



WATER-RIGHT DOCKET

Richmond National Battlefield Park

Docket No: 2

COLD HARBOR

Supporting Hydro Data

04-25-1962: chemical analysis of water

F&R		FROEHLING & ROBERTSON, INC.		RICHMOND, VA.	
1881		INSPECTION ENGINEERS • CHEMISTS • BACTERIOLOGISTS		APRIL 25, 1962	
NO: K-522-4-A		CHEMICAL ANALYSIS OF WATER			
MADE FOR:		REGIONAL DIRECTOR, NATIONAL PARK SERVICE, P. O. BOX 10008, RICHMOND 40, VA. ATTENTION: MR. ALFRED VICK			
MARKED:		SAMPLE TAKEN FROM 280 FOOT DEEP WELL AT COLD HARBOR SECONDARY VISITOR CENTER IN HANOVER COUNTY, VIRGINIA			
pH VALUE (ELECTROMETRIC)		8.3			
				PARTS PER MILLION	
~~DISOLUBLE~~ —TOTAL SOLIDS AT 103°C.				154.8	
LOSS ON IGNITION (ORGANIC AND VOLATILE MATTER)				23.2	
MINERAL RESIDUE (NON-VOLATILE MATTER)				131.6	
SUSPENDED (INSOLUBLE) MATTER				-	
FREE CARBON DIOXIDE (CO ₂)				0.0	
PHENOLPHTHALEIN (CARBONATE) ALKALINITY as CaCO ₃				12.0	
METHYL ORANGE (BICARBONATE) ALKALINITY as CaCO ₃				102.0	
TOTAL HARDNESS (BY CALCULATION) as CaCO ₃				46.6	
SOAP HARDNESS as CaCO ₃				50.0	
ANALYSIS OF MINERAL RESIDUE:					
SILICA (SiO ₂) AND INSOLUBLE MATTER				2.8	
IRON (Fe)				0.1	
ALUMINUM (Al)				3.3	
CALCIUM (Ca)				12.4	
MAGNESIUM (Mg)				3.8	
SODIUM AND POTASSIUM as SODIUM (Na)				32.0	
BICARBONATE (HCO ₃) (BY CALC. FROM ALKALINITY)				124.4	
CARBONATE (CO ₃) (BY CALC. FROM ALKALINITY)				7.2	
CHLORIDE (Cl)				6.0	
SULFATE (SO ₄)				11.7	
NITRATE (NO ₃)				0.2	
PHOSPHATE (PO ₄)				-	
COPPER (Cu)				0.0	
FLUORIDE (F)				0.1	
REMARKS:					
4cc INCL.		RESPECTFULLY, FROEHLING & ROBERTSON, INC.			

ARVIN M. SUTHERLAND
Director

S. R. CHASE, JR.
Executive Assistant

DIVISIONS

FORESTRY

INDUSTRIAL DEVELOPMENT

MINERAL RESOURCES

MARKS

PUBLIC RELATIONS AND ADVERTISING

WATER RESOURCES

COMMONWEALTH OF VIRGINIA



DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

DIVISION OF MINERAL RESOURCES

NATURAL RESOURCES BUILDING

BOX 3667, CHARLOTTESVILLE, VA.

JAMES L. CALVER, State Geologist

May 1, 1962

BOARD
C. ALVIN MASTENBERG, Hampton
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ERWIN H. WILL, Richmond

WILLIAM P. WOODLEY, Norfolk

Mr. Raymond O. Mulvany
Acting Assistant Regional Director
National Park Service
Region 1
Richmond 40, Virginia

Dear Mr. Mulvany:

Enclosed please find copy of a description of the sample cuttings collected from the Richmond National Battlefield Park water well and an interval sheet listing those depths from which samples were collected during drilling. Your efforts to provide us with the drill cuttings and with a commercial analysis of water collected from this well are appreciated and if we can be of further assistance to you, do not hesitate to contact us.

Very truly yours,

James L. Calver
James L. Calver
State Geologist

JLC:D:w

Enclosures

REGION ONE
MAY 2 1962
Reg. Director
Asst. Reg. Dir. (CIU)
☒ Asst. Reg. Dir. (Gen. Inv.)
Asst. Reg. Dir. (Spec. Pl.)

INTERVAL SHEET

Page 1VDMR Well No.: 652 WWCR # 94Date 4/23/62Sample Interval: from 0 to 280PROP: Richmond National
Battlefield Park
COMP: SydneyTotal depth 280COUNTY: Hanover (Cold Harbor)Oil ☐ Gas ☐ Water ☒ Exploratory ☐Cuttings ☒ Core ☐ Other ☐

WASHED SAMPLES

From-To	From-To	From-To	From-To	From-
-	0 - 5	150 - 155	Complete set of sampled intervals	-
-	5 - 10	155 - 160		-
-	10 - 15	160 - 165		-
-	15 - 20	165 - 170		-
-	20 - 25	170 - 175	-	-
-	25 - 30	175 - 180	-	-
-	30 - 35	180 - 185	-	-
-	35 - 40	185 - 190	-	-
-	40 - 45	190 - 195	-	-
-	45 - 50	195 - 200	-	-
-	50 - 55	200 - 205	-	-
-	55 - 60	205 - 210	-	-
-	60 - 65	210 - 215	-	-
-	65 - 70	215 - 220	-	-
-	70 - 75	220 - 225	-	-
-	75 - 80	- missing -	-	-
-	80 - 85	230 - 240	-	-
-	85 - 90	240 - 245	-	-
-	90 - 95	245 - 250	-	-
-	95 - 100	250 - 255	-	-
-	100 - 105	255 - 260	-	-
-	105 - 110	260 - 265	-	-
-	110 - 115	265 - 270	-	-
-	115 - 120	270 - 275	-	-
-	120 - 125	275 - 280	-	-
-	125 - 130	-	-	-
-	130 - 135	-	-	-
-	135 - 140	-	-	-
-	140 - 145	-	-	-
-	145 - 150	-	-	-

OWNER: National Park Service
 (Richmond National Battlefield Park)
 DRILLER: Sydnor Pump & Well Co.
 COUNTY: Hanover (Cold Harbor)

VDMR # 652
 NWCR # 94
 DEPTH: 280

SAMPLE EXAMINATION

0-5	Sand-quartz, medium to fine grained, subangular, trace blue quartz and apatite nodules, (Apatite determination by x-ray analysis)
5-10	Sand-as above with increase in medium grained sand
10-15	Sand-quartz, medium to coarse grained, subangular, 1% blue quartz sand
15-20	Sand-quartz, fine to medium grained, subangular, 1% blue quartz sand
20-25	Sand-as above, fine to coarse grained
25-30	As above
30-35	Sand-quartz, fine to coarse grained, subangular, 1% blue quartz sand, trace orthoclase feldspar
35-40	Sand-same as above with small increase in orthoclase feldspar
40-45	Sand-quartz, very fine to fine grained, subangular, micaceous and argillaceous
45-50	Sand-quartz, very fine grained, gray, micaceous, subangular, trace blue quartz
50-55	Sand-quartz, fine to coarse grained, gray, micaceous, subangular, trace of blue quartz and apatite nodules
55-60	Sand-quartz, fine to very coarse grained, gray, trace blue quartz and apatite nodules
60-65	Sand-quartz, fine grained, gray and green, glauconitic, calcareous, 5% shell fragments.
65-70	Sand-quartz, very fine grained, gray, calcareous, trace shell fragments
70-75	As above with trace mica
75-80	Missing
80-85	Sand, quartz, very fine grained, gray, calcareous, subangular, 2% shell fragments

-2-

- 85-90 Sand-quartz, very fine grained, gray, calcareous, micaceous, subangular, 1% shell fragments, trace spatite nodules
- 90-95 As above with increase in spatite
- 95-100 Mudstone-silty, gray, glauconitic, sericitic
- 100-105 Sand-quartz, very fine grained, gray, argillaceous, trace spatite
- 105-110 Sand-quartz, very fine to coarse grained, gray, 1% spatite
- 110-115 Sand-quartz, fine to coarse grained, gray-black, calcareous, micaceous, glauconitic, 3% spatite, 1% shell fragments
- 115-120 Sand-quartz, 5% spatite, fine to medium grained, white to gray, glauconitic, calcareous, micaceous, shell fragments
- 120-125 Silt-quartz, very fine grained, gray, highly calcareous, sericitic
- 125-130 Silt-quartz & spatite, very fine grained, gray, sericitic, calcareous, trace shell fragments
- 130-135 Sand-quartz and spatite, fine to medium grained, gray, calcareous, highly glauconitic, shell fragments
- 135-140 Sand-quartz, 5% spatite, fine to medium grained, gray to black, highly glauconitic, subangular, calcareous, sericitic shell fragments
- 140-145 As above
- 145-150 Silt-quartz and spatite, very fine grained, gray, calcareous, sericitic, shell fragments, ostracods and foraminifers
- 150-155 Sand-quartz and spatite, fine to coarse grained, gray, subangular, calcareous, sericitic, ostracods, shell fragments.
- 155-160 Silt-quartz and some spatite, fine to very fine grained, gray, calcareous, sericitic, shell fragments
- 160-165 Silt-feldspar and quartz, fine to very fine grained, flesh colored, sericitic
- 165-170 Silt-quartz and spatite, very fine to medium grained, gray, sericitic, calcareous, shell fragments

-3-

- 170-175 As above
- 175-180 As above
- 180-185 As above
- 185-190 As above
- 190-195 Sand-quartz and spatite, fine to medium grained, subangular, gray, 30% shell fragments
- 195-200 Sand-quartz and spatite, fine to coarse grained, subangular to rounded, gray, calcareous, ostracods, one small shark's tooth
- 200-205 Sand-quartz, fine to pea gravel size grains, subangular to rounded, spatite nodules
- 205-210 As above
- 210-215 As above with trace chert and glauconite
- 215-220 Sand-quartz, fine to pea gravel size grains, subangular to rounded, trace spatite nodules
- 220-225 As above
- 225-230 As above
- 230-235 As above
- 235-240 Sand-quartz, fine to very coarse grained, subangular to rounded, trace spatite nodules
- 240-245 Same as above with trace glauconite
- 245-250 Sand-quartz, fine to very coarse grained, subangular to rounded, trace of glauconite and spatite
- 250-255 As above
- 255-260 As above with trace of weathered feldspathic material
- 260-265 Sand-quartz, fine to very coarse grained, subangular to rounded, trace of glauconite and spatite
- 265-270 As above
- 270-275 As above
- 275-280 Sand-quartz, medium to very coarse grained, subangular to rounded, glauconitic, trace spatite and orthoclase

GEOLOGIC SUMMARY

<u>DEPTH</u>	<u>PERIOD</u>	<u>GROUP</u>	<u>FORMATION</u>
7-60	Miocene	Chesapeake	Calvert
60-200	Eocene	Pamunkey	(Nanjemoy
200-280	Lower cretaceous	Potomac	(Aquia
			Potuxent

VIRGINIA DIVISION OF MINERAL RESOURCES
Merrick S. Whitfield, Geologist
April 27, 1962

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
WATER ANALYSIS

W.R. Lab. No. 36216

Location <u>Cold Harbor, Virginia - Hanover County</u>			
Source <u>Visitor Center Well - Point of Coll.: Drinking Fountain</u>			
Owner: <u>Richmond N.B.P. - 3215 E. Broad St.</u>			
Date of collection <u>7/28/62</u>			
Gage height(ft.) _____ Discharge(sec.ft.) _____ Temp.(°F) _____			
(Parts per million)			
Silica (SiO ₂).....	8.9	Carbonate (CO ₃).....	
Aluminum (Al).....	.1	Bicarbonate (HCO ₃).....	132
Iron (Fe).....	*.09	Sulfate (SO ₄).....	6.6
Manganese (Mn).....	*.04	Chloride (Cl).....	.4
Calcium (Ca).....	18	Fluoride (F).....	.2
Magnesium (Mg).....	5.7	Nitrate (NO ₃).....	.0
Sodium (Na).....	14	Phosphate (PO ₄).....	.0
Potassium (K).....	15	.....	
Lithium (Li).....	.5	.....	
(Parts per million)			
Dissolved solids:		ABS.....	
Sum.....	135	Color.....	2
Residue upon evapo- ration @ 180°C.....	134	.....	
Hardness as CaCO ₃	68	.....	
Noncarbonate.....	0	.....	
pH.....	7.4	Specific conductance (micromhos at 25°C).....	220

*In solution when analyzed.

Unpublished records subject to revision

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
WATER ANALYSIS

W.R. Lab. No. 36215

Location <u>Cold Harbor, Virginia - Hanover County</u>			
Source <u>Drilled Well - Point of Coll.: Ext. Drinking Fountain</u>			
Owner: <u>Richmond N.B.P. - 3215 E. Broad St.</u>			
Date of collection <u>7/28/62</u>			
Gage height(ft.) _____		Discharge(sec.ft.) _____ Temp.(°F) _____	
(Parts per million)			
Silica (SiO ₂).....	9.1	Carbonate (CO ₃).....	
Aluminum (Al).....	.1	Bicarbonate (HCO ₃).....	134
Iron (Fe).....	* .09	Sulfate (SO ₄).....	6.4
Manganese (Mn).....	* .04	Chloride (Cl).....	1.4
Calcium (Ca).....	18	Fluoride (F).....	.1
Magnesium (Mg).....	5.6	Nitrate (NO ₃).....	.1
Sodium (Na).....	13	Phosphate (PO ₄).....	.2
Potassium (K).....	15	.....	
Lithium (Li).....	.6	.....	
(Parts per million)			
Dissolved solids:		ABS.....	
Sum.....	136	Color.....	3
Residue upon evapo- ration @ 180°C.....	134	.....	
Hardness as CaCO ₃	70	.....	
Noncarbonate.....	0	.....	
pH.....	7.4	Specific conductance (micromhos at 25°C).....	218

*In solution when analyzed.

Other Supporting Information

Kiener 12/5

*OK'd
12/5*

Region One
Richmond 20, Virginia

D6039

DEC 6 1961

Memorandum

To: Chief, EODC
From: Regional Chief of Operations
Subject: Well for Cold Harbor - Richmond

This is to confirm the Regional Office position regarding the drilling of a deep well at Cold Harbor instead of the shallow well included in the current contract as discussed today by Mr. Cummings and Regional Engineer Kiener.

The shallow well at the Watt House which is only a mile distant from the Cold Harbor development recently went dry and was replaced by a 199' deep well just completed. The deep well provides 5gpm and is chemically good. The cost was about \$1,500 for a 4" diameter well, this cost including screen, casing and testing. Other shallow wells in the general vicinity have been failing, and we therefore recommend a deep well for Cold Harbor. The Superintendent is in agreement.

After the above mentioned discussion, the matter stands as follows:

Mr. Al Vick of this office will prepare the specifications for the deep well and get in touch with Project Supervisor Cornwell, who will negotiate a price with the Contractor for changing the shallow well to a deep well. He will then get in touch with your office and if agreement is reached, prepare a change order to accomplish the switch.

H. Reese Smith
Regional Chief of Operations

Copy to: Supt., Richmond EOP
Mr. Cornwell - Richmond EOP

TBK:mr

General

Daybook



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Ground Water Branch
P. O. Box 2857
Raleigh, North Carolina

IN REPLY, REFER TO:
REGION ONE
JUL 20 1961
Reg. Director
Asst. Reg. Dir.
Ch. Operations 87-26
Ch. Ranger Act.
Ch. Interpretation
Ch. Adm.
Ch. Rec. Res. Pl.
File 47-26

July 19, 1961

Mr. Alfred Vick, III
Regional Water Resources Engineer
Region I, National Park Service
Richmond 20, Virginia

Dear Mr. Vick:

In accordance with our conversation yesterday, I am transmitting the information collected during the construction of the test and supply well at Ft. Harrison, Richmond Battlefield Park, and suggestions as to how this information may be utilized in the construction of a supply well in the same Park at Cold Harbor.

The test hole was drilled to a depth of 225 feet below land surface. An electric log of the well shows that the major water-bearing zones occur at depths of 48 to 56 feet, 68 to 76 feet and 84 to 96 feet. Water samples were collected from these zones for iron and analyzed for total iron content. The analysis indicated that the best quality of water could be derived from the two lower zones.

The supply well was constructed by installing a 6 inch casing with two 5 foot screens in the same hole. The screens were set from 85 to 90 feet and from 68 to 73 feet below land surface. The well was developed and a pumping test was conducted for 4 hours. After the pumping test was completed, the well was pumped for 7 days at 10 gallons per minute to determine the maximum yield of the well over extended periods of time.

The well pumped more than 100,000 gallons during the 7 day period. An analysis of the water, made by the Quality of Water Branch, indicates that the iron content of the water was less than 0.01 parts per million, the total hardness of the water was 6 parts per million, and the total dissolved solids were 30 parts per million. A field measurement of the pH of the water gave a value of 5.6 .

Thus, it appears that this well can reasonably be expected to pump 10 gallons per minute of water, which will not require treatment for objectionable chemical constituents, for extended periods of time if a submergible or jet pump is set at 83 to 85 feet below land surface.

On the basis of the above information, it appears that a well may be constructed at Cold Harbor which would yield water of acceptable chemical quality. The well at Cold Harbor should be 80 to 100 feet deep, 6 inches in

Page No. 2- Mr. Vick

diameter, with one 5 to 10 foot screen. A well of this type would have the following advantages over a shallow well. The deep well would afford a more reliable supply of water, of better chemical quality, and would be less likely to become polluted by surface run-off than a shallow well.

I believe this covers the questions you had during our discussion. If you have further questions please contact me and I will give you whatever information I have concerning these sites. We will plan to work with you on the Cold Harbor well wheather you construct a deep or shallow well.

Sincerely,



G. G. Wyrick
Geologist

For: P. M. Brown
District Geologist

B5039
154

Region One
Richmond 20, Virginia

MAR 3 1961

Kinn
3/3
Vick
3/3
H/T
3/3

Memorandum

To: Chief, RDC
From: Acting Regional Director
Subject: Preliminary Drawing WBP-RIO-3037 Water and Sewage Systems
for Fort Harrison and Cold Harbor - Richmond

We have examined the subject plans and they were approved by the Regional Director on February 28 with the condition that the following suggestions be incorporated in the working drawings:

Water System - Fort Harrison

The consensus is that an elevated tank will be the proper method for storing water and will not be objectionable at any height up to 80 feet to the bottom of the tank. Small size hose bibs (say 1" diameter) should be sufficient for fire protection if placed in the vicinity of the secondary visitor center, but larger sizes in the residential area will not be objected to.

The Superintendent is somewhat concerned with the adequacy of the present water supply. We believe with a good reserve storage it will prove satisfactory. As you know this water, and in the case of any supply in this general area, will need treatment. In case visitation becomes so heavy that another supply must be added, this can be done when the fact becomes apparent. In this regard, we have a suggestion which you may wish to consider, and which should prove cheaper than the gravel-packed deep well about to be proposed by the U.S.G.S. This would be the rehabilitation of the deep well now abandoned in the old comfort station behind the old log museum. This water contains excessive iron but could be added to the water from the present well and put thru the same treatment with perhaps a small settling tank for precipitated iron following aeration. The two supplies should be ample for the presently proposed development.

For your information the old CCC camp at Fort Harrison used the latter well referred to above and pumped it into an elevated tank which was located close to where the most easterly residence is shown on Sheet 1 of Eng. No. 3037

I am enclosing a copy of the Superintendent's comments for your files.

SMH

Acting Regional Director

Attachment ✓

Copy to: Supt., Richmond

TEKiener:mr

~~General~~

Daybook



L54

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Ground Water Branch
Box 2857
Raleigh, North Carolina

IN REPLY REFER TO:

REGION ONE	
MAR 2 1961	
Reg. Director	
Asst. Reg. Dir.	
Ch. Operations	am
Ch. Ranger Act.	
Ch. Interpretation	
Ch. Adm.	
Ch. Rec. Res. Pl.	

[Signature]

March 1, 1961

4/27/61

Mr. Alfred Vick, III
Regional Water Resources Engineer
Region I, National Park Service
Richmond 20, Virginia

Dear Mr. Vick:

Mr. P. M. Brown, District Geologist, instructed me to make the following recommendations for specifications concerning test wells at Richmond National Battlefield after his meeting with you in Raleigh. These test wells are considered essential because the available data is insufficient to estimate the depths and yields of water-bearing zones and the chemical characteristics of water from the various zones.

Two 6-inch test holes should be drilled. One hole near the present supply well at Fort Harrison and the other near the contact station at Cold Harbor Battlefield. The holes should be drilled by the rotary-hydraulic method to depths of approximately 250 feet below land surface. The drilling and testing of one hole should be completed before work on the other hole starts.

During drilling the driller should keep an accurate log of the depths and types of materials penetrated by the drill hole. Samples of the material drilled should be collected at intervals of 5 feet of depth.

After each hole is drilled it should be logged with electrical and gamma-ray logging equipment by the U. S. Geological Survey.

Upon completion of the logging at each hole the driller should lower a string of small diameter casing, fitted with a 3 to 5 foot length of screen on the end, to the depths indicated as water-bearing zones by the logs and a gravel-envelope emplaced around the screen. The casing, with the screen set at the required depth,

Mr. Alfred Vick, III

- 2 -

March 1, 1961

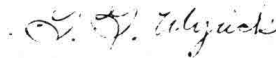
should be pumped at approximately 5 gallons per minute until a clear water sample is obtained for chemical analysis. Available data indicate that 4 to 6 such water samples from different depths should be collected from each hole. The chemical analyses of water samples will be made by the U. S. Geological Survey. As aeration changes some of the chemical characteristics of water samples, air lift methods of pumping should not be used for collecting water samples.

The completion of each hole as described above should yield sufficient information to properly convert the test hole to a production well. The type of construction used in the production wells may vary from gravel-walled to tubular screened wells, depending on the data obtained from the test wells. The well should be developed until the drill mud is cleared from the water-bearing zones tapped by the well and the formations yield sufficient water to conduct a pumping test for 8 hours at 25 gpm.

During the pumping test the yield of the well should be held to a constant rate. The well should be constructed so that the water level in the well may be measured by air line or electrical tape during the pumping test. Water samples for chemical analysis should be collected during the pumping test.

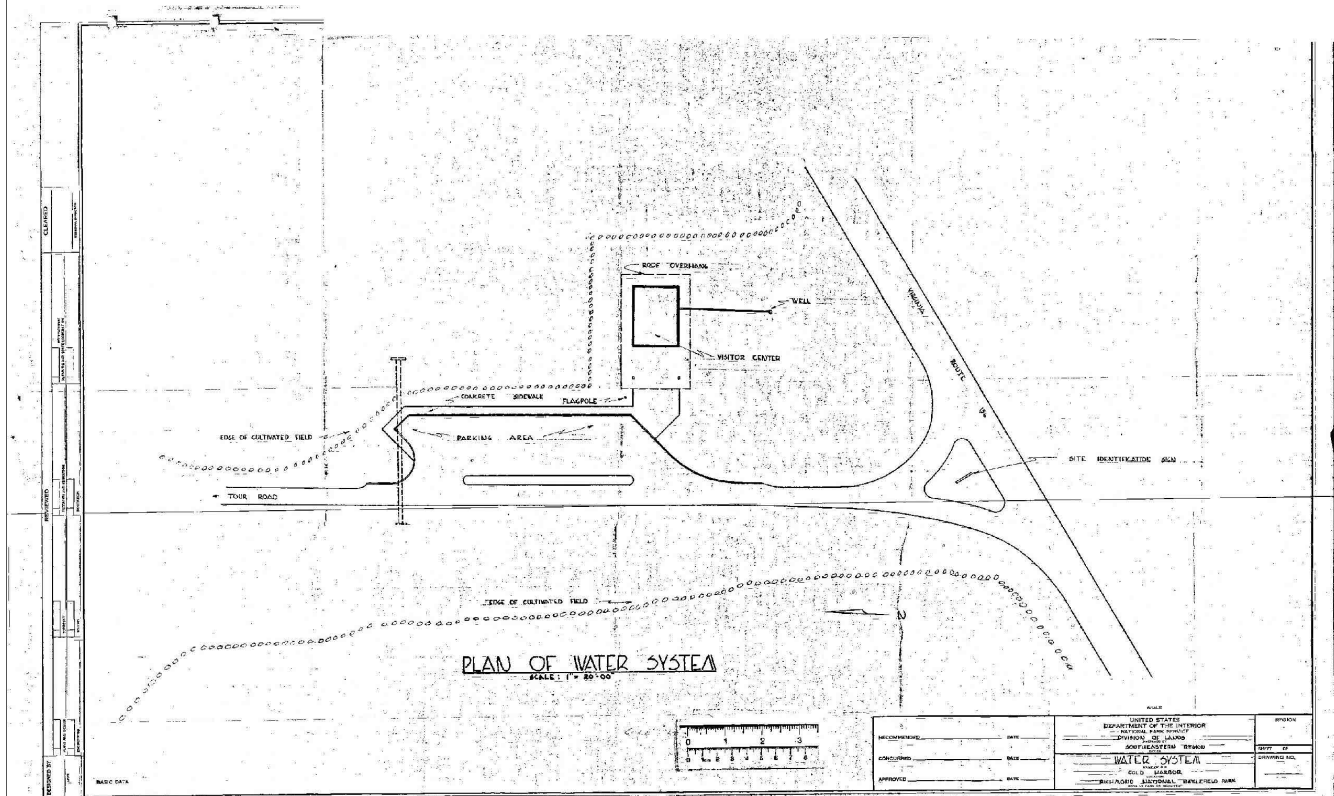
The Geological Survey will observe the testing program, make chemical analyses of the water and run the well logs as the Park Service so desires. It is my understanding that these recommendations are to facilitate the drawing up of specifications and well contracts by the National Park Service. If you have any questions concerning these recommendations please feel free to contact me.

Sincerely,



G. G. Wyrick
Geologist (107 WRA)

For P. M. Brown
District Geologist



Docket Information

Number of Documents in Docket 17

Documents Dated from 3/1/1961 to 7/28/1962

Docket Compiled: 6/14/2011