



WATER-RIGHT DOCKET

Mammoth Cave National Park

Docket No: 1

THREE SPRINGS AND BRADFORD SPRINGS AREA WELL

Supporting Hydro Data

12-10-1964: letter to superintendent from district geologist regarding data relating to the pumping test of the well

Water Resources Division
Ground Water Branch

522 W. Jefferson, Rm. 310
Louisville, Kentucky 40202
December 10, 1964

Mr. Paul McG. Miller
Superintendent
Mammoth Cave National Park
Mammoth Cave, Kentucky

Dear Mr. Miller:

Herewith, in triplicate, are data relating to the pumping test of the well at Bransford Spring made on November 25, 1964 by D. V. Whitesides and me. You will recall that the performance of this well had dropped off in recent years and that it was decided to pull the pump for inspection and to surge and test pump the well.

The pump was pulled on November 23, 1964 and the well was surged and bailed for several hours prior to this test. The driller reports that he found only about a foot of sand and a foot of rusty scale in the bottom of the well.

PUMP SETTING - Intake of 10 H.P. submersible pump set at 403.0 feet below top of casing, about 8 inches above the concrete floor of the pump house. Intake was set about 24 feet above bottom of well to allow for a basin for sand accumulation.

AIRLINE SETTING - Bottom end of 1/8" I.D. copper airline set 5.0 feet above pump intake. Total length of airline from bottom to center of gauge (set 1.0 foot above top of casing) was 399.0 feet.

DISCHARGE PIPE - 2-inch plastic pipe discharging from top of pump column and about 20 feet downslope from well.

DURATION OF TEST - Pumped for 24 hours to waste. Test began at 0000 on November 25, 1964; ended at 0000 on November 26, 1964.

PUMPING RATE - Stabilized at 22 gpm (gallons per minute) with a drawdown of 80 feet. The water was very turbid and contained much fine sand for the last 6 hours at this pumping rate. The valve was then partly closed to reduce the pumping rate

and allow the water level to recover to a level where the turbidity and sand could be reduced. This was accomplished by stabilizing the pumping rate at 15.7 gpm with a drawdown of 56 feet. The water was clear and relatively free of sand for about the last 8 hours of the test. There is indication of a large sand and mud-filled crevice at about 360 to 366 feet below top of the casing in this well. When the water level is pumped below this point, sand and mud is washed out by turbulent flow of water through the crevice. However, as long as the water level is kept at or above the crevice, the sand and mud will not create a problem.

STATIC WATER LEVEL AT START OF TEST - 309.0 feet below top of casing.

PUMPING LEVEL WHILE PUMPING AT 22 gpm - (MAXIMUM SUSTAINED YIELD OF WELL) - 389.0 feet below top of casing.

PUMPING LEVEL WHILE PUMPING AT 15.7 gpm (PRACTICAL YIELD OF WELL TO INSURE SEDIMENT-FREE WATER) - 365.0 feet below top of casing.

SPECIFIC CAPACITY OF WELL - About 0.28 gallons per minute per foot of drawdown.

Data on pumping rates and water levels during the test are summarized in the following table:

Time (CST)	Airline reading (feet)	Net change from static level (feet)	Depth to water below top of casing (feet)	Yield of well (gpm)	Remarks
11-25-64					
0000	90	--	309	--	Static reading. Start test.
0004	80	10	319	55	
0013	70	20	329	47	
0100	56	34	343	41	
0300	38	52	361	33	Probably about top of crevice.
0330	36	54	363	30	
0630	36	54	363	30	
0645	28	62	371	30	Water very turbid and heavy with fine sand.
0745	10	80	389	25.4	
0830	3	87	396	25.4	Closed valve to stabilize pumping rate.
0900	10	80	389	22	Water still turbid and sandy.
1230	10	80	389	22	Closed valve to allow water level to recover.
1235	26	64	373	5.0	Water clear. No sand.
1240	32	58	367	8.2	Probably about bottom of crevice.
1300	36	54	363	9.3	Open valve.
1500	34	56	365	16.5	Pumping a trace of sand.
1600	35	55	364	16.5	Clear; no sand.
2000	34	56	365	15.7	Clear; no sand.
2400	34	56	365	15.7	Clear; no sand. Pump off.

End of test.

Very truly yours,

Enclosures

cc: Branch Area Chief,
St. Louis, Mo.

R. V. Cushman
District Geologist

Form 10-174
(June 1962)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

FACE SHEET FOR COMPLETION REPORT

Park Mammoth Cave National Park		Region Southeast	Work Order No. B-8 MACA
Location in Park Reservoir Hill, Mammoth Cave National Park		State(s) Kentucky	Fund Symbol 14X1035
☒ Contract and/or ☐ Day Labor		County or Counties Edmonson	Year Programmed 1963
Work Order Title Two 500,000 Gallon Water Reservoirs		PCP No. U-84-1, U-85	
Contractor, The Crom Corporation, Gainesville, Florida		Master Plan No. NP-MC-3025B	
		Master Plan Corrected By	
		As Built Drawings By Edward A. Northrop	
		Date Started Oct. 2, 1962	
		Date Completed April 18, 1963 ✓	
DESCRIPTION OF FIXED ASSETS (For completion by employee in charge of project)		TOTAL COSTS (For completion by FFO)	
100.8 - UTILITIES		\$87,083.43	
500,000 gallon composite prestressed concrete water reservoirs, installed (two). Above includes necessary piping, valves, etc. \$66,395.00		~~\$66,395.00~~	
4" cast iron water line (from above reservoirs to, and tied into, the Three Springs pumping line) 1631 feet. \$ 8,676.92		~~8,676.92~~	
Bransford etc.			
TOTAL		\$ 87,083.43	
		~~75,072.92~~	

DISTRIBUTION		THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES	
No.	To	Submitted	Title
1	WASO-D&C	By: <i>Glenn C. Farran</i>	Park Engineer
1	EODC	Approved: <i>Glenn C. Farran</i>	Date: 5/21/63
2	S.E. Region	By: <i>Paul E. Brown</i>	Superintendent
1	Mammoth Cave	Approved: <i>Paul E. Brown</i>	Date: 5/21/63
COSTS VERIFIED		By: <i>Paul E. Brown</i>	Title: Regional Accountant
BY: <i>Paul E. Brown</i>		Date: 7/2/63	

11360

T. J. Reer

NARRATIVE

**COMPLETION REPORT, THE CONSTRUCTION OF 2 - 500,000 GALLON WATER
RESERVOIRS AND WATER LINE EXTENSION**

Contract No. 14-10-0131-971, Project B-8-MACA

**Bids opened: September 12, 1962. Amount of bid was \$61,600.00
(2-500,000 gallon pre-stressed concrete reservoirs).**

Bid awarded: The Cron Corporation, Gainesville, Florida

**Change Order No. 1: 1500 ft. extension of 4" cast iron water line
Amount - \$12,775.00.**

**Original Bid: \$61,600.00 + Change Order No. 1 = \$74,375.00 Total
Contract.**

Original completion date March 30, 1963 + Change Order No. 1.

Extended completion date May 8, 1963.

Project started October 2, 1962.

**The project was divided into nine phases or steps. Phase I -
Excavation and stone sub-base; II - Floors; III - Walls; IV - Domes;
V - Prestressing; VI - Painting and accessories; VII - Testing,
sterilizing and clean-up; VIII - Reservoir Piping; IX - 4" Pipe Line.**

Work will be done on each tank progressively.

**Each phase will be considered separately and applicable photographs
will be entered where feasible..**

PR ORIGINAL RECORDS SUBJECT TO REVISION

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

26W
Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
Source Three Springs Depth (ft.) _____ Diam (in.) _____
Cased to (ft.) _____ Date drilled _____ Point of coll. 300 ft. South of outlets
Owner National Park Service
Treatment _____ Use _____
WBF Sandstone WL _____ Yield 46.5 GPM flow measured
Temp (°F) 54 Appear. when coll. Clear
Collected January 11, 1961, 8:30 AM By D. V. Whitesides
Remarks Field chloride 5 ppm. 4 os. bottle frozen and broken on arrival.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	48	0.79
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.16	--			
Iron (Fe)			Sulfate (SO ₄)	4.8	.10
			Chloride (Cl)	2.0	.06
			Fluoride (F)	.1	.01
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	.3	.01
Sodium (Na)					
Potassium (K)					
Total			Total		0.97

	ppm		
		Specific conductance (micromhos at 25° C)	93
Dissolved solids:		pH	6.9
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	41		
Noncarbonate	2		

Lab. No. Col 23484 Field No. S-1,902.9-314.2 Project KY GS Q GW

PROVISIONAL RECORDS, SUBJECT TO REVISION

 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 WATER ANALYSIS

 2GW
 Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Bypass valve
 Owner National Park Service
 Treatment _____ Use Domestic
 WBF Cypress sandstone WL _____ Yield 500 GPM flow estimated
 Temp (°F) 53 Appear. when coll. Clear
 Collected March 9, 1961 By W. A. Van Couvering
 Remarks Field chloride 5 ppm

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	23	0.38
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.04				
Iron (Fe)			Sulfate (SO ₄)	4.4	.09
			Chloride (Cl)	.5	.01
			Fluoride (F)	.1	.01
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	1.3	.02
Sodium (Na)					
Potassium (K)					
Total			Total		0.51

	ppm		
		Specific conductance (micromhos at 25° C)	53
Dissolved solids:		pH	6.5
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	20		
Noncarbonate	1		

Lab. No. Col 23822 Field No. S-1,902.9-314.2 Project KY GS Q GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

PF SIGNAL RECORDS, SUBJECT TO REVISION
2GW
Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
 Source Three springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Discharge pipe 100 feet south of
outlets Owner National Park Service
 Treatment _____ Use Public supply
 WBF Sandstone WL _____ Yield 300 GPM estimated
 Temp (°F) 54 Appear. when coll. Clear
 Collected April 4, 1961, 12:45 PM By D. V. Whitesides
 Remarks Field chloride 5 ppm

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	24	0.39
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.03	—			
Iron (Fe)			Sulfate (SO ₄)	6.2	.13
			Chloride (Cl)	3.5	.10
			Fluoride (F)	.1	.01
Calcium (Ca)	7.1	0.35			
Magnesium (Mg)	.8	.07			
			Nitrate (NO ₃)	.0	.00
Sodium (Na)					
Potassium (K)					
Total			Total		0.63

	ppm		
		Specific conductance (micromhos at 25° C)	50
Dissolved solids:		pH	7.3
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	21		
Noncarbonate	2		

Lab. No. Col 24215 Field No. S1,902.9-314.2 Project KY GS Q GW

PROVISIONAL RECORDS, SUBJECT TO REVISION
26W
Dec. 1953

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

Location Mammoth Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Discharge pipe, 100 feet south of outlet.
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Sandstone WL _____ Yield 400 GPM flow estimated
 Temp (°F) 54 Appear. when coll. Clear
 Collected May 4, 1961, 2:00 PM By D. V. Whitesides
 Remarks Field chloride 5 ppm.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	25	0.41
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.05				
Iron (Fe)			Sulfate (SO ₄)	6.0	.12
			Chloride (Cl)	2.0	.06
			Fluoride (F)	.1	.01
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	.1	.00
Sodium (Na)					
Potassium (K)					
			Total		0.60

	ppm		
		Specific conductance (micromhos at 25° C)	51
Dissolved solids:		pH	6.6
Sum		Color	
Residue on evaporation at 180°C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	25		
Noncarbonate	4		

Lab. No. Col 24169 Field No. S-1,902.9-314.2 Project KY GS Q GW

PROVISIONAL RECORDS, SUBJECT TO REVISION

 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 WATER ANALYSIS

 2GW
 Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Discharge pipe, 100 feet south of spring
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Sandstone WL _____ Yield 60 GPM flow measured
 Temp (°F) 55 Appear. when coll. Clear
 Collected May 31, 1961, 7:45 PM By D. V. Whitesides
 Remarks Field chloride 5 ppm

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	59	0.97
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.17	--			
Iron (Fe)			Sulfate (SO ₄)	2.8	.06
			Chloride (Cl)	2.0	.06
			Fluoride (F)	.1	.01
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	.4	.01
Sodium (Na)					
Potassium (K)					
Total			Total		1.11

	ppm		
		Specific conductance (micromhos at 25° C)	103
Dissolved solids:		pH	6.9
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	46		
Noncarbonate	0		

 Lab. No. Col 24402 Field No. S1,902.9-314.2 Project KY GS Q GW

PROVISIONAL RESULTS SUBJECT TO REV.

 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 WATER ANALYSIS

2GW

Location Mammoth Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll At outlet
 Owner National Park Service
 Treatment _____ Use _____
 WBF Sandstone WL _____ Yield 40.0 GPM flow meter
 Temp (°F) 55 Appear. when coll. Clear
 Collected June 27, 1961, 8:45 AM By R. A. Kocher
 Remarks Field chloride 10 ppm

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	<u>59</u>	<u>0.97</u>
Aluminum (Al)			Carbonate (CO ₃)	<u>0</u>	<u>.00</u>
Iron (Fe)	<u>0.11</u>	<u>--</u>	Sulfate (SO ₄)	<u>2.6</u>	<u>.05</u>
			Chloride (Cl)	<u>2.0</u>	<u>.06</u>
			Fluoride (F)	<u>.0</u>	<u>.00</u>
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	<u>.4</u>	<u>.01</u>
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	<u>166</u>
Calculated		pH	<u>6.9</u>
Residue on evaporation at 180°C		Color	
Hardness as CaCO ₃			
Noncarbonate	<u>49</u> <u>1</u>		

 Lab No. Col 24632 Field No. 8-1-008-0-31-1

PROVISIONAL RECORD

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

2GW

WATER ANALYSIS

Location Emerald Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Discharge pipe, 100 ft. south of springs.
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Sandstone WL _____ Yield 30 GPM flow measure
 Temp (°F) 54 Appear. when col. Clear
 Collected July 25, 1961, 2:40 PM By D. V. Whitson and R. A. Beeber
 Remarks Field chloride 5 ppm. 1 1/2 seconds to fill 7 gallon bucket.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	73	1.2
Aluminum (Al)			Carbonate (CO ₃)	0	.0
Iron (Fe)	0.02	--			
			Sulfate (SO ₄)	2.4	.0
			Chloride (Cl)	2.0	.0
			Fluoride (F)	.1	.0
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	.5	.0
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	124
Calculated		pH	7.0
Residue on evaporation at 180°C		Color	
Hardness as CaCO ₃	59		
Noncarbonate	0		

Lab. No. Col 24635

Field No

8-1,902.9-314.2

Project

KY. Emerald Cave D. G.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

26W

Dec. 1953

WATER ANALYSIS

Provisional pending order to analysis

Location Mammoth Cave, Kentucky County Edmonson
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Discharge pipe, 300 feet south of springs
 of springs _____ Owner National Park Service
 Treatment _____ Use Public supply
 WBF Sandstone WL _____ Yield 20 GPM flow measured
 Temp (°F) 56 Appear. when coll. Clear
 Collected September 27, 1961, 4:45 PM By D. V. Whitesides
 Remarks Field chloride 5 ppm.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	106	1.74
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.10	--			
Iron (Fe)			Sulfate (SO ₄)	3.6	.08
			Chloride (Cl)	2.0	.06
			Fluoride (F)	.1	.01
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	.8	.01
Sodium (Na)					
Potassium (K)					
Total			Total		1.90

	ppm		
		Specific conductance (micromhos at 25° C)	179
Dissolved solids:		pH	7.3
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	86		
Noncarbonate	0		

Lab. No. Col 25121 Field No. S-1,902.9-314.2 Project KY GS Q GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

NO REVISION
2GW

Location Mammoth Cave, Kentucky County Edmonson
Source Three Springs Depth (ft) _____ Diam (in.) _____
Cased to (ft) _____ Date drilled _____ Point of coll _____
Owner National Park Service
Treatment _____ Use Public supply
WBF Sandstone WL _____ Yield 19.8 GPM flow meter
Temp (°F) 57 Appear. when coll. Clear
Collected August 30, 1961 By R. A. Kachar
Remarks Field chloride 15 ppm

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	<u>102</u>	<u>1.67</u>
Aluminum (Al)			Carbonate (CO ₃)	<u>0</u>	<u>.00</u>
Iron (Fe)	<u>3.6</u>	<u>--</u>	Sulfate (SO ₄)	<u>5.4</u>	<u>.11</u>
			Chloride (Cl)	<u>2.0</u>	<u>.06</u>
			Fluoride (F)	<u>.1</u>	<u>.01</u>
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	<u>2.8</u>	<u>.04</u>
Sodium (Na)					
Potassium (K)					
Total			Total		<u>1.89</u>

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	<u>183</u>
Calculated		pH	<u>6.9</u>
Residue on evaporation at 180° C		Color	
Hardness as CaCO ₃	<u>85</u>		
Noncarbonate	<u>2</u>		

Lab. No. Col 24924 Field No. 8-1,902.9-314.2 Project KY MAMMOTH CAVE Q. GW

GEOLOGICAL SURVEY

WATER ANALYSIS

Location Monmouth Cave, Kentucky County Monmouth
 Source Three Springs Depth (ft) _____ Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. Outlet from reservoir
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Calcareous limestone WL _____ Yield 50 GPM flow
 Temp (°F) 56 Appear. when coll. Clear
 Collected May 8, 1962, 9:00 AM By R. V. Cushman
 Remarks _____

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	<u>49</u>	<u>0.80</u>
Aluminum (Al)			Carbonate (CO ₃)	<u>0</u>	<u>.00</u>
Iron (Fe)	<u>0.05</u>	<u>--</u>	Sulfate (SO ₄)	<u>4.8</u>	<u>.10</u>
			Chloride (Cl)	<u>1.0</u>	<u>.03</u>
			Fluoride (F)	<u>.1</u>	<u>.01</u>
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	<u>1</u>	<u>.01</u>
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	<u>89</u>
Calculated		pH	<u>6.9</u>
Residue on evaporation at 180° C		Color	
Hardness as CaCO ₃	<u>49</u>		
Noncarbonate	<u>2</u>		

Lab. No. Col 15986

Field No

Project

KY MONMOUTH CAVE Q ON

Statement of Progress on Mammoth Cave Project
June 1-30, 1962

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 8 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

Discharge measurements were made on a number of perennial streams tributary to Green River during June. The measurements are as follows:

<u>Stream</u>	<u>Date</u>	<u>Discharge</u> <u>(Cubic feet per second)</u>
Echo River outlet.....	June 12	15.5
Styx River outlet.....	June 12	*-1.0 (est)
Dog Creek 0.1 mile above Pine Branch.....	June 13	4.20
Dog Creek 0.6 mile above Little Dog Creek.....	June 13	8.34
Wet Prong Buffalo Creek.....	June 12	2.04

* Water flowing from Green River into Cave.

Measurements of flow of Three, Bransford, Blair, Adwell, and Cooper Springs were continued. The following flow measurements were taken:

<u>Spring</u>	<u>Discharge in gallons per minute</u>			
	<u>Date</u>			
	<u>6-5-62</u>	<u>6-12-62</u>	<u>6-19-62</u>	<u>6-26-62</u>
Three Springs.....	28	24	26	21
Bransford.....	22	21	No	14
			measurement	
Blair.....	13	13	16	13
Cooper.....	28	26	26	26
Adwell.....	40	40	37	34

During the week of June 18-22, a survey was made of the sediment range lines in the Cave. This was the first time a complete survey could be made since the record high stages of the past winter. At this time, only preliminary generalizations can be made, but sizeable changes occurred. Some ranges showed that over a foot of scour occurred only to be cancelled out by later deposition. Several sunken boats were moved from their former locations. In Echo River, from 1 to 2 feet of scour occurred and the sediment levels were approximately equal to the levels measured in 1959. At the upper ranges, in the Lake Letha and River Styx sections, deposition was predominant, with 0.1 to 0.4 feet of new fill added since January 1962.

A meeting with Park Service officials on June 29 was attended by Geological Survey personnel to discuss plans for investigations and test drilling in 1963 fiscal year. It was agreed that two deep test wells would be drilled and test pumped on Flint Ridge in the area of the present water system, the drilling to be done in September or October.

Statement of Progress on Mammoth Cave Project
May 1-31, 1962

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

A visual inspection of the sediment deposits in the Cave was made on May 23. It appears that some change occurred at nearly all range lines during the record flooding of late February and early March. The detailed survey of the sediment deposition at each range was again delayed by high water, but it is planned that it will be made in mid-June.

Weekly water-level recorders were installed on the 4 test wells and 2 dug wells on Flint Ridge to obtain information on recharge and movement of ground water and the relation of water-level fluctuations to spring flow. The recorders will be continued in operation through the dry season.

Venturi flumes were installed at the outlets of Blair, Adwell, and Cooper Springs to obtain greater accuracy in reading low flows. Measurements at Cooper Spring were begun in May and will be continued through the dry season. The following flow measurements were made at the springs during May:

	Date of measurement	Discharge (gals. per minute)
Three Springs	5/15/62	30
Do.	5/22/62	30
Do.	5/29/62	26
Bransford Springs	5/15/62	23
Do.	5/29/62	18
Blair Spring	5/15/62	23
Do.	5/22/62	18
Do.	5/29/62	13
Adwell Spring	5/15/62	47
Do.	5/22/62	44
Do.	5/29/62	37
Cooper Spring	5/15/62	37
Do.	5/22/62	28
Do.	5/29/62	26

Statement of Progress on Mammoth Cave Project
April 1 - 30, 1962

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

Operation of the single-stage samplers in the Cave was continued in April. Resurveying of the sediment deposition ranges again had to be delayed until such time as the water level declines to a stage of 3.0 feet.

Site No. 4 on Flint Ridge was test drilled to a depth of 57 feet and bottomed in the black shale immediately overlying the Big Clifty Sandstone. Drill samples were collected for study. A short bailing test indicated that the well would yield 5-10 gallons per minute. The samples from all 4 test wells were studied and lithologic descriptions prepared.

Geological Survey personnel assisted in the running of a pump test on the drilled rock well at Crystal Cave. Many difficulties were encountered in the test, but it was finally determined that the well can be pumped at a rate of about 5 gallons per minute.

Several potential water sources were inspected during the month, including streams in Alice's Grotto and in Great Onyx Cave.

The flow of Three Springs and Bransford Spring was measured twice during April and the flow of Blair and Adwell Springs measured once near the end of the month. The computed discharge of the springs is as follows:

	Date of Measurement	Discharge (gals. per minute)
Three Springs.....	4/17/62	210
Three Springs.....	4/25/62	84
Bransford Springs.....	4/17/62	112
Bransford Springs.....	4/25/62	75
Blair Spring.....	4/25/62	23
Adwell Spring.....	5/ 3/62	91

Statement of Progress on Mammoth Cave Project
March 1 - 31, 1962

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

Near the end of February Green River started a rise that resulted in a flood that exceeded the 1913 and 1937 floods. The water surface reached a stage of 57.1 feet, March 2, 1962 in Mammoth Cave. The rise in stage exceeded the range of stage that the bubble gages in Mammoth Cave and at the Mammoth Cave Ferry on Green River can record. A field party is now engaged in putting the bubble gages back in operation and typing in highwater marks.

The flow of Three Springs and Bransford Springs was measured twice during February and the flow of Blair and Adwell Springs measured once. The computed discharge of these springs is as follows:

<u>Spring</u>	<u>Date of Measurement</u>	<u>Discharge</u> (gallons per minute)
Three Springs	2-12-62	120
" "	2-26-62	3,791
<u>Bransford Springs</u>	2-12-62	110
" "	2-26-62	2,041
Blair Spring	2-27-62	1,577
Adwell Spring	2-27-62	4,235

The large discharges obtained near the end of the month are assumed to be ground-water runoff from the period of heavy precipitation the last week in February. The discharge of Three Springs was the greatest ever recorded.

Plotting was completed of the sediment ranges measured in January. Planimetering of the four ranges normally under water shows no noticeable change in deposition or scour. However, there were changes from one side to another. In the land ranges, no significant changes have been observed. Since January, water in the Cave has been too high for any further surveys. A very high flood began at the end of the month which may have significant effects on the sediment deposits in the Cave.

High-water measurements were made at several sinking creeks and wells on the Pennyroyal Plain to record the change in slope of the subsurface drainage toward Green River as the result of the runoff from the heavy precipitation.

Sites were selected for the drilling of 4 test wells on Flint Ridge that will provide a maximum of information on availability of ground water and the size and shape of the ground-water body.

Statement of Progress on Mammoth Cave Project
March 1 - 31, 1962

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

The analysis and inspection of samples of deposited sediment collected during the January survey were nearly completed. Operation of the single stage samplers in the Cave was continued in March. The flood that occurred during late February and early March may have significantly altered some sediment deposits in the Cave. It was the first time that two of the upper sediment ranges have been under water since they were established in 1959. The 13 ranges will be resurveyed as soon as the water level reaches a stage of less than 3.00 feet.

Sites selected for test holes on Flint Ridge, northeast of Park Headquarters, were drilled in March. The purpose of the test drilling was to define the ground-water body perched on the Big Clifty sandstone. Three test holes, measuring respectively 62, 62.5, and 123 feet in depth, were completed. The first was drilled into the Big Clifty about 5 feet, and the second and third bottomed in the pyritiferous black shale immediately overlying the Big Clifty. The first and third holes

yielded small amounts of water, and the second is estimated to yield about 10 gpm. Recorders were installed on the completed holes and on two dug wells nearby. Drilling was under way on a fourth test hole at the end of the month.

The flow of Three Springs and Bransford Spring was measured twice during March and the flow of Blair and Adwell Springs measured once.

The computed discharge of these springs was as follows:

	Date of Measurement	Discharge (gallons per minute)
Three Springs	3/13/62	251
Three Springs	3/27/62	465
Bransford Spring	3/13/62	167
Bransford Spring	3/27/62	156
Blair Spring	3/27/62	237
Adwell Spring	3/27/62	451

Statement of Progress on Mammoth Cave Project
January 1 - 31, 1962

The two recording bubble gates on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued. The weekly samples for Echo River were low in chloride, indicating discharge of local ground water with little or not contamination from the Green River.

The flow of Three Springs and Bransford Springs was measured twice monthly during January. A marked increase in flow was noted during the third week of the month, with all springs overflowing at their sources. The flow of Adwell and Blair Springs was measured during the month and will be repeated at monthly intervals thereafter.

A preliminary geologic map of the Flint Ridge area was obtained from the Geologic Division and a reconnaissance made to check the relation of the tops of several horizons to the land surface. This information is to be used in selecting locations for the drilling of shallow test wells.

Eight of the 13 sediment ranges in the Cave were resurveyed and the sediment deposits resampled on January 4 and 5. This survey, along with the August 1961 survey, provides a measure of the changes in the sediment deposits due to the high water conditions of late December 1961. Samples of the suspended sediment during the high water were collected by automatic samplers in the Cave.

Statement of Progress on Mammoth Cave Project

December 1-31, 1961

The two recording bubble gages on Green River and in the Cave were maintained in operation as were the staff gages in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 4 wells; weekly water-level recorders were continued at 2 wells and at the end of Gardner and Little Sinking Creeks. The operation of the weekly chemical quality stations on Green River and Echo River outlet was continued.

Samples collected weekly at Green and Echo Rivers and at several wells and springs were analyzed. Daily chloride concentrations of the Green River collected at Munfordville rose steadily from October 1 (191 ppm chloride) to November 3 (570 ppm chloride) then decreased steadily to November 30 (92 ppm chloride). Daily chloride analyses for December have not been completed).

Measurements of flow of Three Springs and Bransford Springs were made by-monthly during December and will be continued on this basis until the flow ceases in the late summer.

Sediment ranges in the Cave were not read during December but will be measured as soon as the high water recedes to normal from the moderate rises that occurred in December. These are the first high stages noted since the ranges were surveyed in September 1961.

The inventory of wells and springs was completed in the area adjacent to the Park and south of the rim of the Dripping Springs Escarpment. Preliminary contouring of the water table using data from the inventory shows one major subsurface drainage toward the Turnhole on Green River via Mill Hole reentrant. Another drainage trends north between Cave City and Park City, possibly toward the Mammoth Cave water system.

Statement of Progress on Mammoth Cave Project December 1, 1961

The two recording bubble gages on Green River and in the Cave were maintained in operation. Staff gages were continued in operation in the Cave and at outlet streams. Monthly water-level recorders were continued in operation on 3 wells in the area and weekly water-level recorders were continued at the end of Gardner and Little Sinking Creeks. The operations of the weekly chemical quality stations on the Green River and Echo River outlet was continued.

Measurements of flow of Adwell Springs, Blair Springs, Dog Creek, and Buffalo Creek tributary spring, Echo River outlet, Big Hollow, Three Springs and Bransford Springs were made during November.

Data from 7 of the 13 sediment ranges in the Cave were plotted and prepared for planimetering to determine the net change in sediment deposition during the two years between surveys.

The inventory of wells and springs in the Park and the Pennyroyal was continued and preparation of a water-table contour map was begun which will show the direction of movement of ground water in the area.

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Regional Office
Region III
700 East Jefferson Street
Charlottesville, Virginia

March 3, 1959

Mr. Perry E. Brown
Superintendent
Mammoth Cave National Park
National Park Service
Mammoth Cave, Kentucky

Dear Mr. Brown:

This is a report of the results of chemical analyses that were performed on February 18, 1959, at the Three Springs Area and Bransford Spring Area. The primary purpose of making these tests was to determine the relative stability of the water from these two areas during the times of maximum flow. The chemical tests performed were pH, methyl orange alkalinity and total hardness. Any agitation of water containing carbon dioxide will result in some loss of this gas. For this reason it was necessary to make these determinations immediately after sampling. Samples of water were obtained from the storage reservoir at each spring area. Following are results of these tests.

	pH	M.O. Alk.	Total Hardness
Three Springs	6.8	30 ppm	22 ppm
Bransford Spring	6.8	38 ppm	32 ppm

Figure 1 on the attached chart shows the relationship of the pH and m. o. alkalinity as it affects the relative stability of a water. As will be noted from this chart, the water from these two spring areas, at the time of sampling, would be considered as slightly acid or readily aggressive toward any metal surface. These results explain the presence of the red, rusty water that appears in the residential area, particularly during the colder months of the year.

The most practicable and economical method of stabilizing this water would be to pass the water through a stabilizing filter utilizing marble chips as a filter medium. Considering the arrangement of the piping between the Three Springs Area and Reservoir Hill, it would be necessary to construct the stabilizing filter for these springs adjacent to the pump house. The filter for the Bransford Spring could be constructed either at the pump house or on Reservoir Hill. Each of these filters should have a surface area of at least 30 square feet in plan or 5 feet 6 inches square.

Mr. Perry E. Brown--3/3/59

The depth should be approximately equal to the depth of the storage reservoir. The floor of the filter should be equipped with a very simple water collection system with the design dependent upon the type of pipe or tile to be used. Approximately 12 inches of graded gravel should be placed over the underdrains and at least 36 inches of marble chips placed in the filter. These marble chips should be graded to range in size from about 1/16 inch to 1/8 inch. One place where these marble chips can be purchased is the Jamison Black Marble Company, P. O. Box 405, Roanoke, Virginia, and the last quotation I had indicated that these chips cost about \$23 per ton at the quarry in Harrisonburg, Virginia.

As requested, I will send you a pencil sketch in the near future showing the details of the filter box.

Sincerely yours,

Paul C. Henderson
Sanitary Engineer Consultant
to National Park Service

Enclosure

In reply refer to:
D5039

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
1953 JUN 15 AM 2 0 REGION ONE
RICHMOND, VIRGINIA

case
History
Log

JUN 15 1953

Memorandum

To: Director

From: Regional Engineer, Region One

Subject: Record of Well - Bransford Springs Area, Mammoth Cave NP

We are enclosing two copies of Form No. 9-255, Record of Well and two copies of Log of Well for the new well drilled at Bransford Springs Area, Mammoth Cave NP.

Robert J.
Regional Engineer

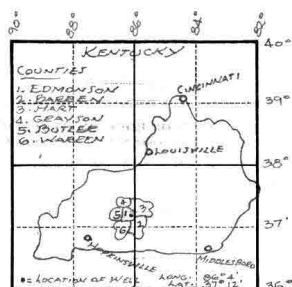
Attachments

9-555
(Jan. 1927)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

RECORD OF WELL

1. Location: State Kentucky County Edmonson
 Nearest P. O. Mammoth Cave Direction from P. O. NE
 Distance from P. O. 2.1 miles; 1/4 sec. _____, T. _____, R. _____
 If in city, give street and number _____



Locate well on plat of section.

2. Owner: Mammoth Cave National Park Address Mammoth Cave, Ky.
 Driller: M. L. Dillingham Address Glasgow, Ky.
 3. Situation: Is well on upland, in valley, or on hillside? Gentle slope
 4. Elevation of top of well: 724 ft. above the level of sea (Above or below) (Sea, depot, lake, or stream)
 5. Type of well: drilled (Dug, driven, bored, or drilled); kind of drilling rig used 22 W Bucyrus (Solid tool, jetting, rotary, etc.)
 6. Depth of well: 426 ft.; year in which well was finished June 8, 1953
 Does well enter rock? Yes; if so, at what depth? 10 ft.; kind of rock Sandstone & Limestone
 7. Diameter: At top 8 1/4 inches; at bottom 6 1/4 inches.
 8. Principal water bed: Five feet sand (Gravel, sand, clay, or rock. If rock, state kind)
 Depth to principal water bed 418 ft.; thickness of bed 5 ft.
 If other water supplies were found, give depth to each 356 to 363
 9. Casings: Kind Lapwell; size 6 1/4; length 80 ft.; between depths of 1 and 80 ft.
 Kind _____; size _____; length _____ ft.; between depths of _____ and _____ ft.
 Kind _____; size _____; length _____ ft.; between depths of _____ and _____ ft.
 Packers (if any): Depth at which packers were used None; kind _____
 Screen or Strainer: Was well finished with screen? _____; kind of screen None;
 length of screen _____ ft.; diameter _____ inches; size of openings None
 10. Head: Does well at present overflow without pumping? No; did it overflow when new? No;
 if flowing, give pressure _____ lb. per sq. inch; or height water will rise in a pipe _____ ft. above surface;
 original pressure or head _____; if not flowing, give water level in well 326 ft. below surface.
 11. Pump: Is the well pumped? Yes; kind of pump Drilling rig with steel line;
 size or capacity of pump 3" sucker rod; kind of power Gasoline engine
 12. Yield: Natural flow at present (if any) _____ gallons per minute; original flow _____ gallons per minute;
 well has been pumped at 30 gallons per minute continuously for 24 hours;
 quantity of water ordinarily obtained from well 43,200 gallons per day.
 13. Use: For what purpose is the water used? For community water supply
 14. Quality of the water: Soft (Hard or soft, fresh or salty, etc.); is there an analysis? No
 15. Cost of well, not including pump: \$2976.00 Temperature of water 56 ° F.
 Name of person filling blank /s/ M. L. Dillingham
 Date June 8, 1953 Address Glasgow, Ky.

On the back of this sheet give the record of the beds through which the well passes and any other facts not given above.

16-55655-1

LOG OF WELL

[illegible]

In reply refer to:
D5039

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
REGION ONE
RICHMOND, VIRGINIA

JUN 15 1953

Memorandum

To: Director
From: Regional Engineer, Region One
Subject: Record of Well - Bransford Springs Area, Mammoth Cave NP

We are enclosing two copies of Form No. 9-255, Record of Well and two copies of Log of Well for the new well drilled at Bransford Springs Area, Mammoth Cave NP.

(SIGNED)

Regional Engineer

Attachments

Log of Well at Bransford Spring Pumping StationMammoth Cave National Park

0-10	Dirt, composed of weathered sandstone, fine to coarse with some fine to medium gravel, yellow-brown
10-15	Sandstone, fine to coarse, and fine gravel; yellow-brown
15-22	Ditto, light gray
22-27	Sandstone, very fine to medium, light gray
27-33	Ditto
33-39	Ditto
39-45	Ditto, crevice rept. at 48'
45-48	Sandstone, very fine to medium, light gray. Limestone layer, at 45', med. grained, gray
48-54	Limestone, fine to medium grain, med. gray
54-60	Ditto
60-64	Ditto
64-71	Ditto, light gray, oolitic
71-78	Ditto
78-85	Ditto
85-90	Ditto
90-95	Ditto
95-100	Ditto
100-105	Ditto, contains Pyrite
105-110	Limestone, med. grain, med. gray
110-115	Ditto
115-120	Ditto
120-125	Ditto
125-140	Limestone, fine grain, oolitic, med. gray
140-148	Ditto
148-152	Ditto
152-151	Limestone, fine grain, med. gray
157-162	Limestone, fine grained, oolitic, med. gray
162-167	Ditto
167-175	Ditto, very oolitic, slightly lighter gray
175-180	Ditto, 167-175
180-185	Ditto, but no oolitic
185-192	Ditto, very oolitic
192-200	Ditto
200-207	Ditto, but no oolites
207-213	Ditto
213-220	Ditto
220-225	Ditto, very oolitic
225-230	Ditto
230-234	Ditto
234-240	Ditto

240-245	Limestone, fine grained, med. gray
245-250	Ditto, very oolitic
250-256	Limestone, fine grained, dolomitic, med. gray
256-261	Ditto
261-267	Limestone, very fine grained, oolitic, ls shows evidence of solution action around oolites, med. gray
267-272	Ditto
272-279	Limestone, very fine grained, oolitic, med. gray. Oolites separate in sample
279-285	Ditto
285-291	Ditto
291-298	Ditto
298-302	Ditto
302-306	Ditto
306-311	Ditto
311-316	Ditto
316-322	Ditto
322-328	Ditto
328-334	Ditto
334-339	Ditto
339-345	Limestone, fine grained, light gray
345-350	Limestone, very fine grained to fine grained, oolitic, med. gray
350-356	Sand, unconsolidated, very fine to medium, angular, clear, Fe stained; yellow-tan First water horizon; pumps 8 g.p.m.
356-362	Ditto, contains some coarse sand (2%)
362-366	Limestone, fine grained, oolitic, med. gray
366-373	Ditto, but slightly oolitic
373-378	Sand, very fine to fine grain, angular, clear, Fe stain; yellow-brown
378-384	Limestone, fine grained, light to med. gray, dolomitic
384-390	Ditto
390-400	Ditto
400-406	Limestone, fine grained, light to med. gray
406-412	Ditto
412-418	Limestone, very fine to fine grained, oolitic, light gray
418-424	Sand, very fine to medium, angular to sub angular, clear, Fe stained, yellow brown Second water horizon; main flow
424-426	Limestone

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER ANALYSIS

210W
Dec 1953

Location Mammoth Cave, Kentucky County Edmonson
 Source Drilled well (Bradford Springs Hotel) Depth (ft) 424 Diam (in.)
 Cased to (ft) 20 Date drilled 1953 Point of coll. Pipe at pump
 Owner National Park Service Use Public Supply
 Treatment None WBF Ste. Genevieve Ls WL 303.29' (6/22/53) Yield 25 gpm
 Temp (°F) 56 Appear when coll. Clear with flakes of sediment
 Collected March 29, 1956 By H. F. Brown & Don Gale
 Remarks Sample No. 3

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)		
Aluminum (Al)			Carbonate (CO ₃)		
Iron (Fe) <u>In sediment</u>	<u>0.26</u>	<u>—</u>			
Iron (Fe) <u>In solution</u>					
Iron (Fe) <u>when analyzed</u>	<u>.20</u>	<u>—</u>	Sulfate (SO ₄)		
<u>Manganese (Mn) In sediment</u>	<u>.00</u>	<u>—</u>	Chloride (Cl)		
<u>Manganese (Mn) In solution</u>					
<u>Manganese (Mn) analyzed</u>	<u>.00</u>	<u>—</u>	Fluoride (F)		
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)		
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
		Specific conductance (micromhos at 25° C)	<u>2,420</u>
Dissolved solids:		pH	
Sum		Color	<u>—</u>
Residue on evaporation at 180° C			
Suspended solids	<u>11</u>		
Hardness as CaCO ₃ :			
Calcium, magnesium			
Noncarbonate			

Lab. No. Col 9984Field No. 8600-3712-6Project By A.D. G. W.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

Dec 1953

Location Manmoth Cave, Kentucky County Edmonson
Source Drilled well (Bred and Spring well) Depth (ft) 124 Diam (in.)
Cased to (ft) 20 ± Date drilled 1953 Point of coll. Pipe at pump
Owner National Park Service
Treatment Use Public Supply
WBF See. Semivium Ia WL 103.50 (6/22/53) Yield 25 gpm
Temp (°F) 56 Appear when coll. Turbid
Collected March 29, 1956 By A. F. Brown & Son Co.
Remarks Sample No. 2

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)		
Aluminum (Al)			Carbonate (CO ₃)		
Iron (Fe) <u>In sediment</u>	<u>117</u>	<u>--</u>			
Iron (Fe) <u>In solution</u>	<u>.36</u>	<u>--</u>	Sulfate (SO ₄)		
<u>when analyzed</u>					
<u>In</u>			Chloride (Cl)		
<u>Magnesium (Mg) sediment</u>	<u>.00</u>	<u>--</u>			
<u>In solution</u>			Fluoride (F)		
<u>Magnesium (Mg) analyzed</u>	<u>.00</u>	<u>--</u>			
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)		
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
		Specific conductance (micromhos at 25° C)	<u>2,710</u>
Dissolved solids:		pH	
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids	<u>60</u>		
Hardness as CaCO ₃ :			
Calcium, magnesium			
Noncarbonate			

Lab. No. Col 9983 Field No. 8600-3720-6 Project By AFB & SN

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

2GW
Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
Source Drilled well (6 red hard Spring Well) Depth (ft) 424 Diam (in.)
Cased to (ft) 20 f Date collected 1953 Point of coll. Pipe at pump
Owner National Park Service Use Public Supply
Treatment Bo. Garvigne Ls Wt. 303.29 (6/12/53) Yield 25 gms
Temp (°F) 56 Apper. when coll. Turbid By R. F. Brown and Ben Gale
Collected March 22, 1956
Remarks Sample No. 1

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)		
Aluminum (Al)			Carbonate (CO ₃)		
Iron (Fe) In sediment	232	--			
Iron (Fe) In solution		--	Sulfate (SO ₄)		
Iron (Fe) when analyzed	.17	--	Chloride (Cl)		
Manganese (Mn) In sediment	.00	--	Fluoride (F)		
Manganese (Mn) In solution		--			
Manganese (Mn) when analyzed	.22	--			
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)		
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
		Specific conductance (micromhos at 25° C)	1,290
Dissolved solids:		pH	
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids	443		
Hardness as CaCO ₃ :			
Calcium, magnesium			
Noncarbonate			

Lab. No. Col 9982 Field No. 8680-3720-6 Project R. F. Brown & Ben Gale

PROVISIONAL RECORDS, SUBJECT TO REVISION

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

2GW
Dec. 1953

Location Mammoth Cave, Kentucky (1.5 mi. Northwest) County Edmonson
Source Bransford Spring well Depth (ft) 426 Diam (in.) 6 1/2
Cased to (ft) 80 Date drilled June 8, 1953 Point of coll. Outflow pipe
Owner National Park Service
Treatment St. Louis ? 380-426 feet Use Public supply
WBF 280 ft. below casing Yield 20 GPM pump estimate
Temp (°F) Appear. when coll. Clear (after pumped 5 min.) head.
Collected May 13, 1961 By J. A. Van Couvering
Remarks

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	170	2.79
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	1.2				
Iron (Fe)			Sulfate (SO ₄)	1,390	28.94
			Chloride (Cl)	2.0	.06
			Fluoride (F)	.3	.02
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)	.4	.01
Sodium (Na)					
Potassium (K)					
Total			Total		31.82

	ppm		
		Specific conductance (micromhos at 25° C)	2,190
Dissolved solids:		pH	7.5
Sum			
Residue on evaporation at 180° C		Color	
Suspended solids			
Hardness as CaCO ₃ :			
Calcium, magnesium	1,540		
Noncarbonate	1,400		

Lab. No. Col 24170 Field No. S-1,904.8-316.3 Project KY GS Q GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

2GW
Dec. 1953

Location Mammoth Cave, Kentucky County Edmonson
Source Drilled well (Breed and Spring well) Depth (ft) 424 Diam (in.)
Cased to (ft) 20 ± Date drilled 1953 Point of coll. Pipe at pump
Owner National Park Service
Treatment _____ Use Public Supply
WBF Sta. Generville La WL 303.29 (6/22/53) Yield 25 gpm
Temp (°F) 56 Appear. when coll. Turbid
Collected March 29, 1956 By R. F. Brown & Ben Gale
Remarks Sample No. 2

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)		
Aluminum (Al)			Carbonate (CO ₃)		
Iron (Fe) In sediment	317	--			
Iron (Fe) In solution			Sulfate (SO ₄)		
when analyzed	.36	--			
In			Chloride (Cl)		
Manganese (Mn) sediment	.00	--			
In solution			Fluoride (F)		
Manganese (Mn) analyzed	.00	--			
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)		
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
		Specific conductance (micromhos at 25° C)	1,740
Dissolved solids:		pH	
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids	681		
Hardness as CaCO ₃ :			
Calcium, magnesium			
Noncarbonate			

Lab. No. Col 9983 Field No. 8600-3710-6 Project By AIB Q GW

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

26W
Dec. 1953

Location Kanmooch Cave, Kentucky County Edmonson
Source Drilled well Depth (ft) 424 Diam (in.)
Cased to (ft) 20 ± Date drilled 1953 Point of coll. Pipe at pump
Owner National Park Service
Treatment Ste. Genevieve Ls WL 303.29' (5/22/53) Use Public Supply
WBF 56 Temp (°F) 56 Appear. when coll. Clear with flakes of sediment Yield 25 gpm
Collected March 27, 1956 By R. F. Brown & Ben Gale
Remarks Sample No. 3

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)		
Aluminum (Al)			Carbonate (CO ₃)		
Iron (Fe) In sediment	0.26	—			
Iron (Fe) In solution					
Iron (Fe) when analyzed	.20	—	Sulfate (SO ₄)		
Manganese (Mn) In sediment	.00	—	Chloride (Cl)		
Manganese (Mn) In solution			Fluoride (F)		
Manganese (Mn) when analyzed	.00	—			
Calcium (Ca)					
Magnesium (Mg)					
			Nitrate (NO ₃)		
Sodium (Na)					
Potassium (K)					
Total			Total		

	ppm		
		Specific conductance (micromhos at 25° C)	2,250
Dissolved solids:		pH	
Sum		Color	
Residue on evaporation at 180° C			
Suspended solids	11		
Hardness as CaCO ₃ :			
Calcium, magnesium			
Noncarbonate			

Col 2734 Field No. 5603-1710-6 Project Ky 115 Q GW

Other Supporting Information

Form 10-174
 June 1962

 UNITED STATES DEPARTMENT OF THE INTERIOR
 NATIONAL PARK SERVICE

FACE SHEET FOR COMPLETION REPORT

Mammoth Cave National Park		Region Southeast	Work Order No. B -MACA
Location in Park Headquarters Campground		State(s) Kentucky	Fund Symbol 1411035
☒ Contract and/or ☐ Day Labor		County or Counties Edmonson	Year Programmed 1963
Work Order Title Construction of Campground Utilities			PCP No. U-85, U-84-1, U-86
			Master Plan No. NP-MC-3026B
			Master Plan Corrected By
			As Built Drawings By EODC
			Date Started April 8, 1963
			Date Completed October 25, 1963
DESCRIPTION OF FIXED ASSETS (For completion by employee in charge of project)		TOTAL COSTS (For completion by FFO)	
Construction of campground utilities by contract, per attached narrative. This narrative also reports on construction under R-7-MACA and R-9-MACA, which was included in the same contract. Buildings and Utilities portion of contract: Water System (3,194 feet) \$16,048.02 Sewer System (2,233 feet) 18,222.16 Total 100.8 - Utilities \$34,270.18		39,753.41	
TOTAL		\$ 39,753.41	

DISTRIBUTION		THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES		
No.	To	Submitted By:	Title:	Date:
1	WASO-DEC	By: <i>Thomas E. Barton</i>	Project Supervisor	2/3/64
1	EODC	Approved: <i>Thomas E. Barton</i>	Title:	Date:
1	SERO	By: <i>Paul McG. Miller</i>	Superintendent	2/3/64
1	Mammoth Cave			
COSTS VERIFIED				
BY: <i>Mildred K. Lawson</i>		Date: 3/19/64		
		Acting Regional Accountant		

MILDRED K. LAWSON

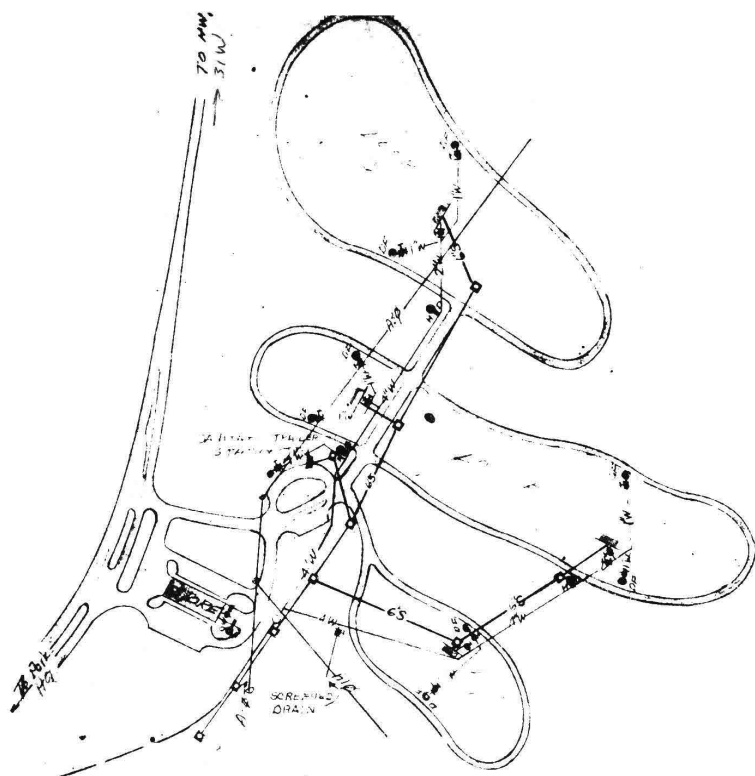
11360

1961. Walter F. Davis, Brownsville, Kentucky
A section of the water was tested
The [redacted] system of the Campground, a portion of contrast
[redacted] and report shows the [redacted] of California Orange
[redacted]-[redacted]-100. The system consisted of the six inch sewer, seven
is complete and the connection to the existing park system. The six inch
sewer was vitrified clay except where water lines were crossed. At these
points twenty feet of six inch Cast Iron soil pipe was used.

WATER DISTRIBUTION SYSTEM: On July 5, 1963, Walter F. Davis, Brownsville, Kentucky, started work on the water system, a portion of Contract No. 14-10-0131-1029. The contract specifications allowed an alternate of either four inch cement asbestos or cement lined cast iron pipe for the water main. The sub-contractor elected to install cement lined cast iron pipe manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama. Two inch and smaller lines were of galvanized steel. Appurtenances included three fire hydrants and eight drinking fountains. Water lines were installed and capped for future connection of four Comfort Stations. A sketch map showing the location of the distribution system, appurtenances and other facilities is attached.

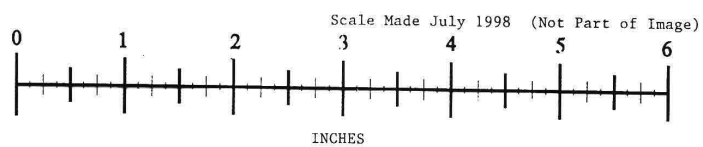
The water lines were tested under 150 pounds per square inch of pressure for a period of three hours with no drop in P.S.I. The lines were then back-filled.

Chlorination: H.T.H. was introduced into the system during the installation of the pipe. One H.T.H. tablet was placed in each eighteen foot joint of four inch and two inch pipe. One tablet was placed in each one inch service line to each drinking fountain between the connection to the main and the drinking fountain. The entire system was filled with water and allowed to stand for 48 hours before flushing.



Memorandum
Mammoth Cave National Park

By: TAY

$$\phi(35:7^0) = 25.1$$


Form 16-597
(Nov. 1958)

U. S. DEPARTMENT OF THE INTERIOR - NATIONAL PARK SERVICE

FIXED PROPERTY RECORD

DESCRIPTION OF PROPERTY (Include reference to the location within the Park; how the asset was acquired, name of contractor, etc.)

1. Water System: Utility No. 23. Water Storage and Pump House; 10,000 gallons capacity tank. Spring. 262 sq. ft. 350 Lin. Ft. pipe. Located MCHP, Ky. (North District). Acquired and constructed by CCC.
2. Water System: Utility No. 24. Pump House, electric pump, masonry structure, concrete floors. 420 sq. ft. Located Three Springs, Ky. Acquired and constructed by CCC. Utility No. 25. Pump House, electric pump. 420 sq. ft. 280 ft. well, 6" pipe, masonry structure of native sandstone, concrete floors. Springs. Located Bransford Springs, Ky. Acquired and constructed by NPS. (Three Springs and Bransford Springs, altogether - length of pipe 29,340 feet.)
3. Water System: 30,290 ft. of 8, 6, 2" lines. Two 50,000 gallon Reservoirs, concrete; Two 50,000 gallons catch basins, concrete. Located Kentucky. Original system by NPS and CCC.
4. Water System: Snowball Dining Room. 4650 Lin. Ft. 4" Water Line; 255 Lin. Ft. 2" Water Line; 200 Lin. Ft. 1" Water Line. Contractor Clarke Stewart and Wood Co. Contract No. 14-10-121-144. Construction.

LINE NO.	DATE	REFERENCE		QUANTITY			COST		
		Journal Vou.	Other	Unit	No. of Units	Accumulated Total	Direct Costs	Indirect Costs	Accumulated Costs
1	10/9/59	31-83		System	1		\$2,800.00		
2	10/9/59	31-83		System	1		7,339.83		
3	10/9/59	31-83		System	1	3	183,779.83		\$193,919.66
4	Account #	331.1		System	1	4	19,453.00	\$2,667.00	\$216,039.66
5	Account #	331.2		Added (Construction)			2,000.00	306.80	\$218,346.46
G.L. Acct. No.		General Classification			Sub-Classification		Region	State	Park or Office
100.8		UTILITIES			Water System		One	Kentucky	Mammoth Cave NP

5. Water System: Construction: 110 Lin. Ft. of 4" cast iron pipe; 60 Lin. Ft. of 1" plastic pipe; two 4" fire hydrants, two 4" Gate Valves w/boxes; 3 1" Gate Valves w/boxes; 3 1" Corporation Stops. Located Residence Area. Contractor Stuart Construction Company. Cont. No. 14-10-131-414.
6. Water System: 395 Lin. Ft. 2" pipe. Construction. Contractor Clarke, Stewart and Wood, Inc. Unnumbered Contract.
7. Water System: 310 Lin. ft. of water lines with two fire hydrants added to water system located at residential area. W.C. No. 231.4
8. Water connection at Visitor Center consisting of 120' of 2½" water line, three ¾" street washers and three outside wall hydrants attached to Visitor Center Building-Glasgow Construction Co., Contract No. 14-10-131-435. And 2 wall type fire hydrants.. one located in the auditorium and the other in the Exhibit Room..each is 1½", no.5-41 sein-automatic hose rack, manufactured by Elkhart Brass Manuf. Co.
9. One water system acquired with Crystal Cave consisting of Fairbanks-Morse plunger type pump, 15 gal. per minute capacity. Depth of well approximately 440' with a 6 7/8" casing. Pump house is of concrete block, concrete floor and steps. House is below ground, and measures 8' x 9' x 8'. 533' of 1" metal pipe to residence and office building, 904' of ¾" plastic pipe to cook house and bunkhouse and 259' of metal to cookhouse and residence. Located at Flint Ridge Section.

Docket Information

Number of Documents in Docket 47

Documents Dated from 6/8/1953 to 12/10/1964

Docket Compiled: 4/27/2011