



WATER-RIGHT DOCKET

Mammoth Cave National Park

Docket No: 9
GREAT ONYX CAVE WELL
Supporting Hydro Data

09-04-1964: letter to superintendent from department of interior regarding results and data relating to the pumping test



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Asst. Dir. _____
Asst. Dir. _____
Sec'y _____
Adm. Asst. _____
Park Eng. _____
Protection _____
Interp. _____
Prep. Reply _____
Comments _____
Action _____

IN REPLY REFER TO:

522 W. Jefferson, Rm. 310
Louisville, Kentucky 40202
September 4, 1964

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

Dear Mr. Miller:

The following results and data relating to the pumping test of the well at Great Onyx Cave made on August 8-10 by H. T. Hopkins and D. V. Whitesides of this office are furnished herewith for your records.

PUMP SETTING - Intake of 15 H. P. submersible pump set at 394 feet below top of casing, which is at land surface. The intake was 4 feet below the level of the principal water-bearing fracture and 11 feet above the bottom of the well.

AIRLINE SETTING - Bottom end of 1/4" copper airline set 5.70 feet above pump intake. Total length of airline from bottom to center of gauge (set at 2.5 feet above top of casing) was 390.80 feet.

DISCHARGE PIPE - 2-inch galvanized pipe discharging at the land surface 15 feet downslope from the well.

DURATION OF TEST - Pumped for 19 hours, pumping to waste at which time 6,400 feet of 2-inch plastic tubing was connected to the end of the discharge line for the purpose of flushing and chlorinating the line. Pumping continued through the extended discharge line for another 5 hours and 20 minutes, at which time pumping was stopped.

PUMPING RATE - Stabilized at 25 gallons per minute.

STATIC WATER LEVEL AT START OF TEST - 325.5 feet below
top of casing.

PUMPING LEVEL AT END OF PUMPING TO WASTE - 367.5 feet
below top of casing.

SPECIFIC CAPACITY OF WELL - About 0.6 gallons per minute
per foot of drawdown.

CHANGE IN CHEMICAL QUALITY OF WATER - The quality, as
determined from field tests, changed as follows:

	<u>Start of test</u>	<u>After pumping 24 hours</u>
Specific conductance (micromhos at 18°C	400	900
Chloride (ppm)	10	35
Hardness (ppm)	342	684
pH	7.8	--
Temperature (degrees F)	61.5	61.0

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

Date	Time (CST)	Airline reading (feet)	Net change from static level (feet)	Depth to water below top of casing (feet)	Yield of well (gpm)
8-8-64	1430	60	--	325.5	0
	1432	16	-44	369.5	90
	1433.5	10	-50	375.5	45 ^{1/}
	1434	18	-42	367.5	15 ^{1/}
	1631	35	-25	350.5	26 ^{1/}
	2345	19	-41	366.5	26
8-9-64	0015	18	-42	367.5	26
	0930	18	-42	367.5	25
	1030 ^{2/}	22	-38	363.5	25
	1200 ^{3/}	28	-32	351.5	25
	1430	23	-37	362.5	25
	1438	19	-41	366.5	36 ^{4/}
	1450	2	-58	383.5	36
End of test					

1/ Output of pump adjusted to stabilize drawdown.

2/ 6,400-foot plastic tubing connected to discharge line to flush and chlorinate tubing.

3/ Plastic tubing disconnected.

4/ Output of pump increased to check yield.

The complete set of readings taken during the test are on file in this office if you should need to refer to them.

Very truly yours,

R. V. Cushman

R. V. Cushman
District Geologist

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

PROVISIONAL RECORDS, SUBJECT TO REVISION
 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 WATER ANALYSIS

26W

Location Mammoth Cave, Kentucky County Edmonson
 Source Well (Great Dixie) Depth (ft) 405 Diam (in.) _____
 Cased to (ft) _____ Date drilled _____ Point of coll. _____
 Owner National Park Service
 Treatment _____ Use _____
 WBF _____ WL _____ Yield _____
 Temp (°F) _____ Appear. when coll. Slightly turbid
 Collected August 14, 1964 By U.S.G.S. HTH/edw
 Remarks Field check: pH 7.5, Hardness 800 ppm, Cl. 32 ppm, Sp. cond. 900 plus.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	168	2.75
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.12				
			Sulfate (SO ₄)	558	11.62
			Chloride (Cl)	24	.68
			Fluoride (F)	.8	.04
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	.3	.01
Sodium (Na)					
Potassium (K)					
Total			Total		15.10

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	1,270
Calculated		pH	7.6
Residue on evaporation at 180° C		Color	
Hardness as CaCO ₃	724		
Noncarbonate	586		

Lab. No. Col 32204 Field No. S-1,906.1-322.0 Project KY MAMMOTH CAVE Q GW

PREVIOUS RECORDS, SUBJECT TO REVISION
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

26W

Location Mammoth Cave, Kentucky County Edmonson
 Source Well (Great Onyx) Depth (ft) 405 Diam (in.)
 Cased to (ft) Date drilled June 1964 Point of coll. Plastic pipe, 6,400 ft. south of well
 Owner National Park Service
 Treatment Use Public supply
 WBF Edmonson, 324-392 feet WL 325 ft. below LSD Yield 26 GPM pump measured
 Temp (°F) 74 Appear. when coll. Clear
 Collected August 10, 1964 By D. V. Whitesides
 Remarks Field conductance 990, Cl 25 ppm, hardness 772 ppm. Sampled after pumping 40 hours.

	ppm	epm		ppm	epm
Silica (SiO ₂)	8.6		Bicarbonate (HCO ₃)	166	2.72
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	.15				
Manganese (Mn)	.10		Sulfate (SO ₄)	508	10.58
			Chloride (Cl)	24	.68
			Fluoride (F)	1.7	.09
Calcium (Ca)	137	6.84			
Magnesium (Mg)	80	6.58	Nitrate (NO ₃)	.9	.01
Sodium (Na)	19	.83			
Potassium (K)	.7	.02			
Total		14.27	Total		14.08

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	1,190
Calculated	862	pH	7.7
Residue on evaporation at 180° C	947	Color	5
Hardness as CaCO ₃	672		
Noncarbonate	536		

Lab. No. Col 32134 Field No. S-1,906.1-322.0 Project KE MAMMOTH CAVE Q GW

PROVISIONAL RECORDS, SUBJECT TO REVISION

 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 WATER ANALYSIS

2GW

Location Mammoth Cave, Kentucky County Edmonson
 Source Drilled well Depth (ft) 105 Diam (in.) _____
 Cased to (ft) _____ Date drilled July 1964 Point of coll. Bailer
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF limestone, 324-390 ft. WL 331+ ft. below LSD Yield 20+ bbl, estimated
 Temp (°F) 59 Appear. when coll. Turbid & muddy colored (Static)
 Collected July 14, 1964 By B. A. Escher
 Remarks Sampled taken after drilling completed and after bailing 30 minutes. Great Oxyz

test No. 1	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	180	2.95
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	2.4	--			
			Sulfate (SO ₄)	188	3.91
			Chloride (Cl)	13	.37
			Fluoride (F)	1.5	.08
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	.6	.01
Sodium (Na)					
Potassium (K)					
Total			Total	7.32	

	ppm		
		Specific conductance (micromhos at 25° C)	663
Dissolved solids:		pH	6.8
Calculated		Color	
Residue on evaporation at 180° C			
Hardness as CaCO ₃	342		
Noncarbonate	194		

PROVISIONAL RECORDS, SUBJECT TO REVISION

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

2GW

WATER ANALYSIS

Location Mammoth Cave, Kentucky County Edmonson
 Source Drilled well Depth (ft) 105 Diam (in.) _____
 Cased to (ft) _____ Date drilled July 1964 Point of coll. Boiler
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Limestone, 324-390 feet WL 320 ft. below L&D Yield 20+ GPM pump estimated
 Temp (°F) 69 Appear. when coll. Muddy colored and sand (Static)
 Collected July 13, 1964 By R. E. Fisher
 Remarks Sampled after boiling 20 minutes.

	ppm	epm		ppm	epm
Silica (SiO ₂)	8.0	--	Bicarbonate (HCO ₃)	184	3.02
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	.25	--			
Manganese (Mn)	.00	--	Sulfate (SO ₄)	195	4.06
			Chloride (Cl)	12	.34
			Fluoride (F)	1.6	.08
Calcium (Ca)	69	3.44			
Magnesium (Mg)	42	3.45	Nitrate (NO ₃)	.9	.01
Sodium (Na)	9.2	.40			
Potassium (K)	1.1	.03			
Total		7.32	Total		7.51

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	674
Calculated	130	pH	7.4
Residue on evaporation at 180°C	169	Color	5
Hardness as CaCO ₃	345		
Noncarbonate	154		

	ppm	Specific conductance (micromhos at 25° C)	403
Dissolved solids:		pH	7.0
Calculation:		Color	
Residue on evaporation at 180° C			
Hardness as CaCO ₃	198		
Noncarbonate	93		

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER ANALYSIS

2GW

Location Mammoth Cave, Kentucky County Edmonson
 Source Drilled well Depth (ft) 325 Diam (in.) _____
 Cased to (ft) _____ Date drilled July 1964 Point of coll. Bailer
 Owner National Park Service
 Treatment _____ Use Public supply
 WBF Limestone 324 ft.- WL 311 ft. below LSD Yield 2 GPM estimated
 Temp (°F) 61 Appear. when coll. Muddy colored and turbid (Static)
 Collected July 6, 1964, 1200 CST By R. A. Escher
 Remarks Sampled after bailing 10 minutes. Onyx Cave test.

	ppm	epm		ppm	epm
Silica (SiO ₂)			Bicarbonate (HCO ₃)	110	1.80
Aluminum (Al)			Carbonate (CO ₃)	0	.00
Iron (Fe)	0.03	--	Sulfate (SO ₄)	75	1.56
			Chloride (Cl)	4.0	.11
			Fluoride (F)	.7	.04
Calcium (Ca)					
Magnesium (Mg)			Nitrate (NO ₃)	1.5	.02
Sodium (Na)					
Potassium (K)					
Total			Total		3.53

	ppm		
Dissolved solids:		Specific conductance (micromhos at 25° C)	336
Calculated		pH	7.0
Residue on evaporation at 180° C		Color	
Hardness as CaCO ₃	168		
Noncarbonate	78		

PROGRESS ON DRILLING OF TEST WELL S-1, 906.1-322.0 AT
GREAT ONYX CAVE, MAMMOTH CAVE NATIONAL PARK

Test well (8-inch diameter) located about 60 feet east of old house foundation at edge of woods on highest hill.

(Time shown is Central Standard; depths in feet)

Monday, June 22, 1964

10:05 a.m. - Started drilling.

- 0 - 7 Soil, brown; fine sand and silt.
- 7 - 10 Clay, red, and some silt. Dense and compact, sticks to drill.

10:45 a.m. - Shut down to wait for bonding papers and contract to be signed and sealed.

Tuesday, June 23

10:15 a.m. - Started drilling at 10 feet. Struck solid bedrock (limestone) at 26-1/2 feet.

- 26 $\frac{1}{2}$ - 30 Limestone, light-gray to brownish-gray, highly fossiliferous, numerous crinoid fragments; chips up to 3/4-inch diameter. Hard drilling from 27 to 29 feet.
- 30 - 32 Limestone, light- to dark-gray, and shale, light-gray. Crinoids present.
- 32 - 35 Limestone, dark-gray, and shale, black. Crinoids present; shale chips up to 1/4-inch diameter. Drilling easier. Driller reports 1-foot cavernous zone at 34 feet; will need casing; made considerable mud when bailed. This probably is the cavernous zone near the base of the Haney Limestone.
- 35 - 41 Shale, black, with a few light-gray sandstone chips and some coal. Much mud when bailed.
- 41 - 45 Sandstone, light-gray, soft, with a little black shale. Sandstone crumbles in fingers; chips up to 1/2 inch.

5:25 p.m. - Quit drilling at 45 feet.

Wednesday, June 24

7:30 a.m. - Started drilling.

- 45 - 55 Sandstone, light gray-brown. Drilling is hard on bits. Changed bits at 9:00 a.m. Driller thinks it may be due to quartz pebbles falling in from above?
- 55 - 60 Sandstone; changed to brown and got harder; came out in chips.
- 60 - 66 Sandstone, light-brown; came out like beach sand. Hard cutting, wore down bit. When bailed, first 3 bailers were full so must be making a little water.
- 66 - 72 Same as 60-66, but no water.
- 72 - 80 Sandstone, light-brown, with numerous small chips of gray-brown shale. Easier cutting; changed bit at 1:10 p.m.
- 80 - 87 Limestone, dark-gray, with a little brown sandstone. Probably hit limestone about 81 feet as there was only a little sand in sample and bit was not worn at all.
- 87 - 93 Limestone, gray, with shale and some clay; small chert nodules present. Shale chips up to 1 inch.
- 93 - 100 Limestone, light-gray, with small chips of shale and some clay; small chert nodules present. Shale chips less than 1/2 inch.

Thursday, June 25

Drillers picked up 44 feet of 8-inch ID pipe to set in upper 44 feet of hole (1 length - 18 ft 5 in; 1 length - 20 ft 8 in; 1 length - 5 ft)

8:00 a.m. - Started reaming hole to 13-5/8 inches to set above sections of pipe.

4:10 p.m. - Lost 13-inch reamer in hole (unscrewed) at 33 feet.

4:40 p.m. - Fishing for 13-inch reamer.

Friday, June 26

Continued fishing operations.

Saturday, June 27

Retrieved 13-inch reamer.

Monday, June 29

7:00 a.m. - Bailed hole. Set 43 feet of 8-inch ID casing.

11:00 a.m. - Started drilling.

100 - 101 Limestone, gray-brown, flaky, with chips of greenish shale.

101 - 106 Limestone, gray-brown, flaky, with chips of green shale; contains some crinoid stems and sand nodules (ironstone).

106 - 112 Limestone, gray, flaky, with clay balls and some shale.

Tuesday, June 30

7:00 a.m. - Started drilling.

112 - 117 Limestone, gray, flaky, with chips of green shale.

117 - 122 Limestone, gray-blue, and shale. Easier drilling than above.

122 - 129 Limestone, gray-brown, hard. Trace of limestone, gray-blue, oolitic.

129 - 136 Same as 122-129.

136 - 142 Limestone, gray-blue, flaky, with shale chips.

142 - 148 Limestone, gray-brown, hard. Trace of shale chips. Oolitic.

148 - 153 Limestone, gray-brown, hard. Fine chips up to 1/4 inch.

Wednesday, July 1

7:00 a.m. - Started drilling.

- 153 - 160 Limestone, gray-blue, little coarser than previous sample.
- 160 - 167 Limestone, gray, with some fragments of white chert and brown ?quartz?; few chips up to 1/4 inch, but mostly subangular fragments. Hard drilling; cutting edge of bit chipped out; changed bits.
- 167 - 174 Limestone, gray-brown, hard, fine cuttings; some whitish chert.
- 174 - 181 Limestone, light-gray, hard; numerous chips of whitish chert and a few small lumps of whitish chalky material.
- 181 - 188 Limestone, gray-blue, hard, with chips up to 3/8 inch; several flakes of buff limestone.

5:00 p.m. - Quit drilling for the day.

Thursday, July 2

7:30 a.m. - Bailed out and started drilling.

9:00 a.m. - Oil line broke. Stopped to go get new line and make repair.

11:00 a.m. - Started drilling again.

- 188 - 192 Limestone, gray-brown, fine-grained, hard; angular fragments up to 1/4 inch. Like lithographic limestone.
- 192 - 197 Limestone, gray-brown, slightly lighter than previous sample, hard; angular fragments and a few chips up to 1/8 inch.
- 197 - 205 Limestone, light gray-brown, flaky, hard, finer than previous sample.
- 205 - 210 Limestone, nearly white, hard, oolitic; a few chips up to 1/4 inch, but mostly fine fragments.
- 210 - 214 Limestone, light gray-brown, hard, about like 197-205 in color and character. Medium drilling; changed bits.

4:45 p.m. - Quit drilling for the day.

Friday, July 3

5:30 a.m. - Started drilling

- 214 - 220 Limestone, dark gray-brown, hard; fragments up to 1/4 inch, a few chips.
- 220 - 226 Limestone, gray-brown, hard, numerous chips; fragments up to 1/8 inch. One fragment of oolite showed fluorite under hand lens.
- 226 - 232 Limestone, gray-brown, hard; fragments up to 1/8 inch.
- 232 - 239 Limestone, gray to dark-gray, hard; some shale chips; largest fragments up to 1/2 inch.
- 239 - 241 Limestone, gray to dark-gray, hard. Driller says may be small crevice at 239 feet.

1:30 p.m. - Quit drilling. Bailed hole dry.

Monday, July 6

7:00 a.m. - Changed bits and started drilling. Bailed before drilling started - dry hole (no water yield).

- 241 - 247 Limestone, gray and brown, base is gray; small fragments. Medium drilling.
- 247 - 253 Limestone, darker gray and brown; larger fragments than previous sample. Medium drilling.
- 253 - 257 Limestone, gray and brown, base is gray; some small fragments. Medium drilling.
- 257 - 263 Limestone, light-gray (change of formation); all small fragments. Hard drilling.
- 263 - 270 Limestone, gray and white with brown mixture (change of formation), few flakes, oolitic. Hard drilling.
- 270 - 272 Limestone, gray and white with brownish mixture, few flakes. Hard drilling.

5:30 p.m. - Quit drilling for the day.

Tuesday, July 7

6:30 a.m. - Bailed hole, hole was dry. Started drilling.

272 - 279 Limestone, gray and brown, numerous small flakes, oolitic, ?some quartz?; fragments up to 1/8 inch. Medium drilling.

279 - 284 Limestone, gray and darker brown, some small white flakes, oolitic; fragments about the same as previous sample. Medium drilling.

This is the elevation of pool of water in lower part of Great Onyx Cave. NO SIGN OF WATER. Reached this elevation approximately 10:15-10:25 a.m.

11:10 a.m. - Valve sticking. Shut down, changed spark plugs.

12:00 noon - Started drilling again.

284 - 289 Limestone, near white and brown, few flakes; fragments starting to get a little larger. Soft drilling.

289 - 295 Limestone, brown with a little white, few small flakes; mostly small fragments. Medium drilling; changed bits.

295 - 301 Limestone, brown with a little white; smaller fragments than previous sample, otherwise same as 289-295. Medium drilling.

301 - 306 Limestone, gray and brown, no flakes; fine fragments. Medium drilling.

5:00 p.m. - Quit drilling for the day.

Wednesday, July 8

7:00 a.m. - Bailed hole; dry hole. Started drilling.

306 - 312 Limestone, gray and brown, more gray than brown, few chips, oolitic; small fragments of light gray. Medium drilling.

312 - 318 Limestone, gray and brown, coarser than previous sample, few flakes; fragments up to 1/4 inch. Medium drilling.

318 - 325 Limestone, gray and brown, more gray than brown, flakes larger and more numerous; fragments larger than previous sample. Hit small vein of water at approximately 11:55 a.m. Driller estimated vein at 2 to 3 gpm. Driller said it took 45 minutes to drill this 7 feet and then became harder so he estimates the vein at 324 feet.

12:20 p.m. - Depth from top of casing to water level = 311.81 feet (311'9-3/4"); depth of water in well = 13.19 feet (13'2-1/4"). Sample taken and field test run. Results were as follows:

Chloride: 10-15 ppm
Hardness: 10 grains/gal
Temperature: 61°F
pH: 7.4 (water purity kit)

Bailer test run. Shut down for 30 minutes, then bailed well. Well makes approximately 2 gpm, according to driller.

1:45 p.m. - Started drilling again.

325 - 332 Limestone, gray and brown, few flakes; fragments up to 1/8 inch, occasional white chert fragments starting to show up.

Bailed hole dry - approximately 90 gallons of water in well. Field test run - results same as before with exception of temperature which was 66°F. Sample not taken because driller said we had hit no new streams. Water appeared turbid and lime colored, not as muddy as previous sample.

332 - 339 Limestone, gray and brown, same as previous sample. Water sample taken at this depth.

5:00 p.m. - Quit drilling for the day.

7:15 p.m. - Water level = 310.46 feet (310' 5-1/2") from top of casing.

Thursday, July 9

7:00 a.m. - Started drilling.

8:10 a.m. - Shut down. Bearing in rig broken; had to go to Bowling Green for repair.

6:45 p.m. - Rig back in operating condition. Started drilling.
Estimated 2 feet drilled before shut down.

Water-level measurement from top of platform = $310' 10\frac{1}{2}"$
or $310' 1\frac{1}{2}"$ from top of casing.

Friday, July 10

7:00 a.m. - Started drilling Driller reported water level same as above.

339 - 346 Limestone, gray and brown; a few fragments up to 1/8 inch. Medium drilling.

346 - 353 Limestone, gray and brown, coarser than last sample; fragments up to 1/8 inch, fragments of light-gray limestone more numerous, occasional flakes. Medium drilling; old bit worn out, changed bit.

353 - 360 Limestone, gray and brown, appears coarser; fragments up to 1/4 inch with a few larger flakes. Medium to soft drilling. Driller expects another vein of water within next 15 feet.

360 - 367 Limestone, gray with some brown; fragments up to 1/8 inch, with occasional chert fragments. Medium drilling.

367 - 374 Limestone, light-gray; fragments up to 1/8 inch, with more chert. Very hard drilling. Bit was very dull when brought out to sample. The last 15-30 minutes the drill moved hardly a foot. Well was bailed down.

4:00 p.m. - Quit drilling for the day.

Monday, July 13

7:00 a.m. - Changed bits and started drilling. Water level = 309.50 feet from top of casing.

374 - 378 Limestone, light-gray and brown; gritty fragments mixed with chert. Hard drilling.

378 - 384 Limestone, light-gray and brown; finer fragments than previous sample and just a shade lighter, otherwise same as previous sample. Hard drilling. Changed bits again. Driller bailed well to check for any extra streams. NO MORE WATER.

384 - 392 Limestone and sand, light-tan (driller calls it water sand). Hit vein at 390 feet (base of it) at 11:40 a.m. Bailed for a half hour at rate of 20 gpm; water level couldn't be lowered below 347 feet. Driller estimates well is producing 20+ gpm. Sample taken and field test run. Results were as follows:

Chloride: 15 ppm
Hardness: 19 grains/gal
Temperature: 60°F
pH: 7.8

1:30 p.m. - Driller's measurement of water level after 45 minutes shut down = 325 feet below top of casing.

4:00 p.m. - Water level checked = 323.6 feet below top of casing. Also sounded depth of well at 392.8 feet.

392 - 397 Limestone, tan and gray; fragments up to 1/8 inch, occasional fragments 1/4 inch or larger. NO MORE WATER.

6:00 p.m. - Quit drilling for the day.

Tuesday, July 14

8:45 a.m. - Water level = 320.3 feet below top of casing.

9:00 a.m. - Started drilling after changing bits.

397 - 405.35 Limestone, light-brown with bits of gray; occasional fragments up to 1/4 inch.

10:40 a.m. - Quit drilling.

10:45 a.m. - Bailer test run. Bailed 28 consecutive bailers full (20 gal. each) in 30 minutes and lowered water level from 320.3 feet to 345 feet; from the last bailer full until the time measuring device was set up (3 minutes) water level rose to 331.25 feet or 14.75 feet in 3 minutes.

11:20 a.m. - Sounded well at 405.35 feet from top of platform which is the approximate level of new nipple to be installed later. Installed coupling on casing. From this time on all measurements will be taken from the top of the coupling 0.96 foot above top of casing. Sample taken and field test run. Results were as follows:

Chloride: 25 ppm
Hardness: 19 grains/gal
Temperature: 59°F
pH: 7.4

1:25 p.m. - Depth to water from top of casing (new coupling) = 323.7 feet; depth of well from new measuring point = 405.37 feet.

After driller has concreted casing in, levels will be run to top of casing and (or) top of coupling.

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

FACE SHEET FOR COMPLETION REPORT

Park <u>Mammoth Cave National Park</u>	Region <u>Southeast</u>	Order No. <u>211710</u>
Location in Park <u>Great Onyx Cave Area</u>	State(s) <u>Kentucky</u>	Fund Symbol <u>14X1035</u>
☒ Contract and/or ☐ Day Labor	County or Counties <u>Edmonson</u>	Year Programmed <u>1966</u>
Work Order Title <u>Great Onyx Well and Water System</u> <u>Contract No. 14-10-0131-1575</u>		PCP No. <u>U-108 MACA</u>
		Master Plan No.
		Master Plan Corrected By
		As Built Drawings By
		Date Started <u>January 14, 1966</u>
		Date Completed <u>April 21, 1967</u>
DESCRIPTION OF FIXED ASSETS (For completion by employee in charge of project)		TOTAL COSTS (For completion by FFO)
<u>230</u> ~~<u>100.0</u>~~ 1. Utility System (Water) 22,948.60		26,620.38
TOTAL		\$ 26,620.38

DISTRIBUTION		THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES		
No.	To	Submitted	Title:	Date:
1	WASO	By: <u>Thomas E. Barton</u>	Project Supervisor	1-26-68
1	PSC	Approved	Title:	Date:
2	SERO	By: <u>William E. Edwards, Jr.</u>	Acting Superintendent	1-26-68
1	MACA	COSTS VERIFIED	Title:	Date:
		BY <u>T. J. Baer</u>	Regional Accountant	APR 25 1968

Rec'd w/ memo to Dept. from: Chap. O.W. - wsc - dated March 7, 1969

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

COMPOSITION OF COST FOR COMPLETION REPORT

Work Order Number

211710

Fund Symbol

14X1035

Year Programmed

1966

Park	Region	Year Programmed
Mammoth Cave N.P.	SERO	1966
Location in Park		
Mammoth Cave National Park - Great Onyx Cave Area		
Work Order Title		
Great Onyx Well and Water System		
Contract No. 14-10-0131-1575		
Great Onyx Cave Area		

COMPOSITION OF COST

COSTS CHARGED TO FUNDS ALLOTTED TO FIELD FINANCE OFFICE		
(1) Personal Services.....	\$ 376.66	
(2) Travel.....		
(3) Contract Work	21,218.45	
(4) Supplies and Materials.....	1,169.63	
(5) Other Direct Expenses.....	4.15	
(6) Operation of Equipment.....	8.71	
(7) Depreciation of Equipment.....		
(8) Purchase of Construction Equipment.....		
(9) Purchase of Other Accountable Equipment	171.00	
(10) Other Costs:		
(11) TOTAL COST CHARGED TO FFO FUNDS	xxxxxxxxxx	\$ 22,948.60
OTHER COSTS:		
(12) PS&S, AP, and/or Facilitating Services @ 16 %.....	\$ 3,671.78	
(13) Inventory and Other Non-Fund Costs		3,671.78
(14) GROSS WORK ORDER COSTS	xxxxxxxxxx	\$ 26,620.38
LESS:		
(15) Residual Value of Construction Equipment on Line 8	\$	
(16) Other Credits		
(17) NET COST OF FIXED ASSETS	xxxxxxxxxx	\$ 26,620.38

Identify other costs and other credits by line item entry, on an attached schedule, or explain in narrative.

DETAILED LISTING AND COST OF ACCOUNTABLE EQUIPMENT

PROJECT 211710 MAMMOTH CAVE

<u>ITEM</u>	<u>COST</u>
Chemical Feed Pump, Model S, Precision, complete with plastic piping	\$171.00
TOTAL	<u>\$171.00</u>

COMPLETION REPORT

Narrative

Contract No.: 14-10-0131-1575
Great Onyx Well & Water System

Prime Contractor: D. Y. Bybee Plumbing Company
Cave City, Kentucky

Sub-Contractors: None

Basic Contract Information:

Bid Invitation No.	135-16-FODC-E-18-66, dated November 22, 1965
No. of Bids Received	3 bids received
Date of Bid Opening	December 14, 1965, at 2:00 p.m., CST
Low Base Bid Accepted	\$20,968.45
Alternate Bid (Maintenance) Accepted	
Total Bid Accepted	\$20,968.45
Date of Award of Contract	December 30, 1965
Preconstruction Conference	January 13, 1966
Notice to Proceed	January 10, 1966
Date Notice to Proceed Acknowledged	January 13, 1966
Designated Starting Date	January 14, 1966
Starting Date	January 14, 1966
Number of Days in Contract	150 days
Contract Completion Date	June 12, 1966
Extended Completion Date	April 26, 1967
Actual Completion Date	April 21, 1967
Date of Final Inspection	April 25, 1967
Notice of Acceptance	April 25, 1967
Final Payment Base Bid	\$21,218.45
Contract Amount Base Bid	\$21,218.45
Alternate Bid (Maintenance)	
Total Contract Amount	\$21,218.45
Overrun	
Release of Claims	April 28, 1967

Change Orders:Change Order No. 1, dated October 17, 1966:

In lieu of installing the solenoid valves specified in Contract Addendum No. 1, the solenoid valves will be omitted, and the pumphouse equipment will be installed in accordance with attached Revised Equipment Layout Sketch and modify the electrical control panel in accordance with the attached copy of revised Healy-Ruff Company Drawing No. 26657. The two unused 1½-inch solenoid valves specified under Addendum No. 1 shall be delivered to the Contracting Officer for future use by the Government.

Total cost increase \$250.00. Increase contract time 10 days.

Stop Work and Resume Work:

Stop Order - Close of business January 21, 1966

Resume Work Order - March 15, 1967, new completion date on August 3, 1966

Stop Order - Close of business April 19, 1966

Resume Work Order - June 20, 1966, New completion date on October 3, 1966

Stop Order - Close of business September 10, 1966

Resume Work Order - September 26, 1966, New completion date on October 18, 1966.

Stop Order - Close of business on October 17, 1966

Resume Work Order - November 30, 1966, New completion date on December 10, 1966.

Stop Order - Close of business on December 2, 1966

Resume Work Order - April 19, 1967, New completion date April 26, 1967

Estimates:

No. 1	September 6, 1966	\$ 8,983.80
No. 2	December 5, 1966	11,234.65
No. 3 (Final)	April 26, 1967	<u>1,000.00</u>
		\$21,218.45

Written Orders: None

Suppliers:

Healy-Ruff Company, 2485 North Fairview Ave., St. Paul, Minn. 55113

Supplied electrical controls

Neptune Meter Co., Long Island City, New York

Supplied water meters

Industrial Paint Co., Haysville Borough, Sewickley, Pa.

Supplied epoxy paint

Reda Pump Co., Bartlesville, Oklahoma

Supplied Water Pump

The Permutit Co., Paramus, New Jersey

Supplied water softeners

Water Paint Co.

Supplied vinyl suede No. 950 paint.

As-Built Quantities and Cost:

	<u>Description</u>	<u>Est. Quan.</u>	<u>Actual Quan.</u>	<u>Cost</u>
1.	Right PVC Water Pipe 2" ID, Class 160	7,650 l.f.	7,650 l.f.	\$ 8,415.00
2.	Water line markers	20 units	20 units	240.00
3.	2" Gate Valve and Valve Box Insulated	4 units	4 units	220.20
4.	Water Station	1 unit	1 unit	463.00
5.	Water System Pump and Equipment, Complete	1 l.s.	1 l.s.	11,879.00

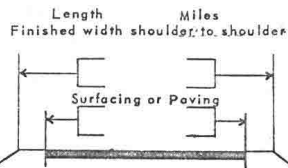
Form 10-411
(Rev. 2/62)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

PROJECT CONSTRUCTION PROPOSAL

1. Statement of requirements, proposed work and construction data, justification, etc. (Use additional sheets as necessary.)

Water (and water system) for Great Onyx Group Campground and Headquarters Water System.

Proposed work and construction data: Drill 8" well; install 8" casing, grout and seal well; pump test well; install pumping equipment and accessories, pneumatic tank, water softeners, chlorinator; construct equipment house; and construct 7400 l.f. 2" pipeline.



Justification: To provide an urgently needed additional source of water for Headquarters Water System and to provide water for the undeveloped Great Onyx Group Campground, which is and will continue to be used extensively.

2. Land Status (if Govt.-owned, what agency), Water Rights, Research, Etc.

Government-owned

3. PCP Data Prepared by (Name, Title & Date) <u>Billy W. Vick 10/26/64</u> <u>Park Engineer</u>		4. Cross-reference PCP's to this Project: PCP numbers of previously completed portions: <u>U-84</u>	6. CLASS <u>B</u> ESTIMATE Construction..... \$ ~~20,200~~ 31,400 Plans, Surveys, & Supervision..... ~~6,400~~ 4,520 Contingencies..... ~~7,500~~ 1,880 SUB TOTAL ~~34,100~~ 37,800 Exhibits, Audio-Visual Installations, etc..... GRAND TOTAL \$ ~~31,600~~ 37,800
5. Construction by: Day Labor ☐ Contract ☒ Work supervised by: Park ☐ Reg. ☐ Design Office ☒			
7. DISTRIBUTION OF COPIES No. To 1 Director 2 Reg. Dir., SE Region 2 EODC 1 Mammoth Cave		8. Recommended by Park Office (Signature, title, date) <u>Paul McG. Miller</u> , Superintendent, October 26, 1964 9. Approved by Regional Office (Signature, title, date) <u>E. M. Lewis</u> , Acting Regional Director, JAN. 20 1965 10. Reviewed by D&C Field Office (Signature, Title, Date) <u>Vincent N. Mauro</u> , Project Control Officer, EODC, 2/2/65	
11. Location within Area or Termini <u>Flint Ridge</u>		12. Master Plan No. <u>NP-MC 31074</u>	13. Bldg. or Rt. # and Sec.
14. Region <u>SE</u>	15. Park <u>Mammoth Cave National Park</u>		
16. Project <u>Great Onyx Well and Water System Expansion</u>		<u>Edmonson</u> (County) <u>Kentucky</u> (State)	17. PCP Index No. <u>U-108</u> 18. P. S. & S. by BPR ☐ NPS ☒

CLASS ☐ (A) - Estim based on working drawings
 CLASS ☒ (B) - Estimate based on preliminary plans
 CLASS ☐ (C) - Estimate based on similar facilities in other parks

19. ESTIMATE		
Item	Quantity	Cost
1. Drill 8" well	404.5'	\$ 4,250
2. 8" casing	44'	140
3. Grout & sealing	43'	50
4. Pump test well	32 hrs.	480
5. Pump, 7½ H.P.; chlorinator, fittings, gages, 2" galvanized pipe, pneumatic tank	Lump Sum	2,080
6. Equipment house	Lump Sum	1,000 2,500
7. 2" polyethylene pipeline	7,400 ft.	14,000 18,500
8. Water softeners	Lump Sum	3,400
Estimate Totals		
Construction.....		\$ ~~26,000~~ 31,400
Plans, Surveys, and .		
Supervision.....		\$ ~~3,000~~ 4,520
Contingencies.....		\$ ~~1,500~~ 1,880
SUB TOTAL		\$ ~~30,500~~ 37,800
Exhibits, Aud.-Vis.		
Installations, Etc.....		\$
GRAND TOTAL		\$ ~~31,500~~ 37,800

J105

Docket Information

Number of Documents in Docket 29
 Documents Dated from 9/4/1964 to 9/4/1964
 Docket Compiled: 4/27/2011