



WATER-RIGHT DOCKET

Mammoth Cave National Park

Docket No: 8

FLINT RIDGE AREA WELL

Supporting Hydro Data

09-04-1962: letter to nps from cave research foundation regarding report on groundwater problems

OFFICE OF THE PRESIDENT

D5039

CAVE RESEARCH FOUNDATION

2900 ADAMS MILL ROAD, N. W.
WASHINGTON D. C.

September 4, 1962

Mr. Paul Miller
National Park Service
Washington DC

Dear Paul:

As I indicated in our phone conversation after our August 28 meeting I am forwarding a report on groundwater problems in Flint Ridge, Mammoth Cave National Park. This report contains information gleaned from our experiences in the study of the Flint Ridge Cave System.

You will note that we are very pessimistic about prospects for either collection of water from the Big Clifty and Golconda or from the base level. While the deep well at Bransford Spring might seem to indicate that we have considerably under estimated that potential from base level, we feel that this particular well has been fortuitous. Additional wells nearby would not necessarily be so productive, judging from what we know about the geology and cave development.

I am sending copies of this report to Richmond and to Supt. Brown. Further, we are forwarding it to Robert Cushman of the USGS in Louisville.

Sincerely,

Philip M. Smith
President

cc: Perry E. Brown

GROUNDWATER PROBLEMS IN FLINT RIDGE

Roger W. Brucker
Secretary, Cave Research Foundation

A sharply increased need for water in Mammoth Cave National Park has focused attention on Flint Ridge as a potential water source. Flint Ridge cannot supply the present water needs of Mammoth Cave, and no amount of water supply development could assure an adequate supply for future requirements. This fact rests on the nature of the geology of the Flint Ridge karst and on the drainage characteristics underground. The only adequate water supply for Mammoth Cave is the Green River.

INTRODUCTION

Caves in limestone are essentially high-speed aquifers with rapid charging rates and almost equally rapid discharging rates. Unlike gravels and sandstones, limestone beds have virtually no interstices between grains. Water flow in limestone is restricted to well-developed joint controlled channels that fill and empty in a matter of hours. The holding time inherent in large reservoir gravels and sands is not present in limestone cave areas. For this reason no substantial reservoir exists in Flint Ridge. During the March 1962 flood the Green River rose almost 60 feet, flooding the lowermost cave passages to the same depth. Despite the fact that the Flint Ridge drainage passages are small compared with the bed of the Green River, the Flint Ridge caves emptied as rapidly as the river fell.

Literature concerning karst drainage is either quite general or concerns specific areas; for this reason it is of minimum help in considering Flint Ridge. This discussion is therefore directed in detail at the suitability of Flint Ridge as a source of water for Mammoth Cave. The two related facts stated above; viz., 1) Water drains rapidly from Flint Ridge caves, and 2) Flint Ridge caves have virtually no reservoir capacity are the basis for the conclusion Flint Ridge could never provide a satisfactory water supply for Mammoth Cave. The only adequate source for the long term needs is the Green River.

RUNOFF AND GROUNDWATER IN THE GOLOONDA AND BIG OLIFTY

For purposes of understanding Flint Ridge drainage a line may be drawn at the base of the Big Clifty sandstone, and the rocks above and below considered as separate problems. The reason for this division is that totally different groundwater problems exist above and below, and the problems below the sandstone can only be understood in relation to each other when the characteristics of the drainage above the sandstone are understood.

While it is convenient to think of runoff versus groundwater in considering the effects of rainfall, these terms must be examined carefully in dealing with Flint Ridge. The runoff component of rainfall is nil during most of the year on Flint Ridge. While the earth atop the ridge may become saturated during heavy rains of several inches in a few hours, the runoff streams thus formed are quickly diverted underground once they descend from the

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sandstone margins. The only exception to the rule is during certain rare times in the spring when heavy rain falls on frozen ground. At this time- and only this time- buried collector channels in the Girkin are essentially blocked by ice. On these infrequent occasions the branches of Three Sisters Hollow have been observed flowing as free surface streams that discharge into the Green River.

A few small free surface streams emerge as springs at the base of the Golconda and flow on the top of the Big Clifty for a hundred feet or more. At the base of the Big Clifty they sink through the Girkin collector channels into the underground drainage system. An excellent example of such a stream is to be found at the head of the reentrant immediately north east of the junction of the Crystal Cave road and the Northtown-Mammoth Cave road. This and other examples of this sort have been gaged by the Groundwater Branch, USGS.

Before considering the movement of groundwater, it should be understood that any plan to impound surface runoff is doomed to failure because for practical purposes there is no concentrated runoff from Flint Ridge. To reiterate, the only exception to the statement is that runoff is found for a few hours at two or three-year intervals when spring rains descend on firmly frozen ground.

Rainfall on Flint Ridge becomes groundwater. The permeability of the overburden varies from place to place on the ridge, from nearly impervious areas as found in the clays sealing the bottoms of the seasonal surface marshes, to areas of high permeability as found in most of Flint Ridge. The marshes serve to hold up ground-

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water percolation, but are not perennial (except for a few man-made ponds) because of drainage and evaporation.

Elsewhere on the ridge top water sinks easily through the overburden to the remnant limestones of the Hardinsburg, and into the Golconda.

Much evidence suggests that the Golconda's 40 foot bed is cavernous on Flint Ridge. One may see a cave in the Golconda on the west wall of a reentrant immediately east of the S curve in the Crystal Cave road. The entrance passage is 18 inches high and 3 feet wide. A draft of air issues from the entrance indicating the presence of an extensive cave. No investigation has been made of this perched Golconda karst, hence beyond the fact that it does exist, little is known. However, certain generalized karst relationships are useful in speculating about the drainage through the Golconda.

Flint Ridge cave passages are partially joint controlled and partially controlled by factors still unknown. Passages in caves in the Golconda should be similarly controlled. The significance is that water flow is concentrated along solution-enlarged passages and cannot be tapped elsewhere. Thus the groundwater which flows through the beds above the Big Clifty after rains and in the spring thaw is difficult to find in any quantity sufficiently useful for water supply purposes.

For this reason wells sunk into the overburden or into the Golconda cannot be very productive since the overburden is well-drained by the Golconda passages. Drilling into a main passage in the Golconda

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would require a high order of luck. Even if one were found there is no assurance that such a channel would continue to be productive since change in watercourse is the rule rather than the exception in underground drainage.

Between the Golconda and the Big Clifty is a zone of impervious shales that locally serves as the bottom of the Golconda karst. Where present in unbreached form, it permits the Golconda karst drains to discharge to the surface. Three Springs, Bransford Spring, and the spring at the old OOO camp are good examples. Typically these springs emerge, trickle down the Big Clifty surface and sink abruptly into the surface.

It is unlikely that these springs represent even a small fraction of the upper formation's groundwater. This is because the shale confining the perched karst is truncated by the slope along a zone rather than a sharp line, and it thus cannot be tapped as a metal roof is drained by a gutter. The reason for this zone of fracturing rather than a line is that relatively more weathering takes place at the edges of the ridge where the top beds are thinnest. A similar zone exists at the edge of the Big Clifty as well. The zone of fracturing may extend a hundred or more feet toward the ridge crest from the sandstone edge; therefore, it is likely that the fractured zone of the Golconda basal shale extends a similar distance toward the ridge crest.

During the summer drought the springs at the base of the Golconda diminish since there is relatively little reservoir capacity in either the overburden or the Golconda karst. Low flows further are

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more likely to be adequately drained by the fractures at the beginning of the head of the front zone. At the time when Mammoth Cave most needs water, there is not only the least amount of groundwater in the Golconda, but it is most likely to be channeled downward before reaching the surface.

On Flint Ridge the Big Clifty sandstone is largely protected from water infiltration by the shale above, except at the zone of fractures. As a result of this capping bed, springs that discharge at the base of the Big Clifty are generally fed by inputs 200 or 300 feet away at the most, that is only as far back along the slope as the shale is stripped away over the sandstone. (See fracture zone of Figure 1) The granular structure of the sandstone might well permit it to function as a homogeneous aquifer (and thus as a well supply), if it were not for the fact that very little groundwater has the opportunity to charge the bed.

There is some evidence, but not at all convincing, that updip exposures of the Big Clifty sandstone may permit some infiltration. A set of abandoned vertical shafts about 1500 feet from an updip exposure may indicate one such occurrence in the past. The sketchiness of this evidence leads to the conclusion that whatever the capabilities of the Big Clifty might be, it is simply not a large source of water worth developing on Flint Ridge.

At the base of the Big Clifty is a greenish-gray shale member that locally confines the small amount of groundwater in the sandstone. As has been stated, this shale has been breached along a zone rather than a line, a feature that manifests itself underground as a zone along which active vertical shafts are abundant.

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In summary, the formations above the Big Olifty base are not useful for water supply development. Their holding time is short compared with water-rich sands and gravels, although they have longer holding time than the Girkin and Ste. Genevieve beds beneath. While there is some surface spring discharge, most of the groundwater drainage is downward into the sandstone along a zone 200 or 300 feet wide running along the edges of the sandstone cliffs.

From the water supply standpoint, the problem is that wells drilled into the overburden will produce only a few gallons a minute at best. Wells drilled into the Goloonda are likely to produce only slightly more water unless by chance they strike enlarged drainage channels. Even if this were to happen, the Goloonda drainage channels are likely to supply only a few tens of gallons per minute because of the rapid discharge rate and then only seasonally. Wells drilled into the Big Olifty in the center of the ridge are likely to be of low seasonal yield. At the edge of the bed a Big Olifty well is not likely to be very productive because the main drainage routes here are already established downward rather than laterally.

TRUNK DRAINAGE OF GROUNDWATER IN THE GIRKIN AND STE. GENEVIEVE

A great deal of information is available in describing the underground drainage in the Girkin and Ste. Genevieve, since it is in these limestone beds that the major cave passages are developed.

Rainfall that descends into the Girkin sinks immediately downward and into collector channels leading to vertical shafts. These collectors extend back under the basal Big Olifty shale member for as much as 300 feet, or wherever the first fractures mark the

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beginning of the zone. Collector channels are enlarged partly along joints. Where vertical joints intersect, or at other areas of greater weakness along joints, water descends enlarging vertical shaft walls. At the bottom of the vertical shaft water flows out a drain. Vertical shaft drain passages combine, as twigs join branches, in a dendritic pattern. Followed downstream these watercourses lead to major passages which act as trunk drains, reaching local base level near the Green River. The dendritic pattern is partly controlled by the orientation of the joints along which the passages are developed.

The trunk drainage passages in Flint Ridge are 10 to 20 feet wide and 6 to 10 feet high. For most of the year the drainage is an imperceptible trickle in streams averaging one to two feet wide and an inch deep. In other words, wells tapping Flint Ridge trunk drains could hardly be expected to produce a better yield than the present well at Crystal Cave— which penetrates a trunk drain.

Deep wells that do not intercept trunk drainage will be even less productive. In the Flint Ridge solution does not produce very wide bedding plane openings, hence there is no possibility of tapping underground "lakes". Such lakes do not exist.

In view of this observation, Echo River in Mammoth Cave requires explanation. The passage level known as River Hall in Mammoth Cave appears to correspond with Pohl Avenue in Flint Ridge in its relationship with other cave passages but probably not in elevation. A slight disparity in elevation can be explained by regional uplift. The passage occupied by Echo River in Mammoth is flooded while its counterpart in the Flint Ridge Cave System— Columbian Avenue— is dry.

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This suggests that the lowest level of both cave systems have been resubmerged and that the present water levels are not the lowest that once prevailed. Evidence for this view is provided by three observations: 1) up to 30 feet of fill lies between the Green River's present bed and its bed rock bed. 2) SCUBA divers report two flat-ceilinged horizontal cave passages 30 feet below water level at Pike Spring. 3) The Brownsville Dam raised the water level six feet at Mammoth Cave.

The question is raised as to how extensive flooded trunk passages might be in Flint Ridge. No answer can be given with certainty because of the impossibility of exploring submerged passages for long distances. Only one underground location in Flint Ridge offers access to a small flooded trunk. This is at a point about 300 feet south of Pike Spring in an area known as the Golden Triangle. Little is known about the configuration of the passage below the water at this point other than that it is a channel for part of the water which is collected out of Pike Spring. The probability of drilling by chance into flooded trunks of the size known is very low. Such trunks would be near the Green River in all probability, and wells drilled into them might produce most of their water through recharge from the Green River. For example, a well drilled to the Golden Triangle siphon would produce water primarily drawn up-channel from the Green River 300 feet away.

The two exceptional underground streams known are the ones extending from Hidden River Cave to the Green River and the

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Mill Hole-Cedar Sink-Turnhole Bend streams. No such stream has been located in Flint Ridge.

CONCLUSION

The geology of Flint Ridge is such that retention time of ground water is very short, and there is no known adequate reservoir capacity in any of the formations.

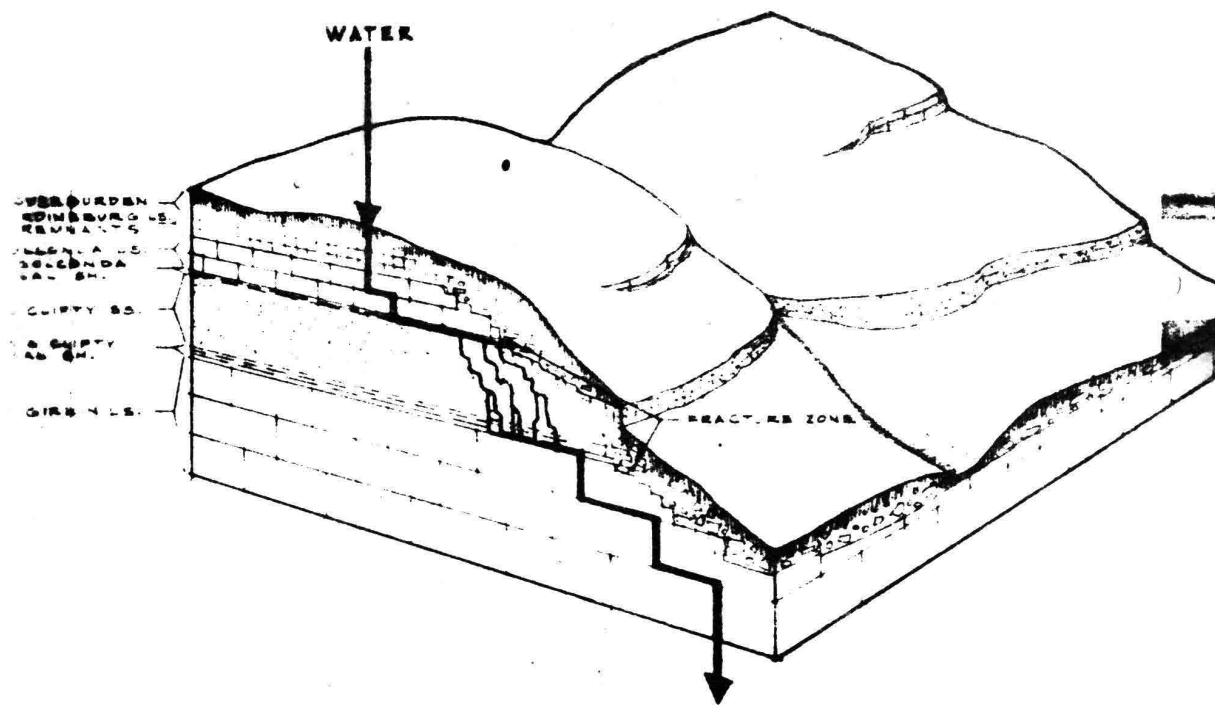


FIGURE 1. SCHEMATIC DIAGRAM OF GROUNDWATER MOVEMENT
IN FLINT RIDGE

Superintendent

April 19, 1962

Park Engineer

Report On Well Drilling and Testing, Flint Ridge

The four shallow wells have now been drilled by M. L. Dillingham of Glasgow. The U. S. Geological Survey kept complete notes and will make a report. They will send us a copy of that report.

The logs of the wells are attached.

Gauge recorders have been installed in these wells and will be observed, and then later in the season pumping tests will be made. I contacted the Farmers REA in Glasgow and made provisions for the use of their equipment for these tests. The USGS asserts that these wells add materially to their growing storehouse of information of the area.

The locations of the wells which were drilled are as follows:

Well No. 1, located about 500 feet to the left of the Onyx Cave road, about 1000 feet toward Onyx Cave from the Bransford Spring road intersection. Depth of well - 62 feet.

Well No. 2, located about 75 feet to the right of the Onyx Cave road and about 500 feet toward Onyx Cave from the Bransford Spring road intersection. Depth of well - 62 feet.

Well No. 3, located on left of Flint Ridge road (traveling toward Crystal Cave) just past Mammoth Cave Church and cemetery. Depth of well - 123 feet.

Well No. 4, located about 1500 feet to the left of the Onyx Cave road and about 1000 feet toward Onyx Cave from the Bransford Spring road intersection. Depth of well - 57 feet.

The U. S. Geological Survey has agreed to finance the drilling of Well No. 3.

Some of the wells will produce water but it is not yet known in just what amounts. The recorders and later testing will give us this information.

Mr. Dillingham moved his "rig" in and began setting up on Monday, April 9, at the Crystal Cave well. He drilled the well in late 1948.

or early 1949, and a Fairbanks-Morse pump was installed in 1949. The size of the drilled hole was 8" and a 6-7/8" casing was installed to a depth believed to be about 100 feet. Mr. Dillingham says that a log of the well was kept when it was drilled and was turned over to the owners. In checking, we find it is not now available. We have investigated as thoroughly as possible and the available information is quite skimpy. When we tried to begin the test, we found that a 4-7/8" casing had been inserted inside the 6-7/8" casing. Further investigation (contact with people who were partially familiar with the well) revealed that no 4-7/8" casing was in the well when the pump was installed. No one seemed to know why the 4-7/8" casing was installed.

As you know, it was decided that we should attempt to pull the 4-7/8" casing because we were not able to get adequate tests otherwise.

On Saturday, April 14, an attempt was made to pull the 4-7/8" casing, but we were unable to bridge it. We attempted to lower it by letting loose the clamps, etc., and also, we tried several "jerks" on the casing but it was very solid. There was not sufficient room between the 3" I.D. suction pipe and the 4-7/8" casing to insert any measuring devices for recording of the draw-down, rate of recovery, etc. Therefore, it was necessary to place the bottom of the suction pipe at several depths in order to get any usable information. Also, we required the contractor to spend a considerable amount of time doing investigative type work to determine just what was in the well and some of this time is included.

On Monday, April 16, it was decided to insert drilling tools inside the 4-7/8" casing to drill out the obstruction which we encountered at a depth of 388 feet. A depth of about 6 feet was drilled. When the drilling was done, it was discovered that the 388 foot obstruction was actually the bottom of the well. This was quite a surprise, since we had believed, from information gathered, that the well was approximately 448 feet deep.

A brief summary is as follows: In 1948 or 1949 a well was drilled to a depth of about 388 feet, a 6-7/8" casing was installed to a depth of about 100 feet, and not too long thereafter a pump was installed. At some unknown date, a 4-7/8" casing was installed inside the 6-7/8" casing and believed to be set to the bottom of the well. The pumping tests show that the well will produce 5 gallons of water per minute.

Although the well did not produce the quantity of water we had hoped for, we do now have much information that we did not have before and which was needed. The well is probably not at all sufficient for the facilities planned as part of the long range program, but will serve for the present time.

Glenn C. Farrar
Park Engineer

Attachment

LOG OF WELLS DRILLED IN THE FLINT RIDGE AREA

By
M. L. Dillingham, Glasgow, Ky.
April 1962

Well No. 1

<u>From Depth</u>	<u>To Depth</u>	<u>Formation</u>
0 ft.	5 ft.	Surface (soil)
5 ft.	20 ft.	Yellow sand
20 ft.	24 ft.	Brown and yellow sand
24 ft.	28 ft.	Cave
28 ft.	31 ft.	Gray lime (hard)
31 ft.	35 ft.	Gray lime
35 ft.	40 ft.	Gray lime
40 ft.	45 ft.	Gray lime
45 ft.	49 ft.	Gray lime (47 ft. - water)
49 ft.	52 ft.	Soft black shale
52 ft.	60 ft.	Silty shale
60 ft.	62 ft.	Gray sandstone FRS ₂

Well No. 2

0 ft.	7 ft.	Surface (soil)
7 ft.	12 ft.	Red sand
12 ft.	16 ft.	Red sand
16 ft.	20 ft.	Red sand
20 ft.	24 ft.	Red sand
24 ft.	28 ft.	Red sand
28 ft.	33 ft.	Yellow sand (Hardinsburg)
33 ft.	37 ft.	Yellow sand (Hardinsburg) (29' - 40' - water)
37 ft.	40 ft.	Gray lime
40 ft.	44 ft.	Gray lime
44 ft.	48 ft.	Lime (Golconda)
48 ft.	52 ft.	Lime (Golconda)
52 ft.	60 ft.	Lime (Golconda)
60 ft.	62 ft.	Dark, soft shale

Well No. 3

0 ft.	5 ft.	Surface (soil)
5 ft.	20 ft.	Pottsville Conglomerate in red clay
20 ft.	34 ft.	Pottsville Conglomerate
34 ft.	40 ft.	Lime - water at 40 feet
40 ft.	45 ft.	Sand Soap (soapstone)
45 ft.	75 ft.	Sandstone
75 ft.	105 ft.	Gray lime - hard
105 ft.	110 ft.	Gray lime - hard (darker)
110 ft.	114 ft.	Gray lime (darker)
114 ft.	120 ft.	Gray lime - soft
120 ft.	123 ft.	Dark limestone with some shale

<u>Well No. 4</u>		
<u>From Depth</u>	<u>To Depth</u>	<u>Formation</u>
0 ft.	3 ft.	Surface (soil)
3 ft.	10 ft.	Sandstone
10 ft.	15 ft.	Sandstone
15 ft.	20 ft.	Sand, yellow
20 ft.	25 ft.	Yellow sand (water)
25 ft.	34 ft.	Lime (hard)
34 ft.	45 ft.	Gray lime
45 ft.	54 ft.	Lime and sand
54 ft.	57 ft.	Black lime and shale

Other Supporting Information

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. 135-211714
Location in Park Mammoth Cave Ridge	State(s) Kentucky	Fund Symbol 14 X 1035
☒ Contract and/or ☐ Day Labor	County or Counties Edmonson	Year Programmed 1968
Work Order Title Water System Improvements, 500,000 Gal. Concrete Reservoir, Pipe Line and Fence. (Contract No. 14-10-7-981-69 and Contract No. 14-10-7-981-76)		PCP No. MACA U-98
		Master Plan No.
		Master Plan Corrected By
		As Built Drawings By PSC-DC
		Date Started June 28, 1968
		Date Completed October 16, 1968 <i>J. B.</i>
DESCRIPTION OF FIXED ASSETS (For completion by employee in charge of project)		TOTAL COSTS (For completion by FFO)
230 Utility System 89,672.45		104,020.04
1. 1.83 miles of 6" Cast Iron Water Line and 325 lin. ft. 7 foot Chain-link fence. (Contract--\$44,732.45)		
500,000 Gal Concrete Reservoir (Contract--\$44,940.00)		
TOTAL		\$ 104,020.04

DISTRIBUTION		THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES	
No.	To		
Ass't. Dir. DC	Submitted	<i>Thomas E. Barton</i>	Title: Civil Engineer Date: October 23, 1968
Cont. Off., PSC	By:	Thomas E. Barton	
Chief, D&C, PSC	Approved	<i>Robert H. Bendt</i>	Title: Superintendent Date: October 29, 1968
SERO (2)	By:	Robert H. Bendt	
Fln. Off., SERO			
MACA	COSTS VERIFIED	<i>T. J. Baer</i>	Title: Regional Accountant Date: NOV 22 1968
	BY	T. J. BAER	

Rec'd up memo to Supr. from Chief, O&W. WSC dated Mar 7, 1969

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

COMPOSITION OF COST FOR COMPLETION REPORT

W	Order Number
	211714
	Fund Symbol
	14X1035
	Year Programmed
	1968

Park	Mammoth Cave National Park	Region	SERO
Location in Park	Mammoth Cave Ridge		
Work Order Title	Water System Improvements, 500,000 Gal. Concrete Reservoir, Pipe Line and Fence. (Contract No. 14-10-7-981-69 and Contract No. 14-10-7-981-76)		

COMPOSITION OF COST

COSTS CHARGED TO FUNDS ALLOTTED TO FIELD FINANCE OFFICE

(1) Personal Services.....	\$	
(2) Travel.....		
(3) Contract Work	89,672.45	
(4) Supplies and Materials.....		
(5) Other Direct Expenses.....		
(6) Operation of Equipment.....		
(7) Depreciation of Equipment.....		
(8) Purchase of Construction Equipment.....		
(9) Purchase of Other Accountable Equipment		
(10) Other Costs:		
(11) TOTAL COST CHARGED TO FFO FUNDS	xxxxxxxxxx	\$ 89,672.45

OTHER COSTS:

(12) PS&S, AP, and/or Facilitating Services @ 16 %.....	\$ 14,347.59	
(13) Inventory and Other Non-Fund Costs		14,347.59
(14) GROSS WORK ORDER COSTS	xxxxxxxxxx	\$ 104,020.04

LESS:

(15) Residual Value of Construction Equipment on Line 8.....	\$	
(16) Other Credits		
(17) NET COST OF FIXED ASSETS	xxxxxxxxxx	\$ 104,020.04

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

NARRATIVE REPORT

Contract No. 14-10-7-981-69

Date of Bid Invitation (IFB No. D&C-49-E-68) April 15, 1968
Date of Bid Opening: May 7, 1968
Number of Bids Received: One (1)
Low Bid: \$44,940.00
Date Contract Awarded: May 31, 1968
Amount of Original Contract: \$44,940.00
Final Contract Amount: \$44,940.00
Prime Contractor: The Crom Corporation
212 S.E. First Street
Gainesville, Florida 32601
Subcontractor: Walter F. Davis
General Contractor
Brownsville, Kentucky 42210
Preconstruction Conference Date: July 9, 1968
In Attendance: Mr. R. Bruce Simpson, The Crom Corporation
Mr. Lamar Cornelius, The Crom Corporation
Mr. Thomas E. Barton, Project Supervisor, Mammoth Cave
Mr. Walter F. Davis, Subcontractor
Mr. Carl W. Lawler, Chief of Maintenance, Mammoth Cave
Mr. Glendon Miller, Gen. Sup. Spec., Mammoth Cave
Date of Notice to Proceed: June 25, 1968
Beginning Date: June 28, 1968
Actual Beginning Date: July 9, 1968
Contract Completion Date: September 25, 1968
Actual Completion Date: August 30, 1968
Date of Final Inspection: September 18, 1968
In Attendance: Mr. Lamar Cornelius, The Crom Corporation
Mr. Walter F. Davis, Subcontractor
Mr. William E. Edwards Jr., Acting Supt. Mammoth Cave
Mr. Carl W. Lawler, Chief of Maintenance, Mammoth Cave
Mr. Thomas E. Barton, Project Supervisor, Mammoth Cave

(Job accepted without a punch list)
Date of Final Acceptance: September 19, 1968
Date of Release of Claims: September 23, 1968
Date of Final Estimate: September 26, 1968
Stop Orders: None
Resume Work Orders: None

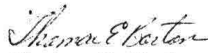
Change Orders: None

Monthly Estimates:

1. Dated August 5, 1968.....	\$22,078.03
2. Dated September 3, 1968.....	20,614.97
3. Dated September 26, 1968 (Final).....	2,247.00
Total Contract Amount.....	<u>\$44,940.00</u>

Scope of the Work:

This project consisted of the construction of one 500,000 gallon Prestressed Concrete Water Reservoir with the Necessary piping for filling and draining, including two 6" Gate Valves with balve boxes.
(See sttached Pictures)


Thomas E. Barton
Civil Engineer

NARRATIVE REPORT

Contract No. 14-10-7-981-76

Date of Bid Invitation: (IFB No. D&G-55-E-68) May 15, 1968
Date of Bid Opening: June 6, 1968
Number of Bids Received: Four (4)
Low Bid: \$44,550.55
Date Contract Awarded: June 18, 1968
Amount of Original Contract: \$44,550.55
Final Contract Amount: \$44,732.45
Prime Contractor: Walter F. Davis
General Contractor
Brownsville, Kentucky 42210
Subcontractors: None
Preconstruction Conference Date: July 12, 1968
In Attendance: Mr. Walter F. Davis, Contractor
Mr. Thomas E. Barton, Project Supervisor, Mammoth Cave
Mr. Glendon Miller, Gen. Sup. Spec., Mammoth Cave
Mr. Carl W. Lawler, Chief of Maintenance, Mammoth Cave
Date of Notice to Proceed: July 12, 1968
Beginning Date: July 19, 1968
Actual Beginning Date: July 19, 1968
Contract Completion Date: November 15, 1968
Actual Completion Date: October 8, 1968
Date of Final Inspection: October 15, 1968
In Attendance: Mr. Carl W. Lawler, Chief of Maintenance, Mammoth Cave
Mr. Thomas E. Barton, Project Supervisor, Mammoth Cave
Mr. Walter F. Davis, Contractor
Mr. Gordon Moody, With the Contractor
Date of Final Acceptance: October 16, 1968
Date of Release Of Claims: *October 25, 1968*
Date of Final Estimate: October 17, 1968
Stop Order: None
Resume Work Order: None

Change Orders: No. 1

Furnish all labor, equipment and materials for the installation of One (1) additional 1-inch gate valve with box (Bid Item No. 3); and an additional 50 linear feet of 1-inch galvanized steel, schedule 40, drain line (Bid Item No. 1).

Bid Item No. 3: 1-1" Gate Valve with Box @ \$115.90	= \$115.90
Bid Item No. 1: 50 lin ft 1" Galv. Steel Pipe @ \$1.32	= 66.00
TOTAL	<u>\$181.90</u>

Monthly Estimates:

1. Dated August 6, 1968.....	\$18,536.56
2. Dated September 4, 1968.....	11,664.00
3. Dated October 17, 1968 (Final).....	<u>14,531.89</u>
Total Contract Amount	<u>\$44,732.45</u>

Scope of The Work:

This project consisted of installing 5,800 lin. ft. of New 6" Cast Iron Water Line; replacing 3,860 lin. ft. of 4" A.C. Water line with new 6" Cast Iron water line; 4-6" Gate Valves with valve boxes; 3 - 1" Gate Valves with valve boxes; 3 - ½" Air Relief Valves with valve boxes; 25 Utility line markers, and 325 lin.ft. of 7 foot galvanized steel chain-link fence with one galvanized steel chain-link double gate, 12 foot opening. Also installed was 250 lin. ft. of 1 inch drain line.

Thomas E. Barton
 Thomas E. Barton
 Civil Engineer

WATER DOCKET CHECK LIST

AREA Mammoth Cave National Park
 NAME OF WATER SYSTEM Well no. 1, Flint Ridge Area
 PRIORITY DATE 1962 NO. OF WATER SYSTEMS 1 of 4

WATER DOCKET INCLUDES THE FOLLOWING:

PART I (INVESTIGATION)

1. Water resources investigations made by qualified geologists:
 - (a) U.S.G.S. ☒ (b) State Agency _____ (c) Consultant, other _____
2. Quantity of water used from water sources in park and quantity needed to meet future visitation _____
3. Application of well drillers certificate _____
4. Record of well and well drillers log. Log 4th April 1962. ☒
5. Pump test data _____
6. Chemical analysis of water samples _____
7. Completion report _____
8. Narrative report _____
9. Photographs of water system _____
10. Sketch showing "as constructed" water system. _____
11. Other: _____

PART II (WATER RIGHTS)

1. Application for water rights from state concerned. _____
2. Alien Water Rights - Use Permit. _____
3. Deed for any tract of land in park which refers to water in any form (Copies of deeds in WASO. _____
4. Other: _____

REMARKS

1. Sources of Information:
 - (a) Statement prepared by Water Resources Engineer or Park Engineer giving brief history of water sources available in general park area. (Usually obtained from park employees who have been working at the park for many years or local people living in area. _____
 - (b) Files checked:
 1. 660-03 Water Sanitation, Mammoth Cave (Plan 2, 47 - June 130, 52) Record Center, Alexandria. Requested 5/2/61 - returned 3/27/62.

0-6

Docket Information

Number of Documents in Docket 23
 Documents Dated from 4/15/1962 to 9/4/1962
 Docket Compiled: 4/27/2011