10 to 35 feet. The purpose of the wells is to measure and record fluctuations in ground water levels found within the monument. The objective of the study is to develop alternating ways in preventing fluctuating ground waters from endangering excavated and unexcavated archaeological ruins of the monument. Preliminary results indicate that the monument is underlain by two

shallow ground water zones which are separated by an impermeable clay zone. The deeper water zone (23 to 30 feet), eastern end of monument, is found in gravel deposits of an ancient stream. It is our opinion, based on limited data, that waters from these deposits do not surface into the ruins within the monument. The upper or shallower water zone (within the upper 10 feet of surface) occurs intermittently and is recharged by local precipitation and from percolated irrigation water from the field located to the north and uphill from the monument. In addition surface runoff from a neighboring pond inundates the northeastern portion of the monument. Waters from this source are responsible for a swampy and densely vegetated area in the vicinity of the ruins referred to as: Mounds A, B, C, D, and Earl Morris Ruins. This Office is planning to install water level recording gages on each observation well recently drilled and to run a resistivity survey of the monument. All of the above data including alternatives with cost estimates to prevent surface, shallow and ground waters from endangering the archaeological ruins, will be completed by December 1979.

The monument enjoys an adjudicated water rights to 4.8 acre feet of water on 1.6 acres of land for irrigation purposes. The monument obtains its water from the Farmer's Ditch Company which enjoys a priority date of 1892 or earlier.

Chaco Canyon

Water Resources-Water Rights

1) U. S. Geological Survey Draft Report titled "Report of effects and recommended monitoring of energy-related development on water resources in the San Juan Basin at Chaco Canyon National Monument," was completed and draft comments submitted. The final report is scheduled for completion by December 1979.

2) Observation well named Aggravation No. 1, located to the south of the monument was perforated on August 4. Pressure monitoring recorders have been delivered to the monument.

The observation well was perforated from 3957 to 3987 feet below ground level. The purpose of the monitoring program is to determine the effects of nearby energy related activities on the West water Canyon member of the Morrison Formation. The results, in raw and uninterpreted form, will be made available to all upon written request to the Regional Office.

3) Trituim analysis for selected wells including "Fields Well" at the monument has been completed by the University of California at San Diego. Additional trituim and Carbon 14 analysis is being discussed with the same University. We anticipate that this study will be initiated in August with a report submitted by December 1979.

4) Geohydrological report has been contracted with Dr. Zane Spiegel of Santa Fe. This report is overdue and we are following up on it.

5) Temperature-Depth profile data was collected by Dr. Marshall Reiter of New Mexico Bureau of Mines and Mineral Resources on May 17, 1979. Results of the survey with interpretation is expected this fall.

6) To date, the National Park Service has protested four industrial applications for water rights within the San Juan Basin. This course of action is expected to continue.

7) Surface water monitoring, chemical and sediment analysis program is being discussed with the U. S. Geological Survey and is in progress of being implemented.

At Chaco Canyon two declarations of Owner of Underground Water Rights have been accepted for filing by the State of New Mexico on May 18, 1977 and have been assigned Declaration Nos. SJ-324 and SJ-325. The above declarations are for 100 and 20 acre feet of water per annum respectively for municipal purposes with a priority date of March 11, 1907. The usual disclaimer clauses are included.

Additional work to be done includes:

1) Water Resources Management Plan
2) Quantification of Reserved Water Rights
3) Water Rights Study for Court and/or Administrative Hearings

Hubbell Trading Post

The State of Arizona has passed an Act requiring registration of water rights with the appropriate State Office. Legal inquiry suggests that the U. S. rights to the Ganado Irrigation System at this Trading Post fits into the State's definition of requiring them to be registered.

Recent telephone conversations with the Field Solicitor in Phoenix recommend that the NPS not file with the State as it is untimely and will in all probability not serve any useful purpose, as any conflicts over water will be with the Navajo Nation where the Secretary of Interior will make a decision and not the State.

Additional work to be done includes:

1) Water Resources Management Plan
2) Quantification of Reserved Water Rights
3) Water Resources/Water Rights Study

Sunset Crater and Wupatki

A replacement well is being drilled at Sunset Crater. Hydrologist Paul Christensen, a graduate cooperative student from NAU is inspecting the project. The well is being drilled by Perry Brothers Well Drilling Company. The project is experiencing great difficulty thus far. We expect this project to be completed before the end of August.

In addition to the above, Mr. Christensen has elected to make a detailed geology map of both areas as partial fulfillment of his thesis for a Master's Degree.

The following work is also being planned:

1) Water Resources Management Plan
2) Quantification of Reserved Water Rights
3) Water Resources/Water Rights Study

A survey is being made of the Cameron Uranium field north of Wupatki to determine the possible geohydrological effects on Wupatki if uranium mining is reactivated.

Navajo National Monument

Enclosed is a report prepared by the U. S. Geological Survey titled "Ground Water in the Navajo Sandstone in the Black Mesa Area, Arizona." In addition discussions have been held with representatives of Peabody Coal Mining Operations and with U. S. Geological Survey. Admittedly, the Company and U. S. G. S. are quiet on the entire subject on how the mining activity will affect the monument's water supply. This Office, however, has made a study based on published or soon to be published data and is in process of interpreting the information. This report will be completed by the end of August. U. S. G. S. puts out limited number of copies of observation well data in the mining area. Peabody Coal Mining Company has been extremely cooperative and interested in determining if their operation will affect existing water table conditions in the Region.

Additional work programmed is:

1) Water Resources Management Plan
2) Quantification of Reserved Water Rights
3) Water Resources/Water Rights Study

Canyon de Chelly

All water rights for this monument must be claimed as Indian Water Rights, as such, it is mandatory that the U. S. apply the Indian formula to any claims for water. This Office with your assistance will contact the Navajo Nation to file the monument's claim for Indian water under the reservation doctrine.

In addition the following is planned:

1) Water Resources Management Plan
2) Water Resources/Water Rights Study
3) Quantification of Reserved (Indian) Water Rights

This information is supplied for your information. Should you have any questions, please contact Garland Moore of this office.

(Sgd.) Leslie P. Arnberger

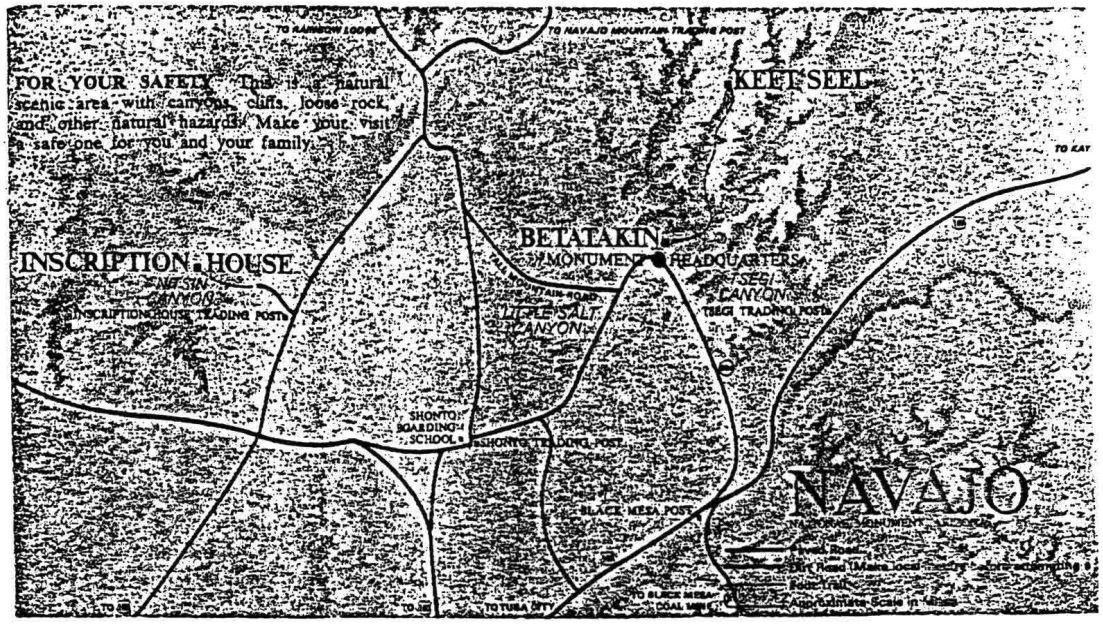
Enclosure

cc:
Chief, Division of Air & Water, WASO (Atten: Vic Berte')
Superintendent, Aztec Ruins, Canyon de Chelly, El Morro, Hubbell Trading Post, Navajo, Wupatki/Sunset Crater

Environmental Assessment/Review
Boundary Adjustments
Navajo National Monument, Navajo County, Arizona

Summary

In May 1962, a Memorandum of Agreement was signed between the Navajo Tribe, the Bureau of Indian Affairs, and the National Park Service. (Copy attached.) Agreements were made in this Memorandum that some 240 acres of land lying south and west of the original Betatakin Section and congruent thereto be turned over to the National Park Service for development in return for assistance supporting legislation of lands to be turned over to the Navajo Tribe. Such a land exchange has been recently formalized and it is now time to approach Congress for legislative enactment which will give the National Park Service title to the aforementioned 240 acres ±.



Description of the Proposal

In accordance with the Memorandum of Agreement, the National Park Service has constructed the following facilities upon the 240 ± acres of land: Visitor Center - 4800 square feet; utility building - 2800 square feet; horse barn - 800 square feet; 4 residences - 6800 square feet total; miscellaneous buildings, campfire circle, 42-site campground, 4-site picnic area, 2 miles of surfaced roads and trails, one sewage lagoon,

one 750 foot deep well; water, sewage and LPG systems, and miscellaneous appurtenances thereto.

In 1977, the Navajo Tribe added six more acres to the original 240± acres enabling the National Park Service to construct sewage lagoons which replaced deficient leach fields.

We propose to acquire 246 acres ± of Navajo Tribal Trust Lands in accordance with the 1962 Memorandum of Agreement. (See attached map.)

Description of the Environment

The land acquisition consists of ±246 acres of mesas, slick rock, sand, and silty sand on which grows a typical southwestern pygmy pinyon-juniper forest. Maximum frost penetration is about 30 inches. Cloudburst precipitation and three feet of snow are the normal weather patterns on this high (7286 ft.) arid environment typical of the Colorado Plateau.

Vegetation consists of a typical juniper-pinyon pine forest. Among the conspicuous plants of this vegetation type are the double-leaf pinyon, one-seed juniper, big sagebrush, silver buffaloberry, mountain mahogany, rabbitbrush, cliff-rose, fendlerbush, various species of cactus and flowering plants such as scarlet gilia, purple beeweed, globemallow and pentstemon.

Fauna, none of which can be considered endangered, consists of mice, lizards, jackrabbits, and occasional deer which come up from the canyons.

Birdlife is quite varied consisting of turkey vultures, four species of hawks, hummingbirds, swifts, woodpeckers, warblers, swallows, jays, crows, etc., none of which are considered endangered.

Alternatives Considered

A. No Action
Not recommended: Will not meet previous commitments made by the Service with other organizational entities.

B. Boundary Adjustment
Recommended: Will meet commitments made by the Navajo Tribe, Bureau of Indian Affairs, and the National Park Service as agreed upon in the 1962 Memorandum of Agreement.

Summary of Environmental Impact of Recommended Action

Impact on Soils

The impact of the boundary change will be nil. Development was done prior to the present and changing the title of the land from the Navajo Tribe to the National Park Service will not constitute an impact.

Impact on Vegetation - Boundary change would not constitute an impact.

Impact on Wildlife - No impact would result from a boundary change.

Impact on Water - Boundary change would not affect water resources.

Impact on Air - Boundary change would have no effect on air quality.

Impact on Land Use - Boundary change would not constitute an impact.

Impact on Visitor Use and Visitor Experience - The impact of a boundary change would be nil.

Impact on Esthetics - Nil.

Impact on Nearby Communities - There are none.

Impact on Historic or Archeological Resources - None would be affected. In compliance with the National Historic Preservation Act of 1966, the National Park Service is consulting with the Arizona State Historic Preservation Officer to determine the effect of this proposal upon cultural resources. It is anticipated that the Advisory Council of Historic Preservation will have no objections.

Impact on Park Management - With approval and implementation of this boundary change, several factors in Park Management will change. We will have accomplished one of the Management Objectives delineated in the Statement for Management, namely: "To protect the natural and cultural resources of the park by providing an adequate land base, as well as facilities that do not adversely affect the park's significant resources." Also, the Navajo Tribe no longer will have jurisdiction over the present 240 acres which will join the rest of the Monument in proprietary jurisdiction administered by the National Park Service.

Mitigating Measures

No mitigating measures will be done as there will be no impact upon the environment.

Unavoidable Adverse Effects

No adverse effects are anticipated.

Relationship Between Short-Term Uses and Enhancement of Long-Term Productivity

We do not envision any change in this relationship.

Irreversible and Irretrievable Commitments of Resources

No commitment of resources is anticipated.

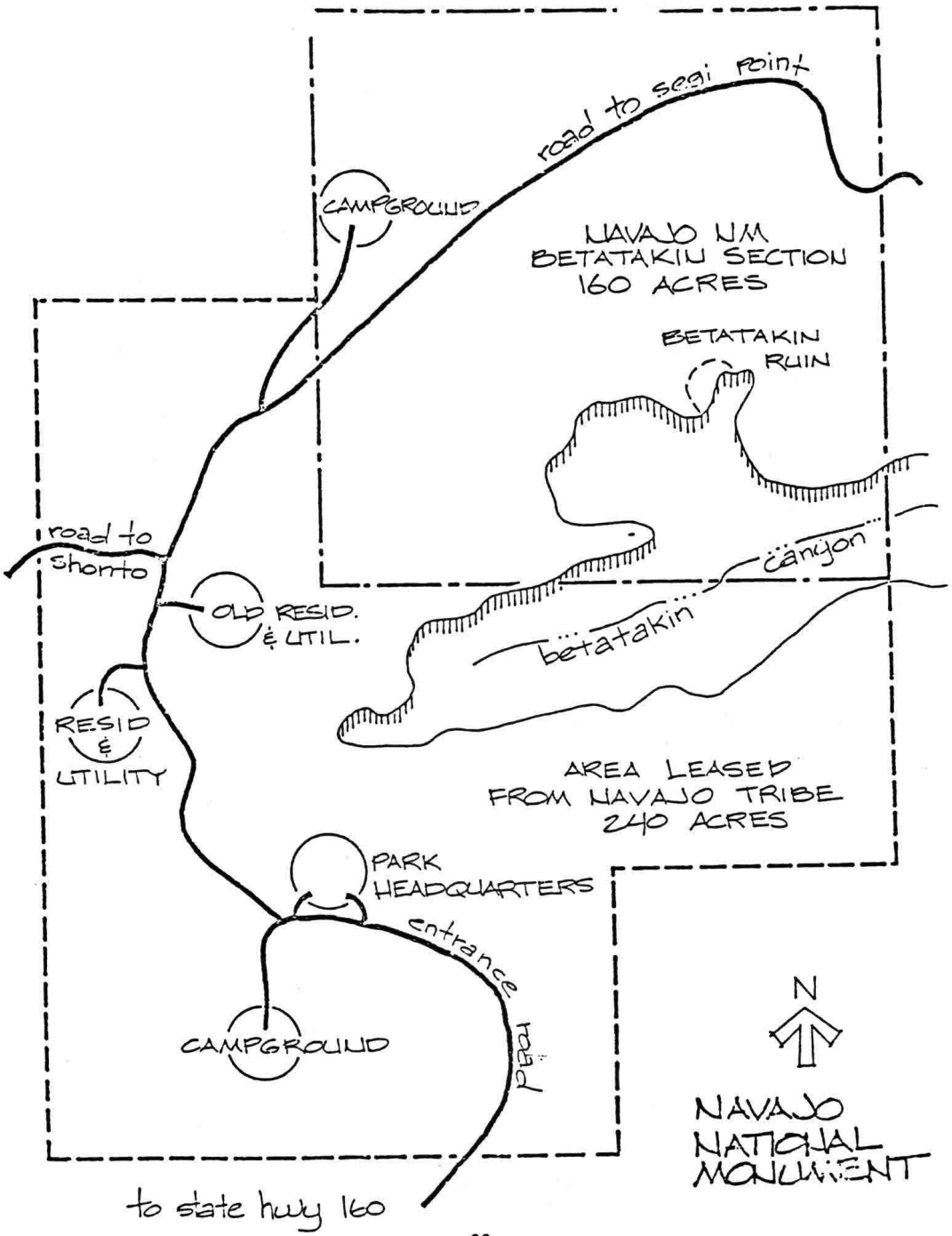
Environmental Review of Proposed Project

A review of the environmental effects of the proposed development indicates that the proposal does not constitute a major Federal action that would significantly impact the environment. It is concluded an environmental impact statement is not required and will not be prepared.

Date: 4/6/79 Prepared by: [signature]
Superintendent
Navajo National Monument

Date: 4/11/79 Recommended by: [signature]
General Superintendent
Navajo Lands Group

Date: 5-16-79 Concur: [signature]
Regional Director, Southwest Region
National Park Service


road to segi point
CAMPGROUND
NAVAJO NM
BETATAKIN SECTION
160 ACRES
BETATAKIN
RUIN
road to
shonto
OLD RESID.
& UTIL.
canyon
betatakin
RESID
&
UTILITY
AREA LEASED
FROM NAVAJO TRIBE
240 ACRES
PARK
HEADQUARTERS
entrance road
CAMPGROUND
N
NAVAJO
NATIONAL
MONUMENT
to state hwy 160

01-03-1974: memorandum to superintendent, nava from hydraulic engineer, water resources, swro regarding water levels (well no.

For Betatakin Well #2 Navajo NM

Southwest Region
P. O. Box 728
Santa Fe, New Mexico 87501

L54

JAN 3 1974

Memorandum

To: Superintendent, Navajo NM

From: Hydraulic Engineer, Water Resources, SWRO

Subject: Water Levels (Well #2), December 3-14, 1973

Enclosed please find analyzed data you reported in returning the M-Scope. Thanks.

The drawdown for each of the average pumping rate falls within the predicted theoretical range and generally supports conclusions reached in previous memorandums. The only question raised is the drawdown figure on December 11. Maybe a tape reading error.

It has been a pleasure working with you and your staff, and we look forward for the continuation of same this year.

97% OF ALL WATER IS GROUND WATER - EXCEPT HERE

(SIGNED)

Garland Moore

GM:ba
Enclosure

cc:
Chief of Maintenance, MRM-WASO
Gen. Supt., Navajo Lands Group
Associate Regional Director, M-SWR
PSM-SWR

Southwest Region
P. O. Box 728
Santa Fe, New Mexico 87501

L54

DEC 17 1973

Memorandum

To: Superintendent, Navajo NM

From: Hydraulic Engineer, Water Resources, SWRO

Subject: Test Pumping - Betatakin Well, July 23-25, 1962

Enclosed are the basic data and well schedule supplied by the USGS at Flagstaff. Analysis of the data performed by this office agrees with our previous analysis in that the well is capable of delivering up to 50 gpm (10 hrs. pumping), if we consider only the final two thousand minutes of test pumping at 20 gpm.

A detail which concerns this office at this time is that the well apparently stabilized at 626.2 feet (BTC) at 20 gpm in 1962; whereas, in our most recent test, the water level within the well did not stabilize. Comparison of the two test pumping data will be continued along the following lines of thought inhouse and with the USGS (Flagstaff).

1. Peabody Coal Mine's water withdrawals have had an effect on our wells.

2. The tape reading and apparent lack of control of discharge in 1962 are questionable.

Chemical analysis from 1962 to present does not indicate any sewage effluent is entering the well. We will continue to keep you informed as additional data and interpretation of data becomes available. Please file in Water Right Docket #1. Navajo NM

WATER ??

(SIGNED)

Garland Moore

GM:ba
Enclosures

cc: Chief of Maintenance, NRM-WASO
Gen. Supt., Navajo Lands Group
Associate Regional Director, PSM-SWR
PSN-SWR

Southwest Region
P. O. Box 728
Santa Fe, New Mexico 87501

L54

DEC - 7 1973

Memorandum

To: Superintendent, Navajo NM

From: Hydraulic Engineer, Water Resources, SWRO

Subject: Well Production and Analysis

Following up on our memorandum of December 3, 1973, an analysis of the test pumping data reveals that existing water supply system is operating at 25 percent efficiency (12.3 gpm) and that the aquifer is capable of yielding up to 50 gpm for ten hours pumping during each day.

The enclosed graph relates projected water level drawdown within the well at various rates of pumpage, recommended pump depth and type of Reda submergible pump which may be used.

The USGS letter (October 20, 1970) has stated that in their opinion the water levels at Betatakin will decline five feet or less in 30 years because of the Peabody Coal Company's operation at Black Mesa. The enclosed graph provides for this lowering of the water table.

We will continue to keep you all informed as additional water table information is made available as the USGS - Navajo Monitoring System begins to take form.

It is recommended that no action be taken until water demands begin to exceed the delivery rate. Please file in Water Right Docket #1. - Navajo NM

POLLUTED WATER - YUK!

(SIGNED)
Garland Moore

Enclosure

cc:
Chief of Maintenance, MRM-WASO
Gen. Supt., Navajo Lands Group
Associate Regional Director, PSM-SWR
PSM-SWR

GMoore:ba 12/7/73

Associate Regional Director, Professional Services, SWRO

December 3, 1973

Hydraulic Engineer, Water Resources, SWRO

Test Pumping - Navajo National Monument, November 27 and 28, 1973

The existing well was drilled in August, 1962, to a depth of 780 feet. The upper ten feet of casing is 8 inches in diameter. The remainder, originally an open hole, was cased with 6-inch casing on/about 1967. Water is reportedly obtained from the Kayenta formation (660-715 ft.) with a static water level of 541.7 ft. BTC.

Test pumping data suggest that the aquifer is limited and that the drawdown is not expected to reach the pump setting (648 ft. BTC) after a month's continuous pumping.

Additional interpretation of the well hydraulics will be forthcoming; in the interim, please file this information in Water Right Docket #1 - Navajo.

Garland Moore

Enclosures

"WATER" AND BOURBON DO MIX.

cc:
DDS-WASO (Vic Berte', Room 2214)
Gen. Supt., Navajo Lands Group
Supt., Navajo NM
PSN-SWR

GMoore:ba 12/3/73

Navajo National Monument
Tonalea, Arizona 86044

L54-OR

April 16, 1973

Memorandum

To: Director, Southwest Region
Through: General Superintendent, NALA

From: Superintendent, Navajo

Subject: Water Supply Inventory

Enclosed please find the Water Supply Inventory for Navajo National Monument.

00-00-0000: epa, water programs operations, water supply division, betatakin domestic water system

ENVIRONMENTAL PROTECTION AGENCY
WATER PROGRAMS OPERATIONS
WATER SUPPLY DIVISION

OMB NO. 158-S 72022
APP. EXP. 12/31/76

IDENTIFICATION NUMBER

DUP. ON ALL CARDS

INVENTORY OF PUBLIC WATER SUPPLIES

NAME OF WATER UTILITY

Betatakin Domestic Water System, Betatakin Section, Navajo National Monument

ADDRESS (Street or P.O. Box)

Navajo National Monument

CITY, COUNTY STATE

Tonalea, Navajo County, Arizona

ZIP CODE 86044

PHONE NUMBER 672 2366 AREA CODE 602

Is the utility owned by a Municipality, District, etc. [X] or Investor owner [ ]

Total population served | Number Services | Number Meters | Number of wholesale customers

What is the predominant characteristic of your service area?

Community [ ] Company Town [ ] Recreation Area [ ] Mobile Home Park [ ] Institution [ ] School or College [ ] Federal Facility [ ]

NO.	SOURCE NAME	INTAKE LOCATION LATITUDE DEG. MIN. SEC.	LONGITUDE DEG. MIN. SEC.	MARK ONLY ONE: Surface	Ground	Purchased	TREATMENT: Aeration	Fluoridation	Coagulation	Sedimentation	Filtration	Softening	Taste & Odor	Iron Removal	Chlorination	Fluoride Adj.
1	Betatakin Deep Well	36 40 57	110 34 01	X												X
2																
3																
4																

CAPACITIES

Production, normal operation	172800	GAL/DAY
Production, emergency power only	000000	GAL/DAY
Distribution storage, gravity flow	0001000000	GAL/DAY

PRODUCTION

Average day	3764	GAL/DAY
Maximum day	10530	GAL/DAY

Date form completed 4 5 7 3 (Mo. Yr.) 9

10 (CIN)

01-29-1973: memorandum to director, southwest region from superintendent, navajo regarding water use

Navajo National Monument
Tonalea, Arizona 86044

154-OR

January 29, 1973

Memorandum

To: Director, Southwest Region

From: Superintendent, Navajo

Subject: Water Use

We have prepared a fairly accurate estimate of the average number of people using our one water system.

Month	Average Numbers of People
January	27
February	29
March	46
April	1[illegible]
May	115
June	209
July	191
August	273
September	145
October	106
November	37
December	27
Totals 12	1330
Yearly average	111

Our one water source is a drilled deep well.

cc:
General Superintendent, Navajo Lands Group

08-12-1972: memorandum to director, western service center attention: mr. witucki from chief, division of water resources regardir

L2415-MW

AUG 1 2 19

Memorandum

To: Director, Western Service Center
Attention: Mr. Witucki

From: Chief, Division of Water Resources

Subject: Black Mesa Coal Mine wells, Navajo

Enclosed is a copy of a memorandum of July 17 from Superintendent, Navajo to Director, Southwest Region expressing concern that the proposed pumping of deep wells at the Black Mesa Coal Mine will affect the well at Navajo National Monument. Although the mine is 15 miles from the monument, and the threat to the monument's supply is not imminent, the Superintendent has wisely brought attention to the problem. An early analysis may prevent a later crisis.

Please contact the Geological Survey District Office, advise them of the problem, and get the Survey's hydrologist's opinion of the potential effects of the proposed pumping at the mine on the monument well. The Survey may have sufficient information on the proposed pumping (or can get it from the Bureau of Reclamation) to predict, at least in a qualified way, any lowering of water level in the monument well. With such an opinion at hand, the need for additional studies can be determined and, if necessary, programmed.

(Sgd) Manuel Morris

Manuel Morris

Enclosure

cc:
Director, Southwest Region (2), w/c enc.
MW, Mr. Morris, w/c enc.

EWReed:mjg 7/28/70

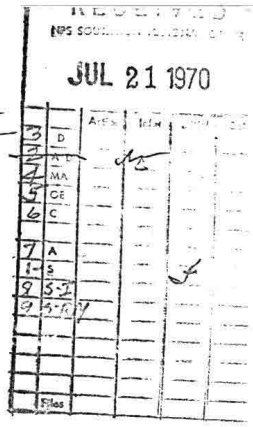
07-17-1970: memorandum to assistant to the director, environmental affairs from superintendent, navajo regarding black mesa co

Send to WASO
For Info
By SWRO-AD Date 7-22-70

L2415
MW

XXXXXXXXXXXXXXXXXXXXXX
Navajo National Monument
Tonalea, Arizona 86044

July 17, 1970



Memorandum

To: Assistant to the Director, Environmental Affairs

From: Superintendent, Navajo

Subject: Black Mesa Coal Mine

Enclosed is a summary of the information which I have available concerning the Black Mesa Coal Mine as related to the deep well pumping operation. This information will be updated as new facts become available.

William D. Simmons

cc:
Director, Southwest Region
General Superintendent, Navajo Lands Group

NAVA

A98 Nava

BLACK MESA COAL MINE

The Peabody Coal Company, a wholly-owned subsidiary of the Kennecot Copper Corporation, is mining coal on a 64,000 acre lease on Black Mesa, 15 airline miles from Navajo National Monument. The coal will be shipped by rail (35 tons a day) to fuel an electric generating plant at Page, Arizona, 80 miles away from the mine. The coal will also be mixed with water to form a slurry which will be pumped to another generating station 300 miles away in Mohave, California. The number of tons of coal to be pumped to Mohave is not known.

It is estimated 2,000 gallons of water a minute will be needed to make the coal slurry. This water will come from three deep wells located on Black Mesa. The depth of the wells in not known. However, it is felt the 2,880,000 gallons of water a day over a period of time would deplete the underground water table and adversly effect the water supply at Navajo National Monument as well as numerous springs and the Tsegi River near the monument.

To the best of our knowledge the rock strata below Black Mesa is warped downward forming a structural depression. With the exception of a small area north of Kaibito, Arizona, and the New Mexico portion of the Navajo Indian Reservation there is no point lower than the Black Mesa Basin.

The aquifer is replinished by rainwater only. We do not feel it can be replinished by underground water loss from Lake Powell because of warping and faulting between the mesa and the lake. Therefore, any water pumped from the lower strata will be replinished by flowage from above.

If the wells are 3,000+ feet in depth this will place them in the Navajo Sandstone aquifer which is the primary aquifer of the Navajo Indian Reservation.

It would take some time before continuous pumping at Black Mesa would be felt at Navajo National Monument. The contract between Peabody Coal Company and the Salt River Project stipulates that <u>if</u> the underground water table is affected Peabody Coal must seek its water elsewhere.

Unless pumped from Lake Powell to the mine, there is no other alternate source of water. By then it would be too late for Navajo National Monument and the surrounding region anyway.

We do not have the studies made by Peabody upon which they determined the adequacy of the underground water supply to meet their needs. Also, we do not have a copy of the Peabody contract. Enclosed, however, is a list of other water resource investigations in Arizona which might be helpful.

From the Superintendent of Documents, Washington, D. C. 20402:

Professional Paper 521-A
Regional hydrology of the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah, by M. E. Cooley, J. W. Harshbarger, J. P. Akers, and W. F. Hardt, with a section on vegetation by O. N. Hicks, 1969.

USGS Bulletin 1202-A
Geology of the Kayenta and Chilchinbito quadrangles, Navajo County, Arizona, by E. C. Beaumont and G. H. Dixon, 1965.

From the Commissioner, Arizona State Land Department, 400 Arizona State Office Building, Phoenix, Arizona 85007:

Water Resources Reports
12-A Geohydrologic data on the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah--Part I, Records of ground-water supplies, by G. E. Davis, W. F. Hardy, L. K. Thompson, and M. E. Cooley, 1963.

12-D Geohydrologic data in the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah--Part IV, Maps showing locations of wells, springs and stratigraphic sections by M. E. Cooley and others, 1966

Thurman Trosper
Through: Chief, Division of Water Resources

August 6, 1970

E. W. Reed

Meeting on Environmental Problems of Fossil Fuel Powerplants of Colorado Area

The July 31 meeting was organized and chaired by Mr. E. A. Seaman, Assistant to the Commissioner-Ecology, Bureau of Reclamation. It was an exploratory session to bring the problems to the attention of the Interior agencies involved, apprise them of the Secretary's interest and discuss possible avenues for future action. The statement on the agenda of a formulation of a policy statement was recognized as being premature.

The first part of the meeting was given over to a description by Bureau of Reclamation personnel of the power projects, the coal deposits and what had been done or not been done. After this, a general discussion, including each Bureau's particular concerns, was launched. This covered a wide variety of subjects, but perhaps the most revealing was the Office of Science and Technology representative who pointed out that the Secretary has expressed concern over the problem, that the broad regional aspects must be considered, and this should evolve at the field level. The Secretary has instructed all Regional Coordinators to see that there is coordination between bureaus. Better communication at all levels is needed so that an Assistant Secretary doesn't find himself boxed in by a decision.

It was concluded that, as a result of the meeting, the Bureaus were somewhat better informed, that further meetings at the Washington level should be held, but that whether the group should be policy-oriented or task-force oriented had not crystallized. Mr. Seaman stated, further comment by memorandum was welcome.

A more detailed summary of the meeting is enclosed. The summary rambles somewhat, but so did the meeting.

(Signed)

E. W. Reed

Enclosure

cc:
MW, Mr. Morris w/c enclosure

EWReed:mjg 8/6/70

Meeting on Environmental Problems of Fossil
Fuel Powerplants of Colorado Area

Commissioner Armstrong said the Secretary is interested in environmental problems posed by power plants in the Colorado area. The power is needed, but the quality of the environment must be maintained. Society and government are now in a transitional period, and are now policy oriented. We must reassess projects on the basis of environmental quality. The fossil fuel deposits in the Colorado Basin have great potential, when coupled with water from the Colorado River project works, but the sociological and ecological impacts must be considered. The Four Corners plant has had problems which have brought criticism of all the proposed plants. A coordinating committee has been set up for the Page plant to study ecological effects.

Dr. Danson, Director of the Northern Arizona Museum, a former member of the National Park Advisory Board and now on the National Parks Advisory Council, discussed the work of his research organization in trying to get baseline environmental data for the area. Dr. Vincent Shaffer of the State University of New York, an expert on atmospherics, heads the program, and two seminars were held last year on environment. Proceedings have been published by the State University of New York. The Northern Arizona Museum has studied the geology and botany of the Grand Canyon. The Museum will act as clearing house for all research in the area. Dr. Danson pointed out that the mines and the powerplant construction have already changed the social and economic status of the Navajo Tribe. Indians making up to $9 per hour have pickup trucks rather than horses, and concrete block houses instead of hogans. However, some Navajos are objecting to these changes. He pointed out need for research on desert grasses for reseeding the mine areas, and scored the arrogance of private industry and government in launching programs without informing the people. He referred to the stocking of pipe in Alaska before a pipeline permit had been issued, and the cutting of trees in the Salt River Valley to improve water supply, but with subsequent flooding. He suggested looking into horizontal smokestacks as a means of controlling air pollution, and hothouse food production as a means of controlling thermal pollution.

Regional Director David Crandall stated, the water needs of the Colorado Basin, which is the most regulated basin in the country, exceed the supplies. He briefly described the location of the proposed power plants and said a mass of data concerning them is available. The Four Corners plant, which has pollution problems, is being altered to take care of them.

Regional Director A.B. West discussed the Black Mesa mining operation by the Peabody Coal Company. The company has leased 640,000 acres, but will mine only about 20,000 acres. Strip-mining methods will be used, but land will be reclaimed by Peabody's methods. If other methods are necessary, Peabody will use them, but increased costs will be reflected in the price of coal. The coal will be supplied to the Navajo plant by rail or truck and to the Mojave plant by slurry pipeline. The mesa is dissected, and the main plant and most of the stripping will be in the valleys. Peabody has contracted with the Salt River Project, which is heading the power plant construction, and not with Reclamation. Reclamation has contracted with the Salt River Project for power. Water for mining and for transporting slurry will come from wells 3800 feet deep. Water level is 900 to 1100 feet below the surface, and will be drawn down to 1700 below the surface. Water is of good quality and a relatively small amount (3100 aft per year) will not deplete the supply. The 274 miles of slurry line will plug up after being shut down for 24 hours, so must be used continuously. The dump area at Mojave plant will be imperviously lined to prevent pollution of the Colorado River.

"The Rape of Black Mesa" and the fact sheet put out by opponents are not factual. There was a spill in the mining area due to a valve failure, but the damage was quickly repaired. There are a great many roads on the mesa, most of them old Indian roads. The company sprinkles the roads it uses. The main access road, which has a large road cut in the mesa was built by the Arizona State Highway Department. The mesa will be changed by the mining operations, but previous work also changed mesa. Junipers were cleared out for better grazing, but grasses did not replace them. Lightning-started coal fires have resulted in extensive burns. The Bureau of Mines has bulldozed the areas to put them out. Test pits have been dug, none have been filled. Some pits contain water, but these can be filled if necessary. The Peabody Company is cooperative and claim to have agreements with NPS and other agencies on mining methods, but probably these agreements are merely discussions rather than firm agreements.

The Mojave plant will start first unit on November 1, and the second unit, 4-6 months later. It will start at 500-600 megawatts and ease up to 750 megawatts (nameplate capacity) to test precipitators. Bechtel Corporation has made studies on pollution prevention for the power plant. He concluded that, although the individual units may have problems, the total effects of the system on the environment is the problem at hand.

In response to a request for agency concerns, Reed said prime concern of NPS was the effect on the recreation areas, and specifically mentioned concern of Superintendent, Navajo, that pumping at Black Mesa would lower the water level in the well at Navajo National Monument. West reiterated his statement that quantity was small and would have no effect, according to consultant's reports. (Consultant's reports may be in error.)

McLean of FWQA said quality standards had been set, and Bureau of Outdoor Recreation raised question of the role of Environmental Quality Act. In the discussion that followed, Seaman said a first draft of an environmental statement for the Navajo plant was being prepared. Interior's preliminary guidelines require consideration of overall impact. FWQA indicated that Council on Environmental Quality can ignore quality of water if it wishes and FWQA had objected to this.

White of Bureau of Sport Fisheries and Wildlife said his regional office had not studied the projects in depth, but didn't see much environmental effect. Some destruction of deer range on Black Mesa would occur and fly ash could affect vegetation for wildlife. The Bureau had no previous studies of fuel plants. He suggested a possible Interior task force on the Colorado, referring to the south Florida group as an example. Thermal pollution of Lake Powell may permit introduction of other species of fish. Seaman stated that Mukley of Arizona State University had studied the thermal question and said there would be no problem.

The Bureau of Land Management representative said BLM was interested in sites, public lands, and recreational areas. The National Environmental Policy Act must be observed. The environmental effects must be determined and viable alternates considered. This will require close cooperation within the Department. BLM tries to view all uses in a regional context.

The Bureau of Indian Affairs representative said there is need to police the contract requirements, especially the reclamation of the mining areas for the social and economic welfare of the Indians.

The Bureau of Mines representative referred to air pollution, principally sulfur oxides and stated that the present regulations cannot be met because of the state of the art and probably won't be met by the power plants. He referred to a recent report by the National Academy of Engineering.

The Geological Survey represented expressed concern about gaseous emissions. The type of fuels used must be known so quantitative analysis of these emissions can be made, and subsequently, plans for the disposition of the ash can be made.

The Office of the Science Advisor's representative said the Secretary was concerned. The Administration will propose legislation giving authority to the States to certify plant and line location. Environmental guidelines for transmission lines have been proposed, but Federal Power Commission has raised objections. Under the Environmental Policy Act, private companies will have to prepare environmental statements. Problem must be looked at broadly from a regional aspect. National Air Pollution Control Administration has not set up national standards for air pollution yet, but will. There is a communications problem; better communication is needed so an Assistant Secretary is not put into a box by a decision before all aspects are considered. This must evolve at the field level. Interior Field Coordinators have been given instructions by the Secretary for full field coordination, and will report on interbureau cooperation at the regional level.

Jerry Meyer of the Geological Survey stated that Survey was doing research on thermal pollution.

Regional Director Crandall said the Black Mesa coal is of good quality; the fly ash will be wetted down for disposal to a toothpaste-like condition, dumped and covered. Seaman described bad disposal methods at Four Corners plant, but said improvements were being made.

The meeting adjourned for lunch and reassembled at 1:00 p.m. The problems were redescribed and Danson raised the question of what to do if the plants shouldn't be built. The Bureau of Reclamation pointed out that the Navajo plant power will become critical in 1974. This started a slight philosophical discussion of the need to supply these demands, the lack of research by the power companies, and the power companies promotion of the increasing use of electricity.

Although questions on the objectives of the meeting were raised, it was agreed that all agencies were better informed on the problem. The purpose of the group, whether policy or technically oriented, was not decided, but it was agreed that further intradepartmental meetings were warranted.

E. W. Reed

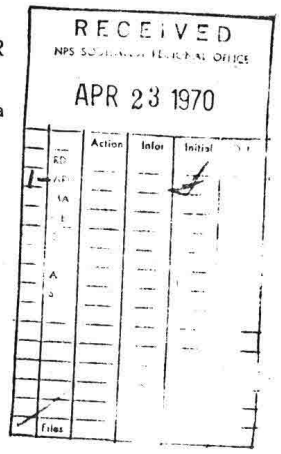
04-20-1970: memorandum to director, southwest region from superintendent, glen canyon regarding navajo steam plant

jch 7/8
awl 7/8

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Glen Canyon National Recreation Area
Box 1507
Page, Arizona 86040

IN REPLY REFER TO:
A3815

April 20, 1970



Memorandum

To: Director, Southwest Region

From: Superintendent, Glen Canyon

Subject: Navajo Steam Plant

In accordance with your request, I attended a public meeting in Salt Lake City on April 1. This meeting was called by Regional Director Crandall, Bureau of Reclamation for the purpose of acquainting Federal and State Agencies as to the current status of Salt River Project.

Virtually the entire meeting was consumed by various personnel of Salt River Project who presented plans for, and changes of, the proposed construction of the Navajo Steam Plant near Page. There was little, if any, additional information divulged which had not been previously presented at similar meetings.

I am enclosing a packet of material which was distributed at the time for your perusal.

Approximately 45 minutes at the conclusion of the meeting were allocated for questions "from the floor" by interested parties. This time was largely consumed by various conservation groups. In most instances these were professional people who are actively engaged in their profession and with educational attainment of a doctorate degree. Their highly technical questions presented to, and answered by, members of the Salt River Project staff, the majority of whom in turn held doctorates in their field, clearly illustrates the need for the Service to be represented by similarly qualified personnel. Although I recognize there is a certain benefit in having Superintendents such as myself attend these meetings, I am firmly convinced that if we are

L 24 Glca
Gen plants

to participate in productive public discussions at such meetings, the Service must be represented by someone far more conversant in these technical fields than I am. I strongly recommend that the Service assign such an individual to attend meetings of this type, with the specific responsibility to represent the Service in preparation, presentation of technical questions and the analysis of the answers received. He, in turn, should prepare a report for the information and use at all Service levels.

C. E. Johnson

Enclosures

10-27-1970: memorandum to director, nps attention: chief, division of water resources from chief, water resources section, office o

634 11-2-76

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WESTERN SERVICE CENTER
450 GOLDEN GATE AVENUE, BOX 36025
SAN FRANCISCO, CALIFORNIA 94102

OCT 29 9 07 AM '70

Read EOR

IN REPLY REFER TO:

L54(WSC)LWW
NAVA/USGS
mw

October 27, 1970

Memorandum

To: Director, National Park Service
Attention: Chief, Division of Water Resources

From: Chief, Water Resources Section, Office of Land Acquisition and Water Resources, WSC

Subject: U. S. Geological Survey investigations in the Black Mesa area - Navajo

In reply to your memorandum of August 12, 1970, enclosed is a letter report submitted by the Geological Survey regarding preliminary speculation on the long term effect of the Peabody Coal Company well field on ground-water supplies in the Black Mesa area.

As you will note in the last paragraph, the Geological Survey suggests deferring any plans for monitoring until we see what the "USGS-Tribal" monitoring system turns out to be. Therefore, we shall await the outcome of this meeting before proceeding further.

Gerard S. Witucki

Gerard S. Witucki

Enclosure 1

cc:
Director, Southwest Region w/encs
General Superintendent, Navajo Lands Gp w/encs

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division
P. O. Box 253
Flagstaff, Arizona 86001

October 20, 1970

Supervisory Hydrologist, W.S.C.
National Park Service
450 Golden Gate Avenue
P. O. Box 36025
San Francisco, California 94102

Dear Mr. Witucki:

The U. S. Geological Survey has made some preliminary calculations of the long term effect of the Peabody Coal Company well field on ground-water supplies in the Black Mesa area. We expect the water table to be lowered about 100 feet at Kayenta over a 30 year period, and lesser water-level declines should occur at several other communities near Black Mesa.

The projected water-level decline near Shonto is about five or ten feet during the next 30 years. This small effect results from the fact that Peabody is pumping from an area where the aquifer is under artesian conditions and Shonto is located where the aquifer is under water-table conditions. The boundary between water-table and artesian conditions is approximately along State Route 64. The influence of Peabody's pumpage will spread much more rapidly through the artesian areas, where little ground water is released from storage, than it will in the water-table areas where the storage coefficient is higher by several orders of magnitude.

The Navajo National Monument at Betatakin is similar hydrologically to Shonto in that ground water there is under water-table conditions. At Betatakin I would expect the water-level decline due to Peabody's pumpage to be five feet, or less, during the next 30 years. I realize that, due to the marginal nature of the Park Service well at Betatakin, any water level decline is cause for concern.

There is serious discussion at this time, in both the U. S. Geological Survey and the Navajo Tribe, of setting up a comprehensive data-collection network to monitor the effects of the Peabody well field. It appears that something will be done along these lines and, if so, the Park Service would receive ample warning of any danger to the Betatakin well. Therefore, I suggest deferring any plans for independent Park Service monitoring until we see what the "U.S.G.S. -Tribal" monitoring system turns out to be.

Sincerely yours,

E. H. McGavock
Subdistrict Chief

08-27-1970: memorandum to superintendents, southwest region from acting director, southwest region regarding water resources

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Southwest Region
P. O. Box 728
Santa Fe, New Mexico 87501

IN REPLY REFER TO:
L54-APR ✓File

AUG 27 1970

Informational

Memorandum

To: Superintendents, Southwest Region
From: Acting Director, Southwest Region

Subject: Water Resources Survey
Reply Due: September 14

We are enclosing a small supply of Water Resource Proposal forms to provide data to support our future water resources programs. The forms should be used for both Water Resource Studies and Acquisition of Water Rights programs and should be submitted in typewritten form, dated, and signed. When preparing proposals for the Water Resource Studies program, those blocks of the form that do not apply should be left blank. Please submit an original and two copies to this office by September 14.

The forms will provide information for use in obtaining cost estimates, justifying our program requests, and furnishing data for water rights dockets. Accordingly, it is important that you give this request your critical attention.

Although your water resources proposals should be correlated with your five-year development schedule, you should also consider distant future needs as you see them now.

James M Eden

Enclosure

70-459

00-00-0000: water resource proposal for inscription house, nava, ranger station

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DISTRIBUTION
NO. TO

WATER RESOURCE PROPOSAL

NAVAJO NATIONAL MONUMENT - INSCRIPTION HOUSE

	PRESENT:	TWENTY YEARS FROM PRESENT:
ESTIMATED TOTAL MAXIMUM DAILY USE OF AREA SERVED BY THIS SYSTEM (GALLONS/DAY)		

FACILITIES TO BE SERVED AND NUMBER OF SITES		ESTIMATED MAXIMUM NUMBER PERSONS/DAY			
		EXISTING	REPLACEMENT OF EXISTING	EXPANSION OF EXISTING	NEW
CAMPGROUND					
PICNIC AREA					
COMFORT STATIONS					
RESIDENCES					
OTHER (SPECIFY)					
Ranger Station	1	None			150
CONCESSION FACILITIES (SPECIFY)					

TYPE AND PERCENTAGE OF WATER USE	DOMESTIC (RES. & MAINT.)	PUBLIC	IRRIGATION	FIRE	WILDLIFE	OTHER
	75%	25%				

PREVIOUS INVESTIGATIONS OR STUDIES	ORGANIZATION	YEAR
None		

LAND STATUS: ~~Owned~~ Navajo Tribe — FIRST YEAR WATER NEEDED: 1975 — % SEASONAL USE: 35%

EXISTING USABLE WATER SOURCES	RIVER	SPRING	WELL	LAKE	OTHER
THOUSAND GALLONS/DAY (Mgpd)		UNKNOWN			

ESTIMATED TOTAL PEAK DEMAND (Mgpd): .5Mgpd	PRESENT WATER QUANTITY AVAILABLE, INCLUDING STORAGE, TO MEET PEAK DEMAND: Spring only
ADDITIONAL WATER QUANTITY NEEDED TO MEET PRESENT PEAK DEMAND (Mgpd): .5Mgpd	ADDITIONAL WATER QUANTITY NEEDED TO MEET PEAK DEMAND 20 YEARS FROM PRESENT: 1 M

NARRATIVE OF SITUATION, MANAGEMENT REQUIREMENTS AND JUSTIFICATION: We plan to build a ranger station at Inscription House (Hogan) which will be used 4-6 months out of the year. A ranger is needed at the ruin site for protection & interpretation of the ruin. AT the present time the site is closed, but should be opened within one year.

SUPERINTENDENTS RECOMMENDATION AND DATE	REGIONAL DIRECTORS APPROVAL AND DATE	PRIORITY
William D. Brinnewis 9/19/70		

PREPARED BY AND DATE	COST ESTIMATE TO BE COMPLETED BY WATER RESOURCES		
		H & F	W&R ATS ACQ.	F. P. COMP
REGION PARK	USGS ASSIST			
	PVT CONCESSION			
	PARK PUBLIC			
DEVELOPED AREA (EXISTING) (PROPOSED)	OTHER			
	TOTAL			
PROJECT TITLE	ESTIMATE DATE	W. R. DATA PAPER		

00-00-0000: water resource proposal for keet seal, nava, ranger station

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DISTRIBUTION NO. TO

WATER RESOURCE PROPOSAL

NAVASO NATIONAL MONUMENT - KEET SEEL

ESTIMATED TOTAL MAXIMUM DAILY USE OF AREA SERVED BY THIS SYSTEM (PERSONS/DAY) PRESENT: TWENTY YEARS FROM PRESENT:

FACILITIES TO BE SERVED AND NUMBER OF SITES		ESTIMATED MAXIMUM MONTHLY DEMAND/DAY: EXISTING	POPULATION OF PRIVATE OR EXPANSION OF EXISTING	NEW
CAMPGROUND				
PICNIC AREA				
COMFORT STATIONS				
RESIDENCES				
OTHER (SPECIFY)				
Ranger Station	1	NONE		150
CONCESSION FACILITIES (SPECIFY)				

TYPE AND PERCENTAGE OF WATER USE	DOMESTIC (RES. & PERSONNEL)	PUBLIC	IRRIGATION	FIRE	WILDLIFE	OTHER
	75%	25%				

PREVIOUS INVESTIGATIONS OR STUDIES: None — ORGANIZATION — YEAR

LAND STATUS: ~~Owned~~ Navaso Tribe — FIRST YEAR WATER NEEDED: 1972 — % SEASONAL USE: 35%

EXISTING USABLE WATER SOURCES	RIVER	SPRING	WELL	LAKE	OTHER
THOUSAND GALLONS/DAY (Kgpd)		← 1.5 Mgpd (est)			

ESTIMATED TOTAL PEAK DEMAND (Kgpd): .5Mgpd — ESTIMATED WATER QUANTITY AVAILABLE, INCLUDING PLANNED, TO MEET PEAK DEMAND: Springs only

ADDITIONAL WATER QUANTITY NEEDED TO MEET EXISTING PEAK DEMAND (Kgpd): None — ADDITIONAL TOTAL QUANTITY NEEDED TO MEET PEAK DEMAND 20 YEARS FROM PRESENT: 1 M

NARRATIVE OF SITUATION, MANAGEMENT REQUIREMENTS AND JUSTIFICATION: We plan to build a ranger station at Keet Seel (hogan) which will be used 4-6 months out of the year. A ranger is needed at the ruin site for protection and interpretation of the ruin. Over 1,000 people will visit the ruin this year. Study and development of water resources at Keet Seel is needed.

SUPERINTENDENTS RECOMMENDATION AND DATE	REGIONAL DIRECTORS APPROVAL AND DATE	PRIORITY
William D. Brinnewis 9/10/70		

PREPARED BY AND DATE	COST ESTIMATE TO COMPLETE THIS PROJECT	M & P	CONSTRUCTION	TOTAL COST
	USGS ACCOUNT			
REGION PARK	PWE OR NCT			
	PARK ACCT.			
DEVELOPED AREA (EXISTING) (PROPOSED)	OTHER			
	TOTAL			
PROJECT TITLE	ESTIMATE BASED ON	W. R. INVESTIGATION		

00-00-0000: water resource proposal for betatakin, nava, all facilities

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DISTRIBUTION
NO. TO

WATER RESOURCE PROPOSAL

NAVAJO NATIONAL MONUMENT - BETATAKIN

ESTIMATED TOTAL MAXIMUM DAILY USE OF AREA SERVED BY THIS SYSTEM (PERSONS/DAY) — PRESENT: 350 — TWENTY YEARS FROM PRESENT: 750 ~~1000~~

FACILITIES TO BE SERVED AND NUMBER OF SITES		ESTIMATED MAXIMUM PERSONS/DAY: EXISTING	REPLACEMENT OF EXISTING	EXPANSION OF EXISTING	NEW
CAMPGROUND	2/44	150	—	300	—
PICNIC AREA	1/4	45	—	150	—
COMFORT STATIONS	1	150	—	[illegible]	300
RESIDENCES	5	18	—	—	22
OTHER (SPECIFY) House Trailers	5	18	—	—	22
Horse barn	1	—	—	—	—
Visitor Center	1	350	—	750	—
CONCESSION FACILITIES (SPECIFY) Navajo Arts & Crafts Guild	1	350	—	750	—

TYPE AND PERCENTAGE OF WATER USE	DOMESTIC (RESV. MAINT.)	PUBLIC	IRRIGATION	FIRE	WILDLIFE	OTHER
	73%	23%				

PREVIOUS INVESTIGATIONS OR STUDIES: Water Dockets #1 & #2 — ORGANIZATION: NPS/USGS — YEAR: 100

LAND STATUS: Leased - Navajo Tribe — FIRST YEAR WATER NEEDED: 1973 — % SEASONAL USE: ~~200~~

EXISTING USABLE WATER SOURCES	RIVER	SPRING	WELL	LAKE	OTHER
THOUSAND GALLONS/DAY (Mgpd)			17 Mgpd		

ESTIMATED TOTAL PEAK DEMAND (Mgpd): 20Mgpd

PRESENT WATER QUANTITY AVAILABLE, INCLUDING SURPLUS, TO MEET PEAK DEMAND: 100 M

ADDITIONAL WATER QUANTITY NEEDED TO MEET PRESENT PEAK DEMAND (Mgpd): 3Mgpd

ADDITIONAL WATER QUANTITY NEEDED TO MEET PEAK DEMAND 10 YEARS FROM PRESENT: + 100 M

NARRATIVE OF SITUATION, MANAGEMENT REQUIREMENTS AND JUSTIFICATION: One 750' well on land leased from The Navajo Tribe produces 17 Mgpd which is stored in one 100,000 gal Tank. This summer (1970) There were weekends when drawdown on The Tank exceeded the amount of water pumped from The well. We feel by 1973 we will have to increase the pumping capacity of the present well, and [illegible] an additional water source and storage will have to be developed 10 yrs from no

SUPERINTENDENT'S RECOMMENDATION AND DATE: William D. Brinegar 9/10/70

REGIONAL DIRECTOR'S APPROVAL AND DATE

PRIORITY

PREPARED BY AND DATE

COST ESTIMATE TO BE COMPLETED BY PARK OR REGION

	MAN	MATERIALS	CONTRACT
USGS ASSIST			
PAT OF [illegible]			
PARK PUBLIC			
OTHER			
TOTAL			

REGION PARK

DEVELOPED AREA (EXISTING) (PROPOSED)

PROJECT TITLE

PROJECT DATA

NUMBER OF [illegible]

10-16-1968: memorandum to general superintendent, navajo lands group through: regional director, southwest region from acting

190-10-21-68
A.R. Capps
Navajo

DW
10/21

16 OCT 1968

L54 LWSSC
OLW

Memorandum

To: General Superintendent, Navajo Lands Group
Through: Regional Director, Southwest Region

From: Acting Chief, Office of Land and Water Rights, SSC

Subject: Water well problems at Navajo National Monument

This will confirm Mr. Fields' telephone conversation with you and your Chief of Maintenance, Bernard Tracy, concerning pump failures on the well at Navajo. During the first week of October, Mr. Fields worked with Regional Engineer Cotton and Mr. Sol Taylor of TP Pipe and Pump Company on this problem.

First, it is felt a short history of the well and the pump installations is in order, to properly orient those who have only recently become involved.

The well was drilled by Elmer L. White Drilling Company in the summer of 1962. The depth was 780 feet. It was drilled in the Navajo formation to 660 feet and from there to 780 feet in the Kayenta formation. The well was supervised by Doc Gillespie of the USGS office. It was pump tested for 48 hours, with flow of 18 gpm; with 46 feet of drawdown; static water level was 536 feet.

During the testing, the well sloughed off and backfilled to 753 feet and a sounding by Mr. Fields in 1966, indicated no further backfilling. At the recommendation of the USGS, the well was not cased, except for 10 feet of casing at the surface. Water quality was excellent --total dissolved solids were 135 (feet) ppm and hardness was 103. The well was left in that condition until 1966, then a pump was installed, and in December 1966, that pump failed. Mr. Fields was stationed in Santa Fe at that time and made a trip to Navajo and observed the pulling of the first pump. There was no indication of sand. It was assumed at that time that because of the cycle fluctuation in the generator, that a power problem was the cause of the failure.

The second pump was installed and failed a few months thereafter. No one from our office was present, but the man from TP Pipe and Pump Company who pulled the pump, said that it might have been caused by sand particles. (Since the Kayenta is a formation which contains quantities of shale, the possibility exists that the second pump

NAVA

failure might have been caused by sand or shale particles.) It was then decided to case the well. This was done under the supervision of Regional Engineer Ronnie Cotton and a new pump was installed and a prime source of power became available. This is a single-phase power line which runs for many miles across the Reservation.

A third pump was installed which worked quite well until recently. At the time of installation of this pump, the Reda Company representative recommended that we reduce the pipe size in the well from a 3-inch to a 1-1/2-inch pipe, to increase the velocity of water and decrease the chances of sand damage. Since the power source now seemed stable and the possibility of sand was reduced, the last outage was unexpected.

The recent pump failure has been analyzed by Mr. Fields, Mr. Cotton, and Mr. Taylor, and it is their opinion that it was something electrical. The sequence of events is not clear, but we do know that the pump motor was burned out along with the starting relay, starting condensor, and the magnetic switch. It is impossible, with the information we now have, to pinpoint the trouble.

Since the source of power is a long line starting at Kayenta, utilizing single phase, it is quite possible that disturbances such as lightning or other electrical impulses could cause induced surges and fluctuations to the voltage and subsequent damage to the pump. The size of the transmission line from the transformer to the pump is #2 wire and should be adequate, but in order to have more information, we recommend the following:

1. Installation of a voltage recorder.

2. Installation of a lightning arrestor at our transformer pumphouse.

3. Installation of a protective device similar to "Go Guard" or a "Motor-Minder."

We suggest that Mr. Dan Zigler be contacted for suggestions on the proper installation of these items.

With the first item in the line, it will be possible to evaluate the voltage in the prime power and the other two items will protect our pump motor from failure. If there is any additional problem, please feel free to contact us.

(Sgd.) A. W. GRAY

cc:
Chief, Branch of Water Resources, WASO

TRIP REPORT - LWSSC

Southwest Regional Office

By: William E. Fields
Supervisory Hydraulic Engr

Dates of
Travel: 9/23--26--27--30
10/1--4, 1968

On September 23, 26, 27 and 30, and October 1 through 4, I was in the Southwest Regional Office. I was there to work with the Regional Chief of Maintenance and Regional Engineer on water conservation, resources, and system problems at Grand Canyon, Walnut Canyon, and Navajo National Monument. I also had the opportunity to discuss reasons for numerous so-called "well failures" which have occurred during the past two years. In all cases, I was able to point out that these failures were not the fault of the wells but instead were either design or maintenance problems. It was mutually agreed that I would write a letter to the Midwest Regional Chief of Maintenance, Jim Dunning, and request that an instruction period on well and water rights maintenance be included in the next maintenance conference in February. Most of our water problems are not noticed until the hydrant is turned on and the water does not come out, and in the majority of cases, proper knowledge of maintenance would have either prevented or alleviated the problem.

I have written a draft form stating my recommendations for the specific problems at Grand Canyon, Walnut Creek Canyon and the Navajo National Monument and these will be forwarded to the Regional Director in memorandum form.

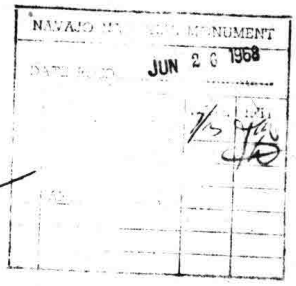
(Sgd) William E. Fields

06-25-1968: memorandum to southwest region superintendents from regional director regarding water resources survey

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Southwest Region
P. O. Box 728
Santa Fe, New Mexico 87501

IN REPLY REFER TO:
L54-0

JUN 25 1968



Informational

Memorandum

To: Southwest Region Superintendents

From: Regional Director

Subject: Water Resources Survey

The Office of Land and Water Rights, San Francisco Planning and Service Center, has requested our cooperation in compiling data for a long-range program for fiscal years 1970 through 1974. As part of this program, we ask that you report on all water resources requirements for your area.

Enclosed are blank "Water Resources Survey" forms to be completed in triplicate, for water sources in your area; one copy to be retained in your file, one copy for our file and one copy for the Office of Land and Water Rights. Also enclosed are copies of the survey material which was submitted to Land and Water Rights Office, in 1967. This material will be used in establishing water requirements as they exist at present. The completion of these forms can contribute greatly to the long-range programing; they may serve as a basis for justification for particular projects and also indicate possible effects should there be revisions in the program.

The survey forms are self-explanatory; we will ask that they be submitted in typewritten form, or printed in ink, dated and signed as they are official documentation to be utilized for programing.

Frank F. Kowski

Enclosures

cc: Chief, Branch of Water Resources, WASO

68-X-301

WATER RESOURCES SURVEY

1. Park Navajo National Monument

2. Area within park where water is required Inscription House section

3. First year in which water is needed 1969 FY

4. Types of uses to which it is to be put (i.e., domestic, irrigation, etc.)
domestic - Ranger Station - 9 month season

5. Was there a previous investigation at this site for water resources unknown
By whom _____ When _____

6. (a) Is water presently available yes. (b) In use? no
(c) From what source stream

7. (a) Will this be new or supplemental water for new development new
(b) Will this supplement or replace an existing supply _____
Why? _____

8. What new or existing (state which) facilities will be served: (a) Campground (no. of sites) primitive - 2 tables. (b) Picnic area (no. of sites) 4+ _____. (c) Concessioner _____
(d) Comfort stations yes. (e) Residences _____
(f) Other Field Ranger station - residence combined.

9. What percentage of the water do you estimate will be seasonal use 100%

10. Estimate of total requirement on day of greatest use in gallons 8000
Estimate of capacity of the present source if it is now in use (gallons per day or gallons per minute) _____. Do you think this source would be adequate for 20 years following its initial use no.

11. What likely effect would result if new water were not developed health problems due to grazing in area plus current supply will not likely meet the demand.

Prepared by Jack R. Williams Date 7/15/68

WATER RESOURCES SURVEY

1. Park Navajo National Monument

2. Area within park where water is required Keet Seel section

3. First year in which water is needed 1969 FY

4. Types of uses to which it is to be put (i.e., domestic, irrigation, etc.)
Domestic - Ranger Station - nine months season

5. Was there a previous investigation at this site for water resources yes
By whom unknown When unknown

6. (a) Is water presently available yes. (b) In use? yes
(c) From what source Spring

7. (a) Will this be new or supplemental water for new development supplemental
(b) Will this supplement or replace an existing supply replace
Why? Current development (spring) is inadequate. New pump, line and storage needed.

8. What new or existing (state which) facilities will be served: (a) Campground (no. of sites) primitive - 2+. (b) Picnic area (no. of sites) 2+. (c) Concessioner
(d) Comfort stations yes. (e) Residences
(f) Other Field Ranger Station - residence combined.

9. What percentage of the water do you estimate will be seasonal use 100%

10. Estimate of total requirement on day of greatest use in gallons 5000
Estimate of capacity of the present source if it is now in use (gallons per day or gallons per minute) unknown. Do you think this source would be adequate for 20 years following its initial use no

11. What likely effect would result if new water were not developed
Health problems could arise due to grazing in area.

Prepared by Jack R. Williams Date 7/15/68

WATER RESOURCES SURVEY

1. Park Navajo National Monument

2. Area within park where water is required ~~Betatakin section - headquarters~~

3. First year in which water is needed negative - see reverse

4. Types of uses to which it is to be put (i.e., domestic, irrigation, etc.)

5. Was there a previous investigation at this site for water resources

   By whom _____ When _____

6. (a) Is water presently available _____. (b) In use? _____

   (c) From what source _____

7. (a) Will this be new or supplemental water for new development _____

   (b) Will this supplement or replace an existing supply _____

   Why? _____

8. What new or existing (state which) facilities will be served: (a) Campground

   (no. of sites) _____. (b) Picnic area (no. of sites) _____

   _____. (c) Concessioner _____

   (d) Comfort stations _____. (e) Residences _____

   (f) Other _____

9. What percentage of the water do you estimate will be seasonal use _____

10. Estimate of total requirement on day of greatest use in gallons _____

    Estimate of capacity of the present source if it is now in use (gallons per day or gallons per minute) _____. Do you think this source would be adequate for 20 years following its initial use_____

11. What likely effect would result if new water were not developed _____

Prepared by Jack R. Wilburn Date 7/15/68

07-13-1966: memorandum to supervisory hydraulic engineer from superintendent, navajo regarding inventory of reports on water r

Navajo National Monument
Tonalea, Arizona 86044

L54

July 13, 1966

Memorandum

To: Supervisory Hydraulic Engineer, L&W, SSO

From: Superintendent, Navajo

Subject: Inventory of reports on water resources investigations.

Attached please find the inventory of investigations as requested by you in your memo of June 23, 1966.

This information represents all that we have in our files.

Jack R. Williams

cc: SWRO

Inventory of Reports
Water Resources Investigations

I. (1) No title. Subject is ground water at Navajo National Monument.

(2) Betatakin section.

(3) Prepared by U.S.Geological Survey, March 29, 1962, memo form, preliminary report.

(4) The report concludes that Betatakin Springs and the seep used by the National Park Service as a water source prior to 1962 are both inadequate for the increased facilities planned at Navajo. Recommends test drilling in west-southwest direction from Visitor Center to a depth, if necessary, of 1200 feet.

(5) This report was for a new water system to either replace or to enlarge the old system which was dependent on a seep and spring in Betatakin Canyon.

II. (1) No title.

(2) Prepared by National Park Service, July 13, 1962; date of
(3) investigation is the same; memo form; final report on the location of the test well for new system. Betatakin section.

(4) Concludes and recommends to locate test well just inside southwest corner of the monument.

(5) This was for the new water system.

III. (1) Log and Report on well D 5039.

(2) Betatakin section.

(3) Prepared by Elmer L. White Drilling Company, August 22, 1962; letter form; drilling done in July 1962; final report on the drilling of new well.

(4) At 715' tested out at 18 GPM with 46' drawdown; no recommendations; checked out by Doc Gillispee of USGS.

(5) New source of water; replacement well; one well drilled.

IV. (1) Analytical Statement.

(2) Replacement well - Betatakin section.

(3) U.S.Geological Survey, Ground Water Branch, prepared the report.

(4) This is an analytical report of sample gathered at the end of the pump test on the well drilled by Elmer L. White in July 1962; date of report is October 8, 1962; form is USGS form GW. Conclusion is "Mighty good water".

(5) Water quantity - 20 GPM.
Water quality - good.
There was one well drilled, source developed is good.

V. (1) Annual Summary of Bacteriological Examinations.

(2) Betatakin Springs and new replacement well.

(3) Department of Health, Education and Welfare prepared the report; letter form dated February 10, 1966.

(4) This report concludes that the replacement well (new source of water) is good but the springs in Betatakin Canyon is heavily contaminated. It is recommended that these springs be abandoned as a source.

* Water rights for Navajo National Monument are subject to the Memorandum of Agreement of May 8, 1962 between the Navajo Tribe, Bureau of Indian Affairs and the National Park Service.

From paragraph 3 of that agreement:

"While it is understood that the current status of the above described lands in regard to the Navajo Tribe and the Bureau of Indian Affairs shall remain unchanged, and that such lands shall remain subject to all laws applicable thereto, it is agreed by The Navajo Tribe and Bureau of Indian Affairs that the above described lands will be devoted primarily to recreational use in connection with the operation of Navajo National Monument."

It is on this basis that the new development progressed.

11-20-1962: memorandum to director from regional director regarding designation of headquarters well as replacement well, nava

Southwest Region
Santa Fe, New Mexico

L54
NAVA

NOV 20 1962

Memorandum

To: Director

From: Regional Director

Subject: Designation of Headquarters Well as Replacement Well, Navajo National Monument

On September 25 we transmitted to all concerned an assembly entitled Docket No. 2 for the new Headquarters Well at Navajo National Monument.

When Mr. Dunn and Mr. Reed were in the Regional Office they suggested that this new well at Navajo be designated as a replacement well so that the new well will have the same water rights priority as the old well and that the information in Docket No. 2 be incorporated in Docket No. 1 as Part II.

We have made this adjustment and by copies of this memorandum are requesting that you, WODC and the Superintendent, Navajo, do the same.

We are in the process of making a new drawing which shows the location of the replacement well along with the old well and water system, and as the water system and other improvements are made they will be added to this map. As soon as this map is completed, we will make distribution.

Thomas J. Allen (SIGNED)
Regional Director

W O D C
NOV 23 962

CHF
ADM
PERS
P & P
ARCH
ENGR
L. A.
SPEC
CONT
SFTY
HABS
ACTION TAKEN - DATE

noted

In duplicate

cc:
Chief, WODC (2)
Supt., Bandelier

N/Com

10-19-1962: memorandum to regional director, southwest region from acting chief, branch of water resources regarding water sou

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON 25, D.C.

IN REPLY REFER TO:
L54-RL

October 19, 1962

RECEIVED
NPS SOUTHWEST REGIONAL OFFICE
OCT 22 1962

	Surname	Date
Regional Director		
Cons., Interp & Use		
Administration		
Resource Planning		
Program Coord.		
Operations		
Concessions		
Natural History		
Hist & Archaeology		
Ranger Service		
Files		

Reed
WOT 11/17

Memorandum

To: Regional Director, Southwest Region

From: Acting Chief, Branch of Water Resources

Subject: Water Sources of Dockets Nos. 1 and 2, Navajo

We have received the assembly of Docket No. 2 for Headquarters Well No. 1 by Mr. Miller's transmittal letter of September 25.

There is virtually no information yet in the new well docket locating it on the ground but comparing the map in Docket No. 1 with Master Plan Drawing 2050A leads us to believe there is a strong likelihood that Docket No. 2 well is actually a replacement well for that in Docket No. 1, in which case the data on the new well should just become Part II of Docket No. 1, eliminating the necessity of a new docket. If it is a replacement it carries the priority date of the old well as shown on the tab of Docket No. 1 which may become important should ground water become subject to appropriative rights. Its location should be shown on the Docket No. 1 map, or if both wells are still in use, Docket No. 2 should have a location map in it tying the well to a boundary corner or a redrawn portion of the existing water system.

E. W. Reed

cc:
Superintendent, Navajo
Chief, WODC (2)

L54

08-22-1962: letter to nava, superintendent from stevenson & babbitt regarding notice to proceed and release of claims and well log

LAW OFFICES
STEVENSON & BABBITT
203 TALKINGTON BUILDING
P. O. BOX 440
FLAGSTAFF, ARIZONA

WM. W. STEVENSON
J. R. BABBITT, JR.
ROBERT W. WARDEN

August 22, 1962

United States Dept. of the Interior
Navajo National Monument
Tonalea, Arizona

Attn: Arthur H. White, Superintendent

Re: D 5039

Gentlemen:

Enclosed are two copies of Notice to Proceed, an original and three copies of Release of Claims and Well Log and Report on the well in Quadruplicate submitted for the Elmer L. White Drilling Company.

Since Mr. White completed the well last month, he would appreciate a prompt payment.

Mr. White thanks you for all your cooperation.

Very truly yours,

STEVENSON & BABBITT

J. R. Babbitt, Jr.

JRBjr.:ms

Enc.

PRospect 4-6153

ELMER L. WHITE DRILLING CO.

Diamond "S" Trailer Ranch

WELL DRILLING WELDING AND PUMPS

P. O. BOX 74
FLAGSTAFF, ARIZONA

Navajo National Park
Log and Report on Well
D 5039
August 22, 1962

0-7	Soil
7-85	Navajo sand, bad crack, lost water 65'
85-600	Navajo sand, hit 2 gal. water at 555'
660-715	Kayenta formation
715-745	Thin layers sand, shale, sandstone
745-752	Red shale
752-780	Thin layers sand, shale, sandstone
780	Total depth (Bailer)
	Tested at 715' for 1½ hours, 18 gal. per minute
	46' drawdown
	Started pump test at 3:00 the afternoon of 7/23/62.
	Completed pump test at 3:00 the afternoon of 7/25/62.
	Checked out by Doc Gillispee - Holbrook - USGS

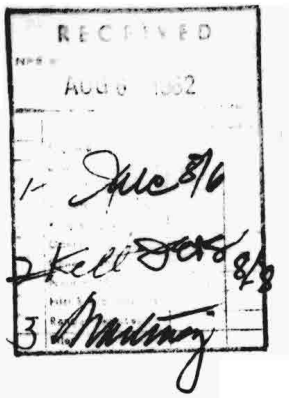
Recovery on Well after Gillispee Left

7-25 -	7:05 - 540' 4" with pigtail
	8:05 - 539' 11" with pigtail
7-26 -	6:05 - 536' 5" with pigtail

Total depth of backfill - 753'

Samples in possession of J. Akers, USGS

08-01-1962: letter to regional director, region 3 from elmer l. white drilling co. regarding contract no. 14-10-0333-891, drilling test



ELMER L. WHITE DRILLING CO.
Diamond "S" Trailer Ranch
WELL DRILLING WELDING AND PUMPS
P. O. Box 74
Flagstaff, Arizona
August 1, 1962

Regional Director
Region 3
National Park Service
P. O. Box 1728
Santa Fe, New Mexico

Re: Contract No. 14-10-0333-891

Project: Drilling Test Wells and Developing One Water Well, Navajo National Monument, Arizona

Dear Sir:

As I believe you know, I have completed the above contract and submit herewith in quadruplicate my statement in the total sum of $5,631.25 for work performed in completing said contract.

I had no employees on the payroll during the drilling of the well at Navajo National Monument, for all labor was performed by me and my associate co-owner of the drilling rig.

I also wish to advise that the U. S. Geological Service has taken and made copies of my log and report on the above well, of water samples taken from the above well, and also the water recovery report made during the pump testing of the above well. If you need these figures directly from me please advise and I will submit them very promptly.

I particularly wish to express my thanks and appreciation to Mr. Arthur H. White for his cooperation and assistance during my drilling operations as well as similar help at all stages from the people in the U. S. Geological Service.

I believe that your department is very pleased with the quantity of water obtained.

Respectfully yours,

Elmer L. White

Elmer L. White

cc: Mr. Arthur H. White
cc: Yancey Lewis Agency
cc: Elmer L. White

A. H. White
NAVAJO NATIONAL MONUMENT
DATE RECD MAR 30 1962
SUPT 3/30 W
3/28

Ground Water Branch
P. O. Box 4070
Tucson, Arizona

L54
NAVA

March 28, 1962

Memorandum

To: Assistant Regional Director, Region Three, National Park Service, P. O. Box 1728, Santa Fe, New Mexico

From: District Geologist, Tucson, Arizona

Subject: PROGRAMS AND PLANS—Ground water at Navajo National Monument (Betatakin Ruins)

We have made a preliminary study of ground water at Betatakin Ruins area, Navajo National Monument, and consulted with Art White, the Superintendent. Mr. White understands the geology very well and we were able to explain to him our reasoning concerning the alternatives in developing a water supply.

The springs at the ruins and elsewhere in the canyon issue at the contact between the Navajo Sandstone and the Kayenta Formation. By extending the tunnel west-southwestward, parallel to the cliff face, some additional water could be recovered that now issues as seeps into the alluvium in the canyon. However, the amount probably would be small and the expense of tunneling considerable and satisfactory supplies probably can be obtained from wells.

The Navajo Sandstone is the best aquifer in the area. A well in the Navajo 2-1/2 miles west of the Monument headquarters yields 20 gpm (gallons per minute) with 10 feet of drawdown, and a well 4 miles southwest yields 10 gpm with 35 feet of drawdown. The saturated thickness of the Navajo in these wells is 177 and 290 feet, respectively. However, near the canyon, the Navajo is largely drained and the saturated thickness is less than 10 feet—or, the Navajo is dry. Our fieldwork indicated the strata at the Monument dip about 3° west-southwest. Thus, the farther west-southwest one goes the thicker is the saturated thickness of the Navajo aquifer and the better are chances of obtaining a greater yield.

The question was considered as to whether or not wells might obtain water in formations below the base of the Navajo. The Kayenta is shaly and serves as confining beds. It is about 150 feet thick. Below it is the Lukachukai Member of the Wingate Sandstone. This formation crops out for several miles along the perennial Laguna Creek and so is subject to recharge from the stream if it is permeable enough to carry water. No wells in the immediate vicinity of the Monument obtain water from the Lukachukai but near Dennehotso wells obtain a few gallons per minute from it.

It is possible to get about half a mile west of the canyon that drains the Navajo and stay on National Park's property. If the westerly dip of 3° holds, this might give about 130 feet of saturated Navajo Sandstone. If the location is at about the same elevation as the headquarter's building (7,100 feet), about 750 feet of drilling will reach the base of the Navajo. If bailing indicates a sufficient quantity of water (10-15 gpm), it can be completed at that depth. However, if only a few gallons per minute are obtained it probably would be worth drilling through the Kayenta and Lukachukai to determine if additional water can be obtained from the Lukachukai. Total depth of hole would be about 1,200 feet.

The hole probably should be started at least 8 inches in diameter to permit reduction to 6 inches if necessary should it be carried to the greater depth. Only surface casing likely will be required in the Navajo. The Kayenta probably should be cased throughout. The Lukachukai will require no casing.

The hole should be considered as a test but it may yield the estimated requirements of 15 gpm. It almost certainly will yield several gallons per minute and thus will serve the immediate needs until arrangements can be made to drill a well farther to the west. As additional water is required, development can proceed in that direction.

Art,

Hope this will get things started for you.
Jerry endorses a little equity in Navajo Mountain.

P. Eldon Dennis

cc - A. H. White, Tonalea, Ariz.

Navajo Mountain, sacred to the Navajo Indians, is formed of rock strata that have been arched upward, probably by injection between the rock layers of molton rock material from deep within the earth. The foot of the mountain is formed of the same geologic formations seen in the canyon walls at Betatakin National Monument.

Navajo Mountain was formed about 10 to 25 million years ago. It has an altitude of 10,416 feet and it stands about 4,000 feet above the Rainbow Plateau at its base.

02-04-1962: memorandum to regional director from superintendent, nava regarding drill log

Navajo National Monument
Tonalea, Arizona

February 4, 1962

D5039

Memorandum

To: Regional Director

From: Superintendent, Navajo

Subject: Drill Log - Navajo

Persuant to a verbal request by Mr. Kell for the log of the hole drilled at this area the following is quoted from a letter from Kersey and Co., Alamogordo, New Mexico, dated May 31, 1939 to Southwestern Monuments Headquarters, Coolidge, Arizona:

"We have completed the drilling of the hole at Navajo National Monument. Upon completion a test was made of the quantity of water available in the hole and the test showed that 27 gallons per hour can be produced. This water is coming into the hole between 423' and 452'."

The log of the hole is as follows:

" 0 - 423' - Sandstone
423 - 452' - Water Bearing Sandstone
452 - 460' - Red Shale "

This is all we have been able to find in our files that pertains to the log of this hole.

Arthur H. White
Superintendent

In duplicate

PRospect 4-6153

ELMER L. WHITE DRILLING CO.

Diamond "S" Trailer Ranch

WELL DRILLING WELDING AND PUMPS

P. O. BOX 74
FLAGSTAFF, ARIZONA

August 1, 1962

STATEMENT

Contract No. 14-10-0333-891
With National Park Service

Moving Equipment to and from Well Site	$ 700.00
780 Feet of Drilling @ $4.40 per ft.	3,432.00
10 Feet of 8" I. D. Casing @ $3.30 per ft.	33.00
1 3/4 hrs. of Bailing Test @ $15.00 per hr.	26.25
48 hrs. of Pump Test @ $30.00 per hr.	1,440.00
Total	$5,631.25

08-01-1960: memorandum to regional director, region three from chief, wrs regarding u.s. geological survey investigation, addition

L54-OEL

August 1, 1960

Memorandum

To: Regional Director, Region Three

From: Chief, Water Resources Section

Subject: U. S. Geological Survey Investigation, Additional Water Supply, Navajo National Monument

The memorandum of July 20 from Mr. Miller arrived while Mr. Dunn and Mr. Paul P. Bieber of the Geological Survey were discussing the 1961 program of USGS water resources studies and related procedure. One point of discussion was the late date at which final request for the 1960 and 1961 programs was submitted. Another point was the obsolescence of the liaison procedure with present delegation of authority. These points have been under consideration for some months in both bureaus, and will be the subject of later correspondence.

The USGS program for 1961, which has now been requested by memorandum of July 21, of which a copy was sent to each region, does not even include work in Arizona. We also note that you have not made initial contact with the District Geologist, and obtained an outline of the work, its cost, and whether USGS could do the work this year. It is suggested that you get these details and reconsider both whether the work should take priority over other scheduled work in 1961, and whether USGS can conveniently do it before 1962.

We have allotted or obligated all 1961 M&P funds, except that we may reallot the USGS funds to the regions for disbursement after further consideration of the liaison procedure. We would also instruct you to revise your Work Order 3-WR-61 to pick up the related construction funds, and could probably supply your requested additional construction funds if the work becomes practical in 1961. You will have to be the judge as to the advisability of changing the program and rescheduling funds.

It is not clear from Mr. Miller's memorandum how you propose to justify the use of both funds for the project, and believe that the portions of each fund may be changed on the basis of the outline of work. At the small cost you do not seem to contemplate much, if any, general geological and hydrological study for payment from M&P funds. If the USGS only needed to select a well site on the basis of a brief reconnaissance and other available data, the cost might all be charged to construction.

Mr. Miller does not state whether Docket 1 and the related correspondence have been reviewed. Drawing 6950 in that docket shows that the drill hole and spring are within the Betatakin area, but the Park Service development is otherwise all on the adjacent Indian Reservation. So far as I have been able to determine the Park Service use of Indian land is either covered by such an early permit that I have been unable to find it, or is based on occupancy without permit since before the National Park Service was established. Land status records should be completed, as to both the present status and any future water development.

A. van V. Dunn
Chief, Water Resources Section

Copy to: Superintendent, Navajo
Chief, WODC 2

Region Three
Santa Fe, New Mexico

L-54

JUL 2[illegible]1960

Memorandum

To: Director

From: Assistant Regional Director

Subject: U. S. Geological Survey Investigation, Additional Water Supply, Navajo National Monument

During the week of July 11-15 Superintendent Arthur H. White was in the Regional Office and discussed with Mr. Kell the need for an additional water supply at Navajo National Monument. You may remember the original water supply at Navajo contemplated tapping a spring known as Betatakin Spring located at the base of the cliff near Betatakin Ruin. The plans called for a drilled hole from the top of the mesa through the sandstone to the base of the cliff and a drift or tunnel to intercept the drilled hole and water to be carried through the pipe in the drilled hole to the mesa top and point of use. During the drilling operation a seep was encountered and a catchment was constructed at the back of the drift or tunnel and the pump installed near the mouth of the opening. The spring itself was never tapped. This seep over the past years has produced a limited quantity of water which thus far has been sufficient by careful use but never completely adequate. The reason we have managed thus far has partially been the limited travel to Navajo.

For most of the time since Navajo's existence it has been an isolated area and travel generally confined to those persons not afraid to venture in back country. In the last few years with uranium activity, pavement in this isolated country has been extended and the road is now paved from U. S. 89 to Utah State Route 47. As you know we have plans for paving a connecting link from the existing road to the Monument headquarters tentatively scheduled for 1964. Travel is already increasing and we can expect additional increases as soon as this road is completed.

The spring, which was never used as a source of water at the Headquarters Area, is a limited source and if used to supplement the existing supply would only be adequate for one or two additional

years. More important the spring is undoubtedly the reason the ruins were constructed at this location and, in our opinion, is more important as an exhibit in interpreting the area than it would be as a meager additional, supplemental supply.

According to Superintendent White there are two probabl. sources. One is a stream approximately 1½ miles away and which is used by the Indians both for irrigation and stock watering. The use of this water, if there was no objection from the Indians, would require treatment, and a permit would need to be obtained from the Navajo Tribe. The second potential source is a drilled well. It would probably have to be drilled to a depth of 1,000 feet.

After discussing this matter in the Regional Office with Mr. Kell it was his opinion that we should ask the U. S. Geological Survey at Tucson to make a study and investigation before we expend any funds for test drilling. It is estimated the U. S. Geological Survey will want $750 to $1,200 to make a study of this area. Some of the funds can come from 143.2 money allocated to this office. The remainder might be supplied from 143.2 funds earmarked for the Chiricahua test well now determined to be charged to the construction account. Before we write to the U. S. Geological Survey asking their estimate, we would like Mr. Dunn's assurance that the additional amount of funds could be provided. It is estimated that the Region can provide $300 from funds already allocated.

George W. Miller
Assistant Regional Director

In duplicate

Copy to: Superintendent, Navajo

10-01-1958: memorandum to d. e. lee from a. van v. dunn regarding meeting with bureau of indian affairs and tribal officials regar

D. E. Lee

October 1, 1958

A. van V. Dunn

Meeting With Bureau of Indian Affairs and Tribal Officials
Regarding Boundary Matters - Navajo National Monument

It has worried me for years and has been subject of correspondence, that developments of Navajo are not all on monuments.

The present source of water is ground water which may or may not have emerged on surface before tunnel and well were drilled. If it never emerged on surface, it is not subject to appropriation in Arizona.

There was a plan to add spring supply, but I think that is dead.

If present or former surface water is used, state law requires appropriation, but such appropriation would not establish right against Indians.

Indians do not use either the well and tunnel or said spring.

Water at Canyon de Chelly is from shallow wells (main area) in what may have been spring areas originally. Use of back country spring has recently been made, where there are adjacent mining claims. Again, no filings have been attempted in this Arizona Monument because of potential superior Indian claims.

Rainbow Bridge - no water development yet.

09-03-1958: memorandum to regional director from regional chief, division of recreation resource planning regarding meeting with

SEP 9 1958

L1417

Region Three
Santa Fe, New Mexico

SEP 3-1958

Memorandum

To: Regional Director

From: Regional Chief, Division of Recreation Resource Planning

Subject: Meeting with Bureau of Indian Affairs and Tribal Officials Regarding Boundary Matters - Navajo National Monument

On August 25, in company with Mr. Arnberger, I was in Gallup to confer with Bureau of Indian Affairs and Navajo Tribal officials regarding boundary proposals at the Betatakin Section of Navajo National Monument.

Assistant Area Administrator Hall of the Gallup Area Office introduced us to Messrs. Dismuke and Harris, Realty Officers of the Bureau of Indian Affairs, with whom our boundary problems at Navajo were discussed. It was immediately apparent that the Bureau of Indian Affairs was in no position to offer any direct assistance on the matter and could only aid our efforts in an advisory capacity. The first, and evidently the only, real hurdle we must cross is to secure the approval of the Navajo Tribal Council and the rest becomes a matter of routine. Mr. Dismuke secured an appointment for us with Mr. Kenneth Dixon, Assistant General Superintendent in Charge of Resources, at Window Rock.

At 10:00 a.m. the same morning a meeting was held in Mr. Dixon's office at the agency headquarters in Window Rock attended by Messrs. Dixon, Bennett, and one unidentified man - all of the Bureau of Indian Affairs; Mr. Howard Gorman, Chairman of the Navajo Tribal Park Commission; Mr. Ed Plummer, representative of the Navajo Tribe on Lands and Resources; and Mr. Huerta, Attorney for the Navajo Tribe. Copies of our boundary map were given to several members of the group and I briefly outlined our boundary problem at Betatakin. Almost immediately Mr. Huerta wanted to know under what authority our present headquarters establishment was located on Indian lands outside of the Monument boundary. I replied that we had no formal authority for this development, and it was to legalize this as well as future development that we desired to revise the boundaries and add land to the area. It was fortunate that no attempt was made to evade the issue as Mr. Gorman stated that he had been aware for a number of years that our present

NAVA

development at Betatakin was located on Indian land. Mr. Huerta next indicated considerable interest in our source of water, the rights under which we use the water and whether local Navajos also used the water. These questions were answered to the best of our ability, but it seems likely that we may hear more from the Navajos regarding this water situation in the future.

After about 40 minutes of discussion in which Bureau of Indian Affairs officials took no part whatsoever, Mr. Gorman, in effect, closed the meeting by stating that no action could be taken now and that the next step was for us to submit our proposal in writing to be considered in turn by the Tribal Resources Committee, the Advisory Committee and finally the Tribal Council. We could see no reason for any optimism at all as a result of this meeting. It was very plainly stated that the Navajo Tribe is not at all interested in selling land or giving any further rights on the reservation, unless the advantage to the Navajo Tribe could be clearly shown. Mr. Gorman implied that this would be rather difficult for us to show in view of the "unfortunate experiences" he claimed the Navajos had had with the Service.

The next step will be to present our proposal in written form for further consideration. We are considering the preparation of a brochure with illustrations, charts, graphs, etc., which will present both the problem and the economic benefits and opportunities to the Navajos in graphic form. This opens up a different way to approach the matter and we propose to give it everything we got. We would plan to have the material in the hands of the Tribe by December for presentation at the January meeting of the Tribal Council.

After lunch we had a short visit with Mr. Plummer who was quite cordial and who is probably our best contact with the Tribe. He was very interested in the recreation planning that had been done for the reservation side of the Glen Canyon Reservoir and is looking forward to receiving our report. There seems to be some chance of arranging an on-site review of some of our proposals with tribal representatives at some time in the future. I asked Mr. Plummer if he could tell us specifically what some of these "unfortunate experiences" with the Park Service were that Mr. Gorman had referred to. He mentioned only two actual examples involving grazing matters at Chaco Canyon and Wupatki, but mostly his reply was to the effect that resentments of various injustices, real and imaginary, were harbored by many of the older people and that probably the only solution was to wait for time to solve the problem.

09-03-1958: memorandum to regional director from regional chief, division of recreation resource planning regarding meeting with

It is unfortunate that Superintendent White of Navajo could not be present. However, since the decision to go to Gallup and Window Rock was reached only last Friday there was no way to contact him in time to meet us on Monday morning.

(SIGNED)

William L. Bowen, Regional Chief
Division of Recreation Resource Planning

Copy to: Director (2)
Supt., Navajo

Approved for Distribution:

(SIGNED)

SEP 2 - 1958

Date: _____

Hugh M. Miller
Regional Director

WRC

L54-L

May 16, 1957

Memorandum

To: Regional Director, Region Three

From: Chief, Water Resources Section

Subject: Plat and Notes of Independent Survey of the Betatakin Section of Navajo National Monument

At the close of his report of April 8 on Field Trip to Organ Pipe Cactus and other areas, Mr. Arnberger states that he was unable to locate the subject records at BLM Office in Phoenix.

We find that Volume 182 of Field Notes, Utah, in the Washington Office, contains the notes of 1909 surveys of Rainbow or Borohoini Natural Bridge, Utah, and Keet Seel Ruin, the Betatakin Ruin and Inscription House Ruin, Territory of Arizona, and traverses connecting them with Mile Posts 179 and 209, respectively, on the Utah-Arizona line.

The Volume contains 283 pages, more or less. The survey notes are in poor penmanship. There are also typed descriptions of the ruins, photographs, and sketches. There are no section ties even on the State line. Much of the data should be of interest to the Park Service but it should be reviewed by the one who may want to have part photostated. I think the field copies of the notes may be in the Utah Office of BLM, instead of in Arizona.

A. van V. Dunn
Chief, Water Resources Section

Copy to: Mr. Kahler
Mr. B. Thompson
Mr. Doerr
Mrs. Dunn

AvVDunn:lct

L54-L

Memorandum

JUL 20 1955

To: Regional Director, Region Three

From: Acting Assistant Director

Subject: Well Records, Docket 1, Navajo National Monument

Attached is your copy of a statement of July 7, concerning overflow from the well at Navajo National Monument which was requested in the memorandum of June 23 from Mr. Dunn. It should be filed just below the outline in your assembly of Docket 1. A copy is also being sent to the Western Office of Design and Construction, and it appears that the Superintendent of Navajo and the Superintendent of Southwestern National Monuments have copies to file in their dockets.

The information now assembled indicates that two artesian aquifers were intercepted in drilling the well, the water from each rose above the elevation of the tunnel before the latter was dug, and that the water from the lower aquifer rose about 10 feet higher than that from the upper aquifer. Mr. Young's statement indicates that water now flows from the tunnel except when the water level is kept down by pumping.

It is evident that we are wasting water from an artesian source, contrary to the water laws of all western states including Arizona. The quantity of water which is wasted cannot be fully determined because it comes largely from the lower aquifer and may be seeping into the upper aquifer as well as flowing from the tunnel. There is no absolute assurance that the yield is not in excess of 100 gpm and subject to the groundwater laws of 1948. The well is not in any of those critical groundwater areas designated by the State Land Commissioner in 1951 and before, and we have no records of areas which may have been designated since April 1952.

As stated in Mr. Dunn's memorandum of June 23, a well casing should be installed to seal off the upper aquifer and a bulkhead should be installed in the tunnel to prevent any loss of water not used for beneficial purposes. However, that project does not seem to merit high priority unless there is evidence of decreasing yield or the area has been included in a critical groundwater area designated since April 1952.

It is suggested that a construction proposal be prepared after it is determined what will be needed to prevent loss of water, and that periodic measurements be made of the flow from the tunnel to determine how the flow may vary, both seasonally and annually. An overflow weir in the existing bulkhead would probably be most convenient for measuring. It is also advisable to obtain lists and descriptions of the designated critical groundwater areas from the State Land Commissioner from time to time, and we shall appreciate copies of those beyond Number 9, the Duncan Basin.

(SGD) LON E. [illegible]

Acting Assistant Director

Attachment

Copy to: Superintendent, Navajo
Superintendent, Southwestern National Monuments
Western Office of Design and Construction with attachment

07-07-1955: file reference l54, frequency and duration of overflow from tunnel

File reference L54

NAVAJO NATIONAL MONUMENT
TONALEA, ARIZONA

July 7, 1955

Frequency and Duration of Overflow From Tunnel

Since December 1953 a small overflow from the tunnel entrance has been observed on occasional visits to that location, and nothing has been found in the monument records to indicate a change in this condition in recent years. This, of course, does not hold true during and immediately after periods of pumping when the water level in the sump is lowered temporarily.

A low bulkhead constructed near the tunnel entrance in 1941 increased the water storage capacity of the sump to an estimated 5000 gallons or more. Although there has been no occasion to make frequent checks of the water level in the tunnel, there has been no shortage of water for monument use.

Foy L. Young
Superintendent

07-07-1955: received stamp for region three office



L54-L

June 23, 1955

Memorandum

To: Regional Director, Region Three

From: Chief, Water Resources Section

Subject: Water Right Docket 1 Navajo National Monument

Attached are a revised print of Drawing 3950 to replace that now in the docket, and a copy of Mr. Diehl's memorandum of February 1, 1950, which should be added to the assembly as a record of the well drilling and pump test as reported by Mr. Keim on June 9, 1939. We are sending the same instruments to the Superintendent, and a folder containing the same instruments to the Superintendent, Southwestern National Monuments. Also attached is a copy of my statement of September 29, 1949, which should be added to the docket.

The drawing, and Mr. Diehl's memorandum indicate that water rose above the elevation of the tunnel before the latter was dug. It is also suggested that the water level ultimately become stable at about elevation 5904 or one foot below the lip of the 1000 gallon sump in the tunnel. The Superintendent is requested to supply a brief statement for four docket assemblies explaining whether the water has overflowed at the sump since 1939, and give approximate frequency and duration of overflow if so.

If the water overflows, and runs out of the tunnel at times, the drop in water levels may be due to less precipitation since 1939 than before. On the other hand, the water from the lower aquifer may be seeping away in the upper aquifer if there is never any overflow, and possibly in any case. It may be desirable to install a sealed casing from a short distance below the upper aquifer to the tunnel level if there is evidence of a decreasing water supply. If that should result in overflow, a bulkhead should be installed in the tunnel between the pumps and the well hole, so that water will be fully confined.

A. van V. Dunn
Chief, Water Resources Section

Attachments 3

Copy to: Superintendent, Navajo, with three attachments
Southwestern National Monuments, with attachment

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Region Three
Santa Fe, New Mexico

March 13, 1950

Memorandum

To: Director

From: Regional Engineer

660-05.1

Subject: Water rights, Betatakin Ruins Area, Navajo National Monument

In Mr. Demaray's memorandum of November 30, 1949, preliminary prints of drawing NM-NAV-6950 were enclosed. One print of this drawing is being returned, with pencil notations pertaining to the bearings shown and to the "Found" corner No. 4.

Our information is that a United States General Land Office survey, made by A. E. Douglas, was the basis for the descriptive plat used with the second Proclamation of Navajo National Monument.

National Park Service engineers in 1939-1940 found corner No. 4, a set stone marked with a chiseled 4, and outlying bearing trees. Owing to the rugged timbered terrain, no attempt was made to locate other corners.

Copies of correspondence between this office and Superintendent Maxwell are also attached, relating to the drill hole and water supply.

As this water supply does not enter from the mouth of the tunnel, where quick sand and a wet condition was encountered at the time the tunnel was excavated, we are inclined to accept the drill hole water as a ground source.

(SIGNED)

J. R. Lassiter
Regional Engineer

Attachments 3

Copy to: Supt., Big Bend
Supt., Navajo

JHD:mm

02-24-1950: memorandum to regional director from superintendent, big bend regarding water rights, betatakin ruins area, nava

Diehl
Return please

Navajo 60-057

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Big Bend National Park
Marathon, Texas

February 24, 1950

Memorandum

To: Regional Director

From: Superintendent, Big Bend

Subject: Water rights, Betatakin Ruins Area, Navajo National Monument.

This will acknowledge receipt of Mr. Diehl's memorandum of February 16 regarding the water rights at the Betatakin Ruins, Navajo National Monument. I fear that I cannot help you very much in this problem. I did not have the pleasure of visiting Navajo National Monument during any of my varied assignments in the Regional office.

Judging from Mr. Diehl's letter, however, and from the quotations of others included in that memorandum, I definitely agree with Mr. Diehl that the water encountered in the drill hole is not from the same source that is feeding the spring. If it were, I am sure that the water would have risen much higher in the drill hole and would have refilled the drill hole much faster after that hole was completely bailed dry and allowed to stand before the water measurements were taken. This, of course, is pretty much of a guess with me, never having been at Navajo; but if the water encountered in the drill hole was of the same source as that which comes from the spring, I feel quite sure that there would have been considerably more water in the drill hole.

Ross A. Maxwell

Ross A. Maxwell
Superintendent

In duplicate

02-27-1950: received stamp for region three office



02-16-1950: memorandum to superintendent, big bend from acting regional engineer regarding water rights, betatakin ruins area,

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

Region Three
Santa Fe, New Mexico

February 16, 1950

Memorandum

To: Superintendent, Big Bend

From: Acting Regional Engineer

Subject: Water rights, Betatakin Ruins Area, Navajo National Monument

In order to clear statistical data on the drill hole water supply at Betatakin, Mr. Demaray wrote this office November 30, and makes this pertinent statement:

> "Since the water right status differs appreciably in connection with ground water and springs, we should like to have a report as to whether the Regional Engineer thinks we should claim the source as ground or spring water. Perhaps, too, Mr. Maxwell may have given the matter some consideration before he went to Big Bend. The entrance of the tunnel should be considered as the general area near the portal."

During your assignment in Southwestern National Monuments, you no doubt visited Betatakin, and from a professional interest paid particular attention to this unusual project, and will be able to answer the inquiry.

To further assist your opinion, seepage water and quicksand were encountered at the point, in the canyon, of the tunnel entrance in the cliff face. Our files do not contain a log of the drill hole, but the following excerpt from the field report, June 9, 1939, by Assistant Engineer Sam G. Keim, may be enlightening:

> "Mr. Brewer, Custodian, reports that water was first encountered at about elevation 6497 feet, and that water rose 12 feet in the drill hole over night. The well was finally drilled to about the 6471 ft. elevation, leaving the Navajo sandstone and entering the underlying Redbed

formation about 8 ft. Overnight the water rose in the drill hole 43 ft. In the 6" drill hole this would indicate about 65 gallons of water in the hole. The well was baled dry and allowed to stand for 15 minutes; measurements were then taken and 4.5 feet of water was found in the hole. Again the hole was baled dry and allowed to stand for 5 minutes and the water depth measured; about 1.67ft. of water having entered the hole during this period."

Reports on the tunnel excavation mention that during this operation, water seepage into the tunnel was encountered.

With the thought that water source encountered in the drill hole was the same source feeding the spring at the ruins site, some 1800 feet distant, I made some calculations on elevation and found that water in the drill hole reached elevation 6514, while the ruins spring elevation is 6522.5. Hence, I am convinced that the drill hole source and the ruins spring source are not in the same water supply channel. Your respected opinion will be gratefully received.

John H. Diehl
Acting Regional Engineer

In duplicate

11-30-1949: memorandum to regional director, region three from associate director regarding water rights, betatakin ruins area, na

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON 25, D. C.

ADDRESS ONLY
THE DIRECTOR, NATIONAL PARK SERVICE

In reply refer to:
L54 NAVA

Memorandum

NOV 30 1949

To: Regional Director, Region Three

From: Associate Director

Subject: Water rights, Betatakin Ruins Area, Navajo National Monument

Enclosed are three preliminary prints of November 17, 1949, of drawing NM-NAV-6950 as revised on the basis of the memorandum of October 19 from Mr. Lassiter.

Since the latest information places the Monument Headquarters and place of water use on the adjacent Navajo Indian Reservation, we checked with the Bureau of Land Management to see how the corners of the Betatakin Ruins Area had been established. We were advised that, although the survey of the Monument was authorized before or during the war, no field party has been assigned to the work. Accordingly, we should like to know what kind of markers have been found at Corners 1 and 4 as shown, and what you may know about who set them.

In the second place, Mr. Richey advises that some evidence of a spring was found at the entrance of the tunnel before the 6-inch hole was drilled. Since the water right status differs appreciably in connection with ground water and springs, we should like to have a report as to whether the Regional Engineer thinks we should claim the source as ground or spring water. Perhaps, too, Mr. Maxwell may have given the matter some consideration before he went to Big Bend. The entrance of the tunnel should be considered as the general area near the portal.

Associate Director

Attachments 3

In duplicate

1849 A Century of Conservation 1949

12-05-1949: received stamp for region three office



UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

In reply refer to:
L54 NAVA

Region Three
Santa Fe, New Mexico

October 19, 1949

Memorandum

To: Director

From: Regional Engineer

Subject: Water rights, Betatakin Ruins Area, Navajo National Monument

Reference is made to Mr. Dunn's memorandum of September 29 with which he transmitted water right deed No. 2 for Navajo National Monument.

In reviewing print of drawing No. NM-NAV-6950 it is noted that the bearings and distances on the pipe line from the drill hole to the 5,000 gallon tank are reversed. The first bearing and distance west of the drill hole should be - S. 89°42' W., 127 ft., and the last bearing to the tank should be S. 61°29' W., 374 ft.

A print of a portion of drawing No. NM-NAV-5304 is enclosed, on which we have plotted the pipe line with the bearings and distances. Drawing No. 6950 should be corrected accordingly. Also, on that print we have shown the Monument boundary and a tie from the drill hole to Corner No. 4 of the Monument. With this information Mr. Dunn can compute a tie to Mile Post No. 209, if he deems it desirable.

The following answers are submitted to the questions asked by Mr. Dunn:

1. The pump is a Deming No. 992 reciprocating pump with a capacity of 5 gallons per minute.

2. The electric motor is 3 horsepower.

3. Surveys were started for this water system in March, 1939.

4. Actual construction was begun in August, 1939.

5. Water was first diverted for use on June 13, 1940.

No information is available for filling in the record of the well as it was not considered that the hole was drilled for a well but merely as a channel in which pipe line could be suspended. Since this drill hole tapped an underground aquifer which is being collected at the bottom of the drill hole, it is believed that we would be safe in calling the source of water a spring rather than a well.

Unless we have a definite request from you we will not make any effort to fill in the "Record of Well" form.

SIGNED

J. R. Lassiter
Regional Engineer

In duplicate

Copy to: Superintendent, Navajo

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON 25, D. C.

In reply refer to:
L54 NAVA

September 29, 1949

Memorandum

To: Regional Director, Region Three

From: Chief, Water Resources Branch

Subject: Water rights, Betatakin Ruins Area, Nevajo National Monument

Enclosed, in duplicate, are Navajo National Monument Deed 2 and related Form L-1 as an index.

The assembly is only a record at this time, but may become essential to perfection of rights either if the spring is connected to the system, or if the Arizona ground water laws are amended to cover such appropriations. It is probable that the latter is more likely.

In order to complete the records, a provision has been made for a statement by the Regional Engineer, and two copies are requested for this Office, as well as the two for the enclosed assemblies. The statement should give:

1. Type and capacity of pump.

2. Horsepower of electric motor.

3. Actual date surveys were started for original plans, if available.

4. Date of beginning of actual construction, if available.

5. Date water was first diverted and used.

The assembly is also outlined to include a Record of Well, in accordance with our memorandum of July 22, 1947. Realizing that the hole was not originally drilled as a well, there may be little data for a log, but it is requested that data be provided as far as possible, particularly with regard to pump tests and water levels. Five forms are enclosed for this record. Three copies should be returned, of which one will be sent to the Geological Survey.

Only preliminary prints of drawing NM-NAV-6950 are included in the assembly. We should have a tie to the well or spring from a section corner or to corner 1 of the Betatakin area, whence we have a tie to Mile Post 209 on the Utah-Arizona boundary, or some indication of the approximate section lines. The latter will serve until a filing is made with the State Land Commissioner, if an accurate tie is not available. We may also wish to show a change in the water level in the well on the basis of the well record. An extra print of the drawing is enclosed for such changes and additions as you can show.

(SGD.) A. VAN V. DUNN.

A. van V. Dunn
Chief, Water Resources Branch

Attachments 10

In duplicate

AvanVDunn:sh

September 20, 1949

Statement by A. van V. Dunn

The 6-inch drill hole was sunk with PWA funds in 1939, in accordance with plans on drawing NM-NAV-5304. The hole was planned only as a shaft through which to pump water to be delivered by gravity from the spring shown on the same plan and drawing NM-NAV-6950.

However, the shaft intercepted a water bearing aquifer which has provided all water needed at the Betatakin Ruins Area to date, as a ground water supply. The waters of the spring have not been piped to the collecting sump at the bottom of the drill hole.

The ground water is not subject to appropriation at this date. Wells yielding 100 gpm, or more, were made subject to State regulation under the Arizona Ground Water Code of 1948, but the yield of this well is not 100 gpm, and the United States is not subject to State police powers. Accordingly, this assembly has been made only as an historical record for use if: (1) the Ground Water Code is amended to require appropriative filing; or (2) it becomes necessary to divert and use the waters of the spring. In either case, the United States should claim a priority of July 1939.

(SGD.) A. VAN V. DUNN

A. van V. Dunn
Chief, Water Resources Branch

C O P Y

In reply refer to
D5039 NAVA

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Region Three
Santa Fe, New Mexico

August 8, 1949

Memorandum

To: Director

From: Regional Engineer

Subject: Water System, Navajo National Monument

The water system at Navajo National Monument is as shown on drawing No. NM-NAV-6950, which shows a system as it was installed. The water obtained from the bore hole appears to be ample to take care of our requirements for the foreseeable future, and it is not now contemplated to pipe water from the spring adjacent to the ruins to the bore hole in order to augment that supply.

If in the future it does become necessary or desirable to utilize the water from this spring, you will be advised of such a fact so that adequate provision can be made for the establishment of the water rights for the waters of the spring.

/s/ John H. Diehl

John H. Diehl
Acting Regional Engineer

06-09-1939: memorandum for regional engineer from assistant engineer regarding report of trip to walnut canyon nm and nava

REPORT OF TRIP BY SAM. G. KEIM, ASSISTANT ENGINEER, PWA, TO WALNUT CANYON NATIONAL MONUMENT AND NAVAJO CANYON NATIONAL MONUMENT.

June 9, 1939.

Memorandum for the Regional Engineer;

The writer has just returned from a trip to Walnut Canyon National Monument, where a Transite pipe line for water is being installed and to Navajo National Monument, where it is planned to install a sewerage system for the Custodian's residence now under construction, and 1400 feet of water line, with pump and tank, for supplying the residence with water from a 461-foot well which has just been completed.

Work on the Walnut Canyon water line is progressing nicely; several hundred feet of the line has been put together in the ditch. Backfilling was being carefully done; all joints being left exposed until after test of the line can be made. The ditch in which the line was to be placed was progressing as a workmanly job.

At Navajo National Monument it was found that the well drilling contractor had completed his work, had capped the drill hole with concrete at the ground surface, and left. Mr. Brewer, Custodian, reports that water was first encountered at about elevation 6497 feet, and that water rose 12 feet in the drill hole over night. The well was finally drilled to about the 6471 ft. elevation, leaving the Navajo sandstone and entering the underlying Redbed formation about 8 ft. Overnight the water rose in the drill hole 43 ft. In the 6" drill hole this would indicate about 65 gallons of water in the hole. The well was baled dry and allowed to stand for 15 minutes; measurements were then taken and 4.5 feet of water was found in the hole. Again the hole was baled dry and allowed to stand for 5 minutes and the water depth measured; about 1.67 ft. of water having entered the hole during this period.

As the well was capped and materials were not readily available for recapping, the depth of water in the well was not measured, nor was the well otherwise disturbed during this trip.

From Navajo Monument the writer went to Coolidge, Arizona and discussed the two projects mentioned with Superintendent Pinkley and Assistant Superintendent Miller of the Southwestern National Monuments. It was agreed by all that the work on the water line at Walnut Canyon was progressing satisfactorily at this time. In regard to the Navajo Monument project, Mr. Pinkley and Mr. Miller both feel that it would

be best to proceed along the following lines:

(1) Proceed to try to produce a satisfactory water supply from the drill hole, by constructing the proposed tunnel and sump at the bottom of the drill hole as planned, in order to provide storage capacity, so that with the small inflow of water as indicated, sufficient water could be stored to allow the pump to be run continuously for several hours.

(2) Install the pump for the water system on top of the drill hole, with the equipment sufficiently powered to lift the water from the well and force it into either a pressure tank located in the basement of the Custodian's residence, or preferably into a reservoir located near the residence.

(3) Have all material on the ground before starting construction of the septic tank, disposal line, water line, tunnel and sump, as supervision should be kept at a minimum and the same amount of supervision can handle all parts of the project satisfactorily at the same time, as the crews will be small. Too, it is felt that difficulty will be encountered in securing satisfactory labor unless we can offer reasonably continuous work throughout the duration of the project, as the work will be at quite a distance from a reliable labor supply, and the men will be compelled to live in a camp.

(4) The Branch of Engineering should furnish a complete list of equipment immediately to the Superintendent's Office, that it feels will be needed in order to do this work.

(5) A bill of material should be submitted to the Office of the Superintendent, Southwestern National Monuments, showing sizes, quantities, etc., of pipe, valves, fittings, etc. required, so that bids may be obtained as soon as possible.

(6) The gasolene engine and pump should be connected by V-belts and the sucker rod should pull through the tubing. It is desired that the Washington Office purchase this equipment.

The writer feels that the procedure as outlined will prove workable and satisfactory. However, in regard to the reservoir which is desired instead of the pressure tank, it is felt that it will be impossible to include it in the present project, as the extra pipe, fittings, excavation, cement, gravel, sand, and labor will far exceed the cost of a pressure tank, and money is limited. However, the gravity reservoir is to be preferred and should be included if possible.

The writer also questions whether or not a pressure tank of the size desired can be put in the basement of the residence, due to difficulty of getting it through doors, etc.

It was noted that the drill hole is fairly close to the edge of the cliff and in a pocket through which considerable water must run during a rain; this should be remembered when a pump shelter is designed.

From the drill hole toward the house the rock wall rises rather abruptly in several places and difficulty is to be expected in properly providing protection for the water line in these places.

The drill hole should be checked soon to determine whether or not it is plumb and straight, as Superintendent Pinkley is withholding final payment of the drilling contractor until approval of the hole by the Branch of Engineering is received.

Respectfully submitted,

Sam C. Keim,
Instrumentman.

cc: Supt.Pinkley.

07-18-1949: memorandum to regional director, region three from chief, wrb regarding water system, betatakin ruin area, nava

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
WASHINGTON 25, D. C.

ADDRESS:
THE DIRECTOR, NATIONAL PARK SERVICE

In reply refer to:
D5039 NAVA

July 18, 1949

Memorandum

To: Regional Director, Region Three

From: Chief, Water Resources Branch

Subject: Water System, Betatakin Ruin Area, Navajo National Monument

Enclosed are three prints of drawing NM-NAV-6950, Water System, Betatakin Ruin Area, Navajo National Monument, which was prepared in the summer of 1947 with the idea of filing a water claim. However, ground water is not subject ao appropriation, and, if I recall correctly, the source of supply was the ground water in the tunnel at the pump site at the time the map was completed. In addition, there was some question as to whether it would be necessary to divert the spring as a more adequate supply for some time to come.

As a matter of record, please confirm this information as to the status of the water system or return one print indicating any changes in the present status. Even if the spring is brought in, we are not altogether certain that we will file a water claim at this time, but we should make a record of the date at which the diversion is made for possible use in connection with priority for a future claim.

(SGD.) A. VAN V. DUNN

A. van V. Dunn
Chief, Water Resources Branch

Attachments 3

In duplicate

AvanVDunn:sh

January 10, 1947.

MEMORANDUM for Files.

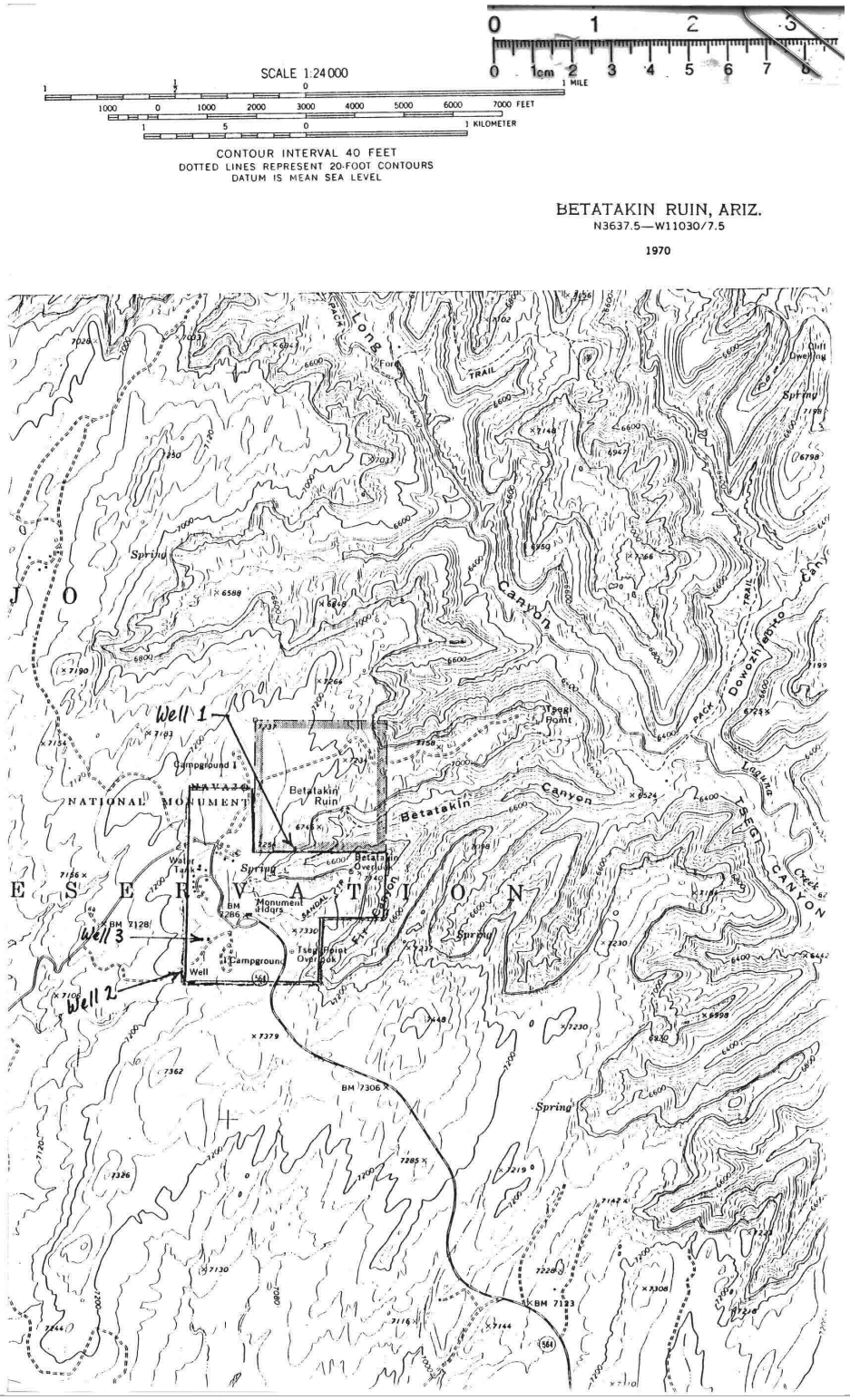
December monthly engineering report indicates that pump at Navajo National Monument needs too much attention for one located as it is, a half a day trip from headquarters.

A. van V. Dunn,
Chief, Water Division.

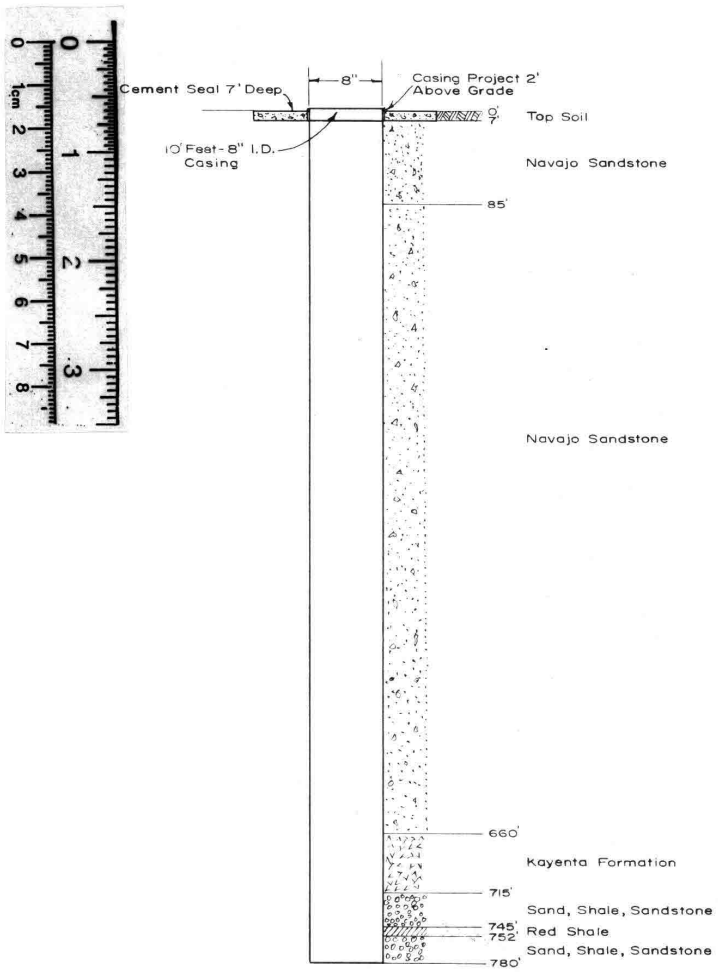


Maps and Miscellaneous Information

00-00-1970: topographic map of betatakin ruin, contour interval 40 ft.



10-23-1962: sketch of well log, headquarters well no. 1, nava



Scale
Hor. 1" = 1'
Ver. 1" = 100'

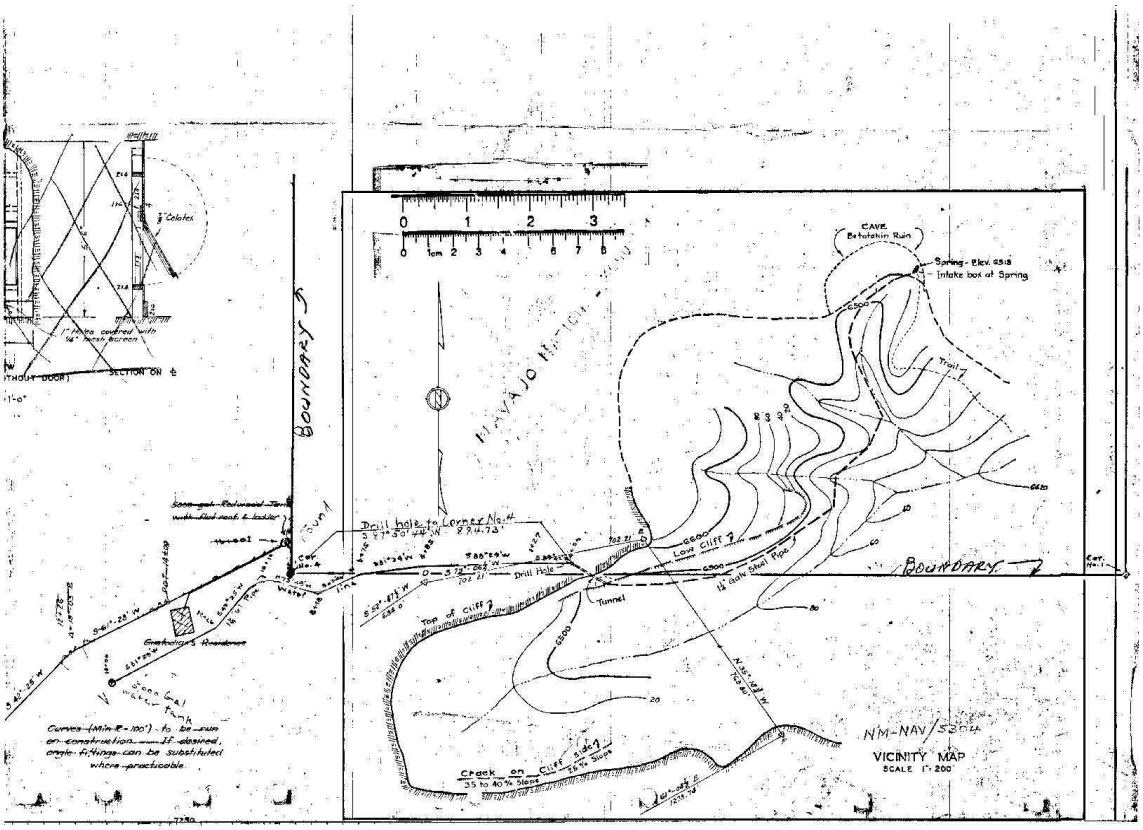
WELL LOG
Headquarters Well No. 1
(Elmer White Drilling Co.)
NAVAJO NATIONAL MONUMENT

BASIC DATA: Report of Elmer L. White Drilling Co. 8-22-62. By C. Arquero 10-1-62.

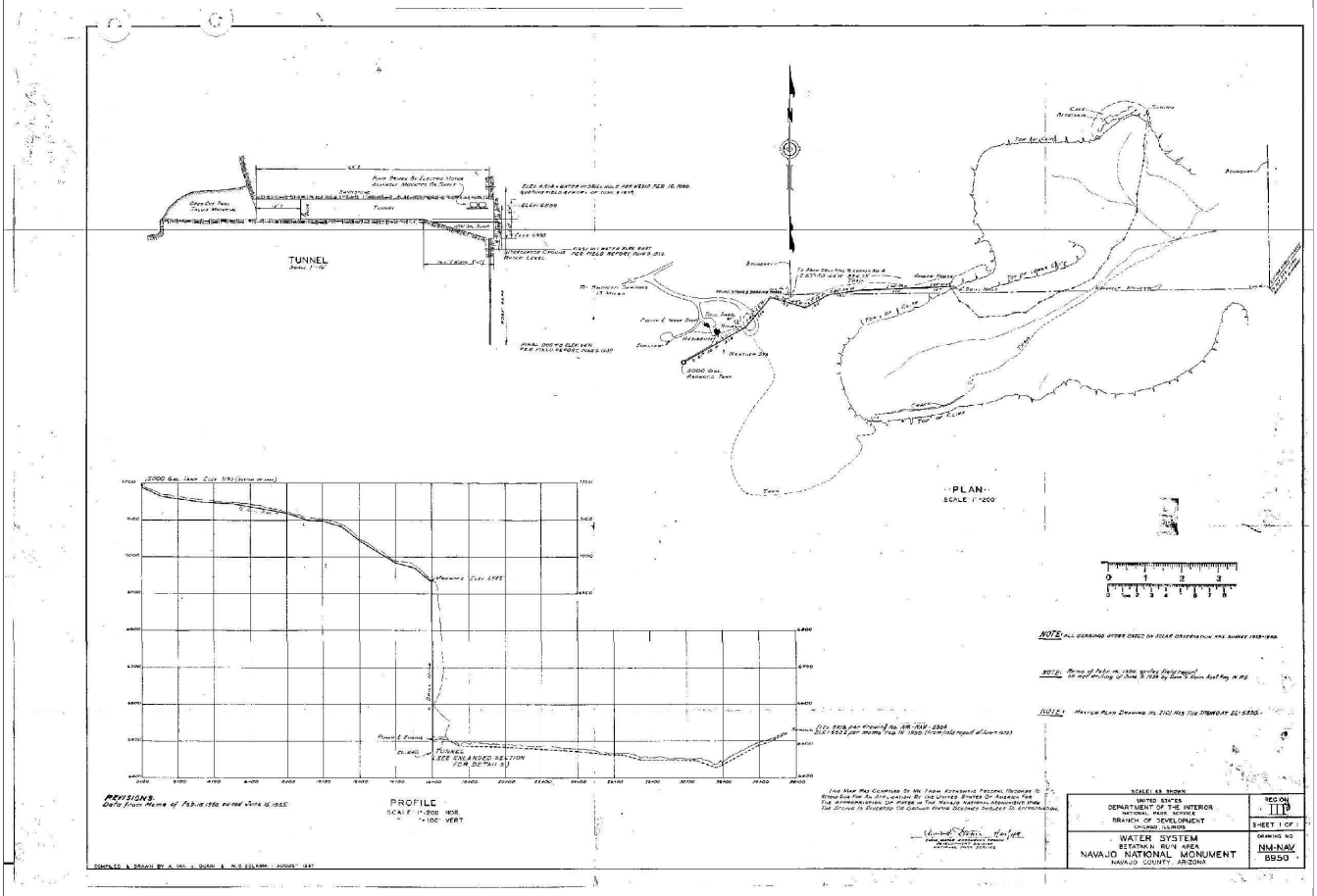
NM-NAV- 7104

Rec'd w/ Reg. memo Oct. 23, 1962

00-00-0000: map of the water sytem improvements



08-00-1949: map of the betatakin ruin area water system



Docket Information

Number of Documents in Docket 184

Documents Dated from 6/9/1939 to 12/30/1988

Docket Compiled: 6/2/2011