

National Park Service  
U.S. Department of the Interior

Mammoth Cave National Park  
Kentucky



# HOUCHIN FERRY SITE

DEVELOPMENT CONCEPT PLAN AND ENVIRONMENTAL ASSESSMENT | JUNE 2020

Estimated Lead Agency  
Total Costs Associated with  
Developing and Producing  
This EA: \$54,000.

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CHAPTER ONE  
**PROPOSED ACTION**



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# CHAPTER 1: PROPOSED ACTION

## PROJECT BACKGROUND

The Houchin Ferry planning site consists of a 4-acre site situated on a narrow bluff on the south side of the Green River at River Mile 185.2, together with a 1-acre site on the north side of the river. Existing site facilities are aging and need improvements and river conditions have substantially changed in recent years with the failure and subsequent removal of Lock and Dam No. 6 just downstream from this location, and will change again with the possible removal of Lock and Dam No. 5.

## PURPOSE

The purpose of this development concept plan (Plan) is to address the site's deficient facilities and re-establish safe river access at Houchin Ferry. This planning effort aims to re-establish the Houchin Ferry site as a destination dedicated to a variety of user groups and recreational activities for both day and overnight use along with safe access to the river. It requires evaluating the site to accommodate these user groups and provide facilities and access to allow for the anticipated increase in recreational use at the site.

## NEED

The catastrophic failure of Lock and Dam No. 6 in November 2016 and its subsequent removal in 2017 caused a river elevation drop of approximately 8 to 10 feet at this location. Both the north and south side concrete ramps at Houchin Ferry no longer reach the river. Lock and Dam No. 5 is slated for removal as well, which will result in a projected loss of an additional 3 to 5 feet of river elevation at this site. Initially after the breach, the park discontinued river access at Houchin Ferry because of the lower water level. As a result, river access for paddlers was still available but involved navigating either up or down a steep muddy riverbank to reach the end of the pavement. The park installed a temporary canoe/kayak access launch in Spring 2018 on the south side of the river until a permanent solution can be installed.

There are two locations for take-out outside the park boundary. One is at the former Lock 6 Site and the other is at the Brownsville Boat Ramp.

For users entering the park from the Nolin River Lake Tailwater, access point on the upstream side of the Nolin River, use of the Nolin River has been impacted with downed trees from riverbank slumping, though both the Nolin and the Green Rivers have begun to revegetate and stabilize. Take-out locations also include the Lock 6 Site and the Brownsville Boat Ramp, with some users going upstream to Houchin Ferry.

Implementation of this Plan will greatly enhance what is presently a very difficult and time-consuming process when incidents necessitate emergency response or law enforcement on the Green and Nolin Rivers. At present, the only ways to access the river are at the Green River Ferry crossing area, which is located 12 river miles upstream from the Houchin Ferry site, or further down river at the Brownsville boat ramp. With current river conditions, including a ripple area at the Lock 6 Site that sometimes impedes motorboat passage, park staff are only able to use the Green River Ferry access point or a canoe or kayak to access locations along the river downstream from Houchin Ferry to the Lock 6 Site.

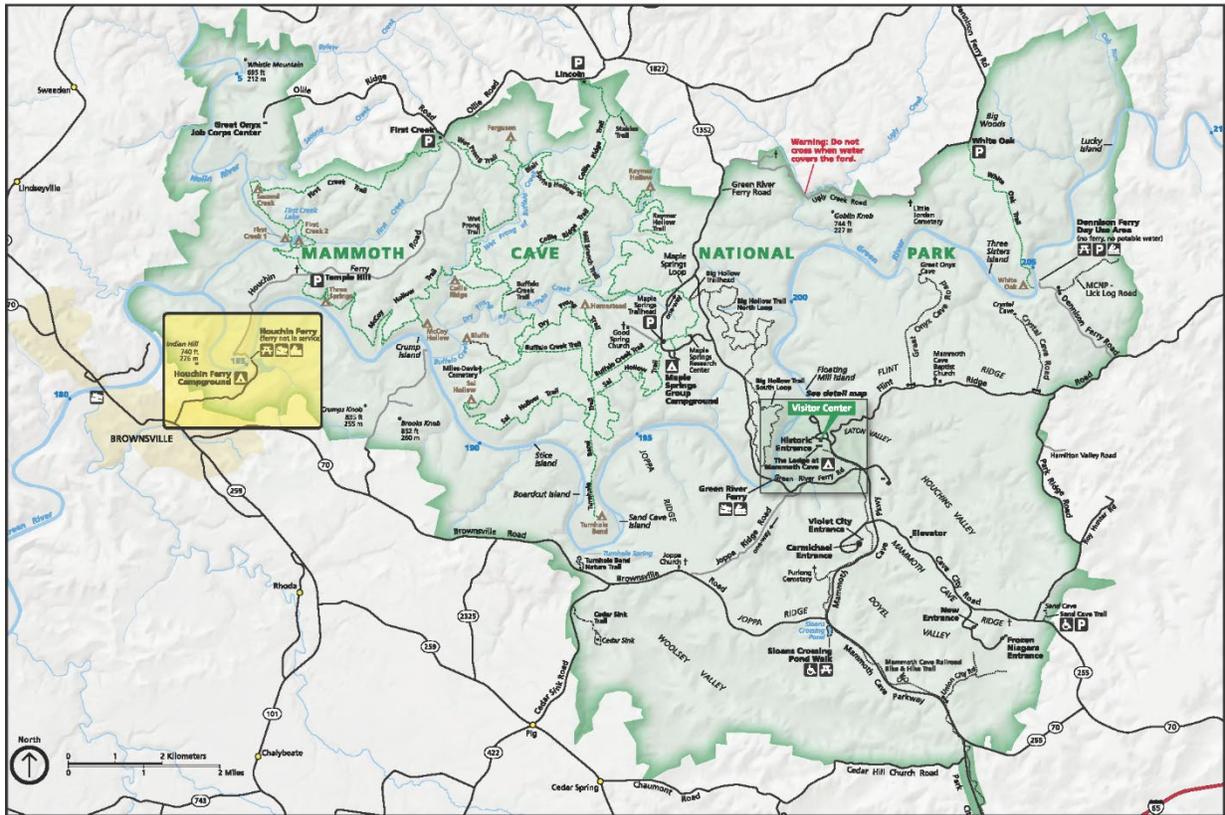


Figure 1: Map of Mammoth Cave National Park

## PROPOSED ACTION

Mammoth Cave National Park proposes to upgrade the Houchin Ferry site as a destination dedicated to a variety of user groups and recreational activities, including safe access to the river. To the extent feasible, improvements would be made accessible. The main site (south side of the river) would continue to be used for overnight camping, with additional picnic shelters for group activities and individual or family gatherings. The number of parking spaces would be increased, and vehicular circulation would be improved by adding a turnaround at the east end of the site. The turnaround would itself provide access to an emergency boat launch to be available for administrative use only. A proposed canoe/kayak launch at the river would require removing the former ferry ramp. A new overlook with an approach trail would be constructed, allowing more dramatic views of the river from above.

The north side would see fewer improvements. A simple turnaround for vehicles would be provided, as would primitive campsites, picnic tables, and a new overlook. Paddlers using the soon-to-be designated Green and Nolin River Blueway (which will subsequently be recommended for National Water Trail status) could use the campsites as a stopover on a multi-day floating trip.

The proposed action also includes construction of a pedestrian-only suspension bridge over the Green River to connect recreational facilities on either side of the river.

## **ISSUES PRESENTED BY THE PROPOSED ACTION**

Regulations issued by the Council on Environmental Quality require the National Park Service (NPS) to “determine the scope . . . and the significant issues to be analyzed in depth in the environmental impact statement” (40 CFR 1501.7(a)(2)), and “identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review . . ., narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere” (40 CFR 1501.7(a)(3)).

The planning team identified the following issues presented by the proposed action:

- The proposed site development activities would disturb soils and vegetation.
- Small amounts of development would occur in floodplains.
- New and upgraded facilities would make changes to the visitor experience at the park.

After a review of the issues raised by the proposed action, the following types of environmental impacts were considered sufficiently important to warrant further study and are carried through the environmental assessment for detailed analysis:

- Impacts to Soils
- Impacts to Vegetation
- Impacts to Wetlands and Floodplains
- Impacts to Public Health and Safety
- Impacts to Visitor Use and Experience
- Impacts to Socioeconomic Conditions

The proposed action will not have disproportionate impacts on socially or economically disadvantaged populations. Also, the actions in this Plan would neither contribute materially to, nor be affected by, global climate change. Accordingly, neither environmental justice nor climate change is addressed as an issue in this environmental assessment.

### **National Historic Preservation Act Section 106 Assessment of Effect**

This environmental assessment is not intended to satisfy the requirements of Section 106 of the National Historic Preservation Act. For purposes of this project, the National Park Service is not combining the National Environmental Policy Act (NEPA) and Section 106 processes but is pursuing separate Section 106 consultation with the Kentucky State Historic Preservation Officer (SHPO). However, the National Park Service’s determination with respect to effects to historic properties is summarized below in order to explain the National Park Service’s conclusion that impacts to historic properties do not warrant detailed analysis in this environmental assessment.

The National Historic Preservation Act, as amended (54 USC 100101 *et seq.*) sets forth the policy of Congress for preserving “the historical and cultural foundations of the Nation” and preserving irreplaceable examples important to our national heritage to maintain “cultural, educational, aesthetic, inspirational, economic, and energy benefits.” Section 106 of the National Historic Preservation Act requires that federal agencies take into account the effects of their actions on properties eligible for or included in the National Register of Historic Places and permit the Advisory Council on Historic Preservation an opportunity to review such

actions. Federal agencies consult as appropriate with state historic preservation officers, tribal historic preservation officers or representatives, and other interested parties in fulfilling section 106 requirements. All actions affecting the parks' historic properties must comply with this legislation.

Tests performed at the Houchin Ferry site have failed to locate the presence of prehistoric sites. This is likely a consequence of previous disturbance associated with development of the ferry crossing, if similar activities related to development of the upstream Green River Ferry are any indication. Green River Ferry was subject to extensive ground disturbance in the 1930s during construction of the access road, ferry landing, and related structures. Except for isolated finds, no intact archeological resources were encountered in the immediate vicinity of the Green River Ferry after archeological testing, whereas relatively intact archeological resources were identified on the flood plains just beyond the area impacted by the ferry development (see Hellmann 2018). The tests at Houchin Ferry indicate the area proposed by the park for further development has also been extensively disturbed during construction of the ferry crossing. While it is still possible that some archeological resources such as isolated artifacts may be present, the potential for intact archeological features or deposits appears to be limited.

With respect to historic structures, the towers, cable, and winches identified on either end of the Houchin Ferry crossing represent a system unique in transportation prior to the 21st century. The diagnostic features of the system are the winches. Beebe Bros., Inc. was founded in Seattle, WA, in 1924. The identified winches connected to the tower cables appear to be from around 1955 (O.B. Avery Catalog No. 111 1955). However, industrial equipment like this often changed little over the original design, and the winches could have been manufactured earlier than this estimate. The cables appear to be replacements of the originals. Based on this information, the National Park Service has determined the towers and winches are significant features of the historic ferry system and eligible for listing in the National Register of Historic Places under criterion A. The towers and winches will not be moved or directly affected by the proposed action. While no longer functional, these resources retain their integrity of location, design, setting, materials, workmanship, feeling, and association.

In accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act (36 CFR Part 800, *Protection of Historic Properties*), the National Park Service identified and evaluated effects to historic properties by (1) determining the area of potential effects; (2) identifying historic properties present in the area of potential effects that are either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected, National Register eligible or listed historic properties; and (4) considering ways to avoid, minimize, or mitigate adverse effects. This information will be provided to the Kentucky State Historic Preservation Office.

To avoid any unauthorized collecting from areas where construction is proposed, work crews would be educated about historic properties in general and the need to protect any resources encountered. See "Mitigation Measures" section. Work crews would be instructed regarding the illegality of collecting artifacts on federal lands to avoid any potential violations. In the unlikely event that unknown historic properties were discovered during construction, work would be halted in the vicinity of the resource, and procedures outlined in 36 CFR 800.13 would be followed.

The Kentucky State Historic Preservation Office will be provided a copy of this Plan and environmental assessment and any comments the state historic preservation office may have on the project will be addressed as a part of Section 106 consultation.

## Endangered Species Act: Section 7 Determination of Effect

Section 7 of the federal Endangered Species Act requires federal agencies to use their authorities to conserve species listed under the Act and to consult with the U.S. Fish and Wildlife Service (USFWS) on actions that may affect these species. This section also prohibits federal agencies from authorizing, funding, or carrying out any action that would likely jeopardize a listed species or destroy or modify its critical habitat.

The National Park Service notified the US fish and Wildlife Service about the proposed action by letter dated September 13, 2018. Thereafter, the National Park Service reviewed the US Fish and Wildlife Service's list of threatened and endangered species for the project site (Houchin Ferry, Edmonson County, Kentucky) found at <https://ecos.fws.gov/ipac/location/index>. This search revealed the potential for 16 listed species to be present at the site, consisting of two endangered bats, one threatened bat, 10 endangered freshwater mussels, one threatened freshwater mussel, one endangered crustacean, and one fish with unoccupied critical habitat. The 16 listed species are:

- Gray bat (*Myotis grisescens*) (endangered)
- Indiana bat (*Myotis sodalis*) (endangered)
- Northern long-eared bat (*Myotis septentrionalis*) (threatened)
- Clubshell (*Pleurobema clava*) (endangered)
- Fanshell (*Cyprogenia stegaria*) (endangered)
- Northern riffleshell (*Epioblasma rangiana*) (endangered)
- Pink mucket (pearlymussel) (*Lampsilis abrupta*) (endangered)
- Purple cat's paw (purple cat's paw pearlymussel) (*Epioblasma obliquata*) (endangered)
- Ring pink (mussel) (*Obovaria retusa*) (endangered)
- Rough pigtoe (*Pleurobema plenum*) (endangered)
- Sheepnose mussel (*Plethobasus cyphyus*) (endangered)
- Snuffbox mussel (*Epioblasma triquetra*) (endangered)
- Spectaclecase (mussel) (*Margaritifera monodonta*) (endangered)
- Rabbitsfoot (*Quadrula cylindrica*) (threatened) (critical habitat on park)
- Kentucky cave shrimp (*Palaemonias ganteri*) (endangered) (critical habitat on park)
- Diamond darter (*Crystallaria cincotta*) (unoccupied critical habitat on park)

The proposed action would take place at a previously disturbed site once used for the former Houchin Ferry facility along with other recreational site developments. On the south side of the Green River, the project would entail the minor enlargement of an existing 4-acre recreation facility consisting of mowed areas, some tree cover, and ancillary graveled and paved surfaces. On the north side, a 1-acre recreation facility (primitive camping, picnicking, overlook) would be constructed in an area previously developed for the former Houchin Ferry facility. A pedestrian suspension bridge is proposed to connect the two sides. Footings for the bridge would be placed on existing soil bluffs rather than in the river or on the riverbanks. Canoe / kayak launches would be constructed on either side of the river in the footprint of the old ferry ramps, with small extensions down to (or below) the new mean low-water line of the Green River (after the removal of Lock and Dam No. 6 and anticipated removal of Lock and dam No. 5).

It is anticipated that the proposed development would have minimal if any impacts on water quality. In addition, the site is 5 miles downstream of the nearest groundwater basin with Kentucky cave shrimp. Hence, the project would have no effect on the Kentucky cave shrimp.

The project will also have no effect on the diamond darter because its critical habitat is unoccupied and located 12 river miles upstream of project.

The project may affect, but is not likely to adversely affect, the 11 species of listed freshwater mussels. The site is in the impounded zone for Green River Lock and Dam No. 5, so the current habitat at the site is unlikely to support populations of the endangered mussels. In studies following the removal of Lock and Dam No. 6, endangered mussel habitat is starting to appear about 4 miles upstream of the Houchin Ferry site. The canoe/kayak launches will require small amounts of new concrete or other building material below the water level on each bank. The location of this improvement consists of muddy, sloped, stream edge and is not conducive to endangered mussels. Effects on listed mussels will be minimized via measures employed throughout the project to ensure water quality reduce turbidity. See “Mitigation Measures” section.

Similarly, the amount of new development associated with expanded camping and picnicking opportunities over four acres and their continued public use into the future, may affect, but is not likely to adversely affect, the three species of endangered bats that potentially may use the area. Impacts to bats associated with construction activities will be mitigated by scheduling construction outside of known roosting times, performing surveys of structures before removal, and directing light away from habitat as feasible. Additional mitigation of effects on endangered bats will come from implementing the park’s hazard tree and vegetation management program (including any required tree removal) in accordance with guidelines in the applicable USFWS biological opinion on the Indiana bat, as supplemented by the rule covering the northern long-eared bat issued under Section 4(d) of the Endangered Species Act.

### **National Wild and Scenic Rivers Act Considerations**

The 1983 General Management Plan for Mammoth Cave National Park provides that future development concept plans should consider the potential impact that any proposed action may have on the eligibility of the Green River to be designated a National Wild and Scenic River under the National Wild and Scenic Rivers Act of 1968 (WSRA):

*The stretches of the Green and Nolin River flowing through Mammoth Cave National Park were included in a January 1982 “Nationwide Inventory” of rivers appearing to have potential for consideration for the National Wild and Scenic Rivers System. No congressionally mandated study or proposal has been made to include the rivers in the national system. However, whenever specific development concept planning occurs, the National Park Service will consider and attempt to mitigate the effects of its action on the values that may qualify the river for inclusion in the system.*

Some form of river crossing has been in place at Houchin Ferry since before the creation of the park in 1941. A vehicle ferry provided connectivity between communities on both the north and south sides of the park for many years and continued to operate until 2013. While in operation, the ferry had only a small impact on the scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values that could possibly qualify the river for inclusion in the National Wild and Scenic Rivers System (called “outstandingly remarkable values” in the WSRA). The proposed action would decrease the level of visual intrusion caused by the original ferry by modifying the former ferry ramps into smaller canoe/kayak launches for hand-powered craft.

New impacts would exist in the form of an emergency launch system for law enforcement on the south side of the river, as well as a pedestrian suspension bridge (under alternative C) linking recreational facilities on either side of the river. However, neither of these new facilities would disqualify the river for “scenic” or “recreational” river status under the WSRA. Because of existing and long-standing road access, the subject stretch of the Green River would not appear to qualify for the “wild” classification even if the current level of development at Houchin Ferry remained unchanged.

Similarly, the Green River within Mammoth Cave National Park has received two state water designations: a state-level “Wild River” and a state-level “Outstanding Resource Water.” As described above, the proposed action items would have both a decrease and an increase in impacts on the Kentucky state river designations for the Green River.

## **VISITOR USE MANAGEMENT AND THE PLANNING PROCESS**

Visitor use management (VUM) is the proactive and adaptive process of planning for and managing characteristics of visitor use and its physical and social setting, using a variety of strategies and tools to sustain desired resource conditions and visitor experiences. Visitor use management is important because the National Park Service strives to maximize opportunities and benefits for visitors while achieving and maintaining desired conditions for resources and visitor experiences in a particular area. Managing visitor access and use for visitor enjoyment and resource protection is inherently complex. It requires that NPS managers analyze not only the number of visitors but also where they go, what they do, their impacts on resources and visitor experiences, and the underlying causes of those impacts. Managers must acknowledge the dynamic nature of visitor use, the vulnerabilities of natural and cultural resources, and the need to be responsive to changing conditions.

Proactively planning for visitor use maximizes the ability of agencies to encourage access and protect resources and values. In this Plan, visitor use refers to human presence in an area for recreational purposes including education, interpretation, inspiration, and physical and mental health. Visitor use goes beyond the types of activities that people engage in at parks. Visitor use also includes the amount, timing, and distribution of visitor activities and behaviors.

This Plan uses the VUM framework to develop a long-term strategy for managing visitor use within the park (figure 2). The general planning process is consistent with the guidance outlined by the Interagency Visitor Use Management Council (IVUMC, [www.visitorusemanagement.nps.gov](http://www.visitorusemanagement.nps.gov)).

### **Desired Conditions**

Desired conditions are defined as statements of aspiration that describe resource conditions, visitor experiences and opportunities, and facilities and services that an agency strives to achieve and maintain in a particular area. They help park managers answer the question “what are we trying to achieve?” Desired conditions focus on fundamental resources and values; the visitor experience opportunities associated with them; and the types and levels of management, development, and access that would be appropriate in a particular location. The desired conditions for this Plan were based on guidance from previous planning efforts and other NPS policies and guidance.

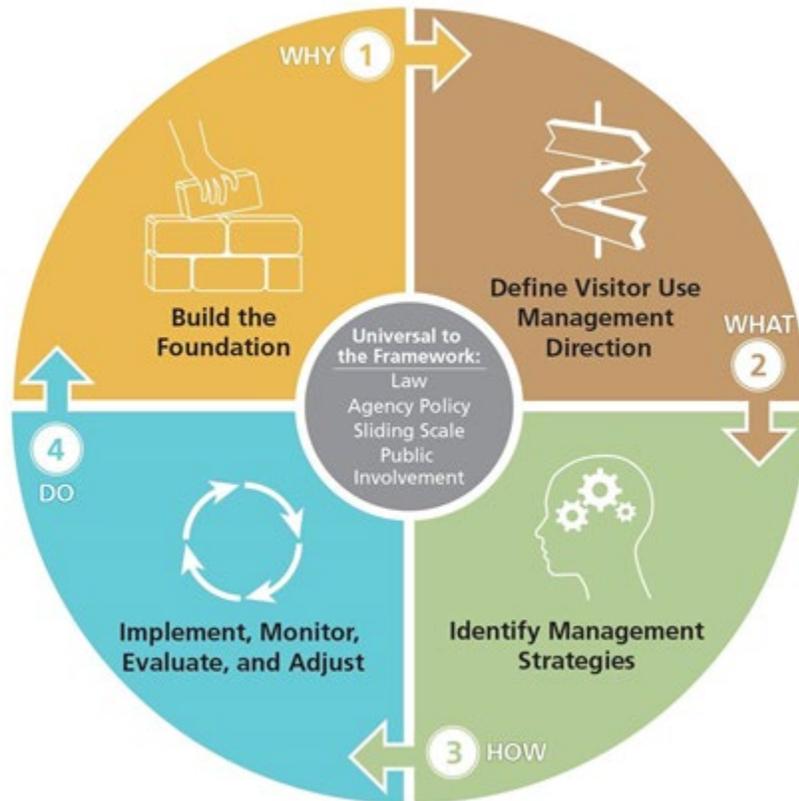


FIGURE 2. OVERVIEW OF THE VISITOR USE MANAGEMENT PLANNING PROCESS

**Natural.**

- To minimize impacts on fragile natural and cultural resources by locating facilities in areas that are able to support such use without sustaining unacceptable environmental damage.
- The spread and introduction of invasive species will be minimized.
- Social trails and trampling will be minimized to preserve natural and cultural resources.

**Cultural.**

- To protect and preserve the park's historic structures, their appearance, and their settings, as well as archaeological sites and objects in accordance with legislative and executive requirements and the Service's historic preservation policies.
- Archeological resources will be preserved and protected from unintentional means and/or disturbance and damage associated with recreational use.

**Visitor Experience.**

- To control visitor use as necessary to protect the park visitor, to preserve the natural and historic resources, and to ensure that interpretive opportunities are available.
- Visitors have the opportunity to experience year-round recreation in a natural, tranquil setting.
- Visitors have opportunities for high-quality experiences in settings with a low visitor density without crowding, congestion, or visitor conflict.



CHAPTER TWO  
**ALTERNATIVES**



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## CHAPTER 2: ALTERNATIVES

The issues and concerns identified during scoping were used to develop and evaluate alternatives for improving recreational facilities at the Houchin Ferry site. In addition to a No-Action Alternative (i.e., continue current management), two action alternatives are described and evaluated. Table 1, which is located at the end of this chapter, summarizes and compares the impacts from the three alternatives. The resources affected by these alternatives and the anticipated impacts to the human environment are described in chapter 3.

### INTRODUCTION

Three alternatives are considered in this environmental assessment— a no-action alternative and two action alternatives. Alternative C is the NPS preferred alternative.

### ALTERNATIVE A – NO ACTION

This concept is an “existing conditions” concept, in which current management policies and procedures would continue. This concept is used to evaluate the effects of the other two action alternatives and is also useful in understanding why the National Park Service or the public may believe that changes are necessary.

This alternative would involve continued use of the south side of the river; the north side would only have the existing vehicular turnaround space. River access would remain in a very poor state with river access challenges related to the river level and a steep, muddy bank on the north side to canoers/kayakers, but no facilities would be provided (figure 3).

#### South Side

Under this alternative, the National Park Service would not move to replace the existing aging facilities on the south side of the Green River. Here, visitors would continue to enjoy the 12 campsites on the western section of the site. These are first come, first served sites; the park will be implementing a system in which visitors may reserve a site with the NPS reservation system or use this same system when they arrive. The maximum number of campers in the recreational sites is eight, and the maximum stay is 14 days in a calendar year. The campground facilities would continue as they currently exist, with four chemical toilets, a fire ring and picnic table at each site, and a parking space. No showers, electricity, or running water would be provided. There would be no ABAAS (Architectural Barriers Act Accessibility Standard) accessible campsites in this campground. Access for visitors using wheelchairs within the site would generally be on unimproved ground with gravel-paved approaches. There would only be a temporary, unimproved canoe / kayak launch, and there would not be an NPS emergency boat launch.

Visitors would also continue to enjoy the aging, large group picnic shelter and picnic tables located to the east of the campground, near the top of the bank with views of the river. The picnic shelter has approximately 10 picnic tables with seating for approximately 60 users. The picnic area would continue to have a single water spigot. There is also a small dumpster located near the west end of the shelter. There is existing car parking as well as parking for longer vehicles or trailers (which could be used by liveries or other visitors).

## **North Side**

The north side of the Green River would remain in a very poor state with river access challenges for canoers/kayakers due to low river levels and a steep, muddy bank. No facilities would be provided. The north side of the former ferry crossing has limited improvements beyond the existing road terminus near the river that previously functioned as a ferry ramp prior to the dropping of the river level. Like the south side, the roadway entrance to the site is rather defined since its primary purpose was for vehicular access to the river and ferry crossing. It also bisects the existing site with ramps on either side creating pedestrian connectivity issues across the site. There are still remnants of the previous ferry operation, including the towers and light pole that is powered by an above grade line that crosses over the river.

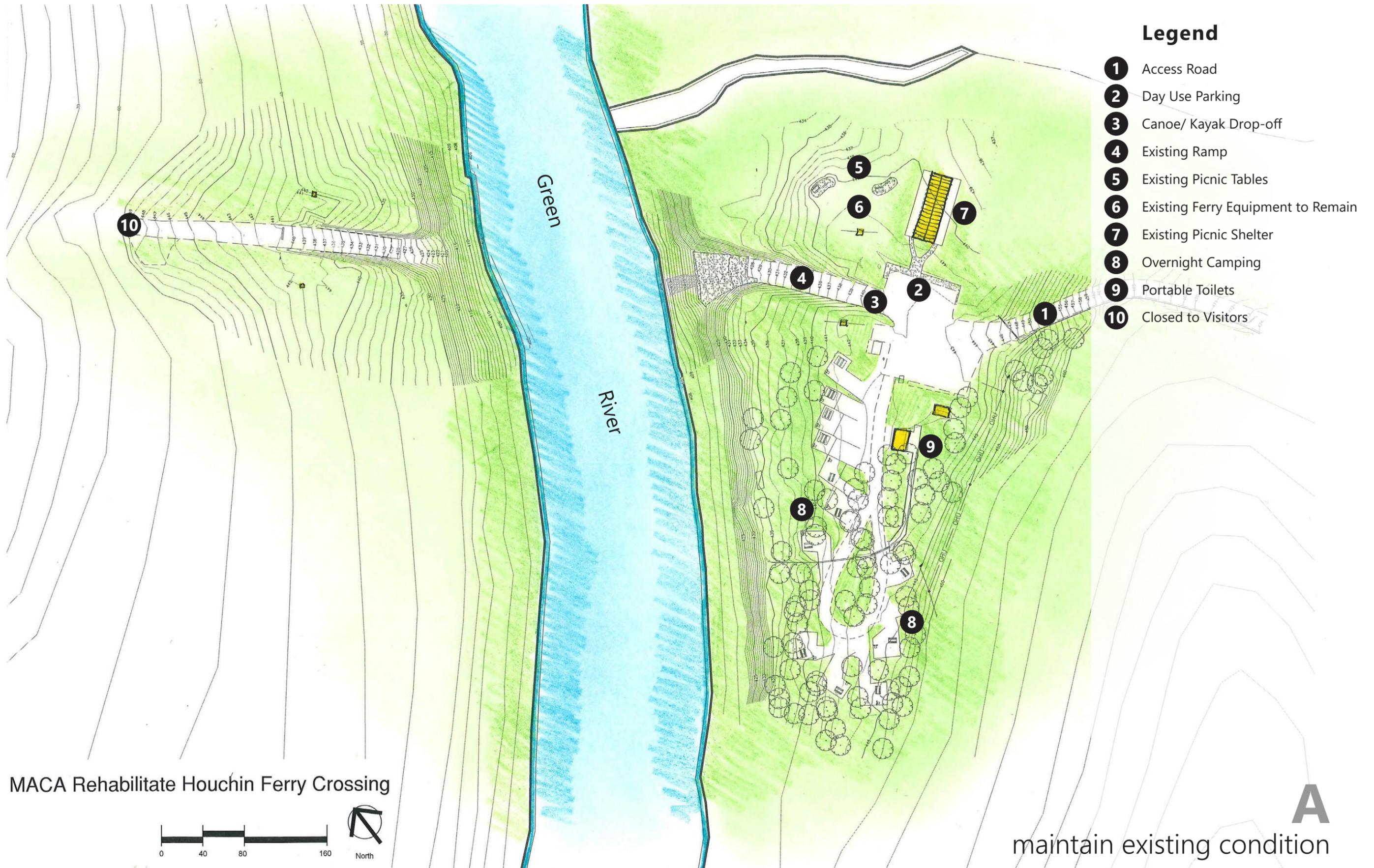


FIGURE 3. DIAGRAM ILLUSTRATING ALTERNATIVE A

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## **ALTERNATIVE B – BALANCE DAY AND OVERNIGHT USE, WITH MODERATE LEVEL OF FACILITY IMPROVEMENTS**

Under alternative B, the National Park Service would balance day and overnight use of the site while providing moderate facility improvements. The south side of the river would have a limited amount of new and upgraded facilities, while the north side would be newly developed with primitive visitor use facilities. River access would be improved via new canoe/kayak launches on either side of the river. See figure 4.

### **South Side**

The south side would provide nine developed overnight camping sites (including 1 accessible site) with fire rings, picnic tables, and access to portable toilets (accessible). There would be no electricity available at the campsites. A single additional recreational vehicle (RV) campsite with water and electricity would be provided to serve a campground host. There would be three to five small picnic shelters for individual or family gatherings and one medium-sized picnic shelter for group activities, holding five to six picnic tables. All picnic shelters would be accessible. A single water spigot would be provided at the main picnic area, as would a composting toilet.

Steps to the river's edge would be constructed in the day-use area, away from the campground.

The number of parking spaces would be increased to approximately 20 to include two accessible spaces (one car, one van). In addition, there would be four trailer spaces (one accessible). Vehicular circulation would be improved by adding a turnaround to the east end of the site, which would include a livery staging loop. The livery staging loop would accommodate two vans with trailers. The turnaround would also provide access to an emergency boat launch. A canoe/kayak launch is proposed at the river, with two rails. This launch would require removing the former ferry ramp. Also included would be an accessible trail to an overlook (accessible), which would allow dramatic views of the river from above.

### **North Side**

The north side would be open for walk-in campers and river users, particularly boaters engaging in primitive riverside camping.

Alternative B would provide for minimal improvements with a simple turnaround for vehicles and two parking spaces (one for park staff). An accessible trail would lead to an overlook. Two picnic tables (not accessible) and a composting toilet would be located along the trail to the overlook. A primitive trail (four feet wide with aggregate surface) would provide access to the river. Other limited walking paths would be provided at the site. There would be three to five primitive reservable tent campsites with fire rings and picnic tables. A primitive canoe/kayak launch would be provided. No water would be available at the site. (Note: The future use of Ollie-Houchin Ferry Road will be assessed in a future update to the Park's Trails Management Plan.)

The estimated net cost of alternative B is projected to be \$3.8 million (2019). This cost does not factor in various other additional cost requirements such as design development and construction management, which could add another 30%–35% to the net cost.

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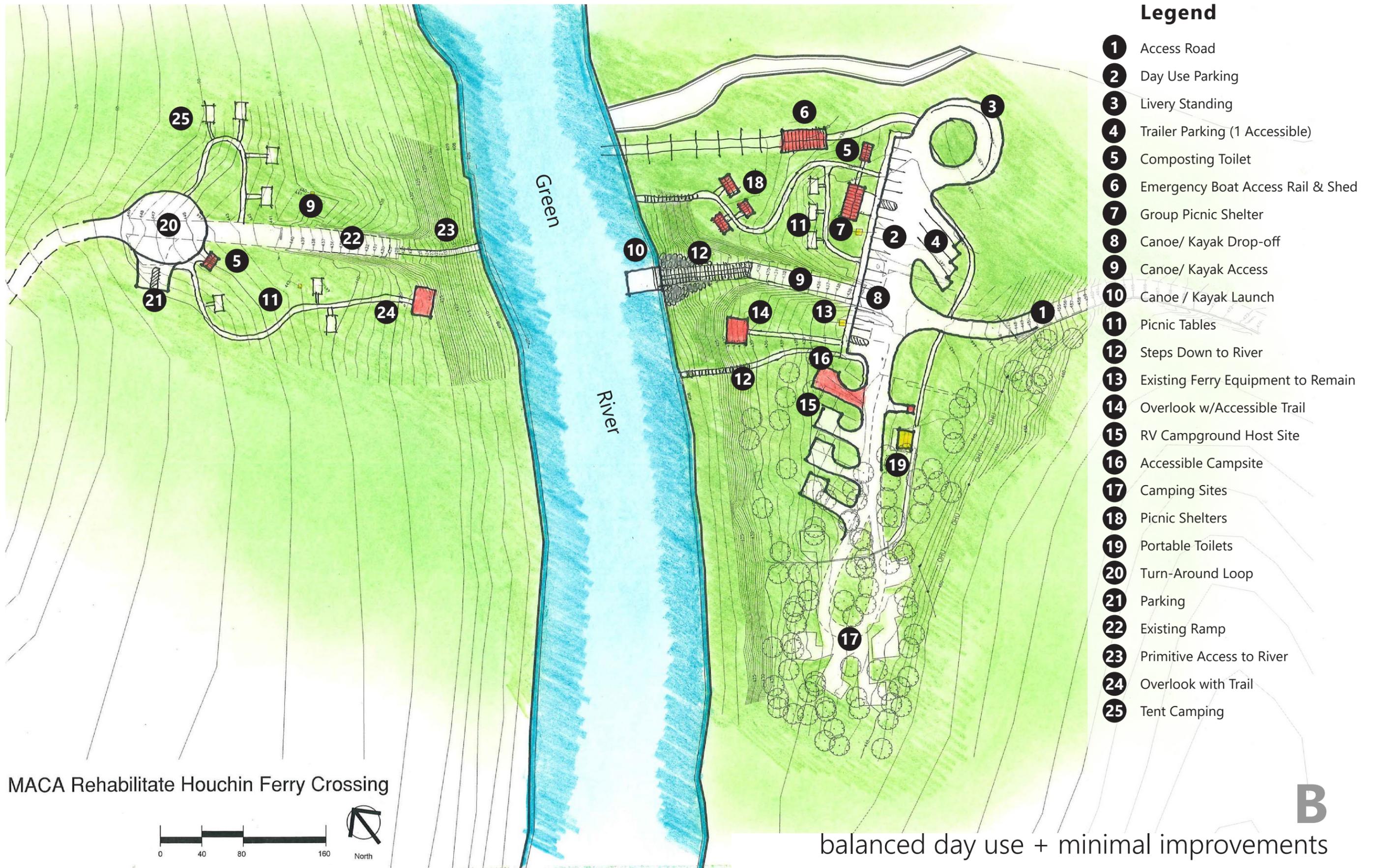


FIGURE 4. DIAGRAM ILLUSTRATING ALTERNATIVE B

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## **ALTERNATIVE C – BALANCE DAY AND OVERNIGHT USE WITH ENHANCED LEVEL OF FACILITY IMPROVEMENTS (PREFERRED ALTERNATIVE)**

Alternative C would balance day and overnight use but with a greater level of development than Alternative B. Camping would be reconfigured, picnicking opportunities would be expanded, and river access would be provided via canoe/kayak launches on either side of the river. A pedestrian suspension bridge would link the south and north sides of the river. See figure 5.

### **South Side**

The south-side campground would have 12 camping sites, each with a fire ring and picnic table. Of the 12 sites, 8 would be tent-only spaces (one accessible) at the west end of the campground, and four spaces would have water and electric hookups for vehicles 20-feet long or less. An additional RV campsite with water and power would be provided to serve a campground host. A dump station with holding tank would be available for vehicles. There would be one accessible group picnic shelter holding about seven to eight picnic tables for group activities, plus about six to eight accessible picnic tables for individual or family gatherings. At least half of the individual/family picnic tables would have shelters. Water and electric hookups would be provided in the picnic area, together with a composting toilet.

Steps to the river's edge would be constructed in the day-use area, away from the campground.

The number of parking spaces would be increased to 25 to include two accessible spaces (one car, one van). Up to seven of the spaces would be located in front of a portable toilet station (accessible) near the eastern edge of the campground. In addition, there would be six trailer spaces (one accessible). Vehicular circulation would be improved by adding a turnaround to the east end of the site, which would include a livery staging loop for two vans with trailers. This turnaround would also provide access to an emergency boat launch. A canoe/kayak launch would be provided at the river, with two rails. This launch would require removing the former ferry ramp. Also included is an accessible trail to an overlook, which would allow dramatic views of the river from above.

### **North Side**

The north side would be open primarily for river users and hikers seeking primitive riverside camping but would have limited vehicle access.

Alternative C would provide a simple turnaround for vehicles. Three parking spaces would be provided. One of these spaces would be accessible and one would be for park staff. More walking paths would be provided than under alternative B. An accessible trail would lead to a north-side overlook above the river. This trail would also serve three to four accessible picnic tables. There would be about six to nine primitive tent campsites, three to five of which would be reservable, with the rest being first come, first served. Boaters paddling the Green and Nolin Rivers could use the campsites as a stopover on a multi-day floating trip. The campsites would have fire rings and picnic tables. There would be a canoe/kayak launch similar to the one on the south side but about 50% smaller and without a rail. No water would be provided at the site. (Note: The future use of Ollie-Houchin Ferry Road will be assessed in an update to the Park's Trail Management Plan.)

Alternative C would also provide a pedestrian suspension bridge over the Green River to connect recreational facilities on the south and north sides of the river. The bridge would have a deck elevation of around 450 feet above sea level and would be reached either by stairs or ramps extending from the ground surface to the bridge deck. The bridge would be approximately 370 feet in length, with the actual distance depending on whether the bridge was served by stairs or ramps. The principal bridge supports would be located on the benches above the riverbanks, thereby eliminating obstructions at the river's edge.

The estimated net cost of alternative C is projected to be \$5.7 million (2019). This cost does not factor in various other additional cost requirements such as design development and construction management, which could add another 30%–35% to the net cost.

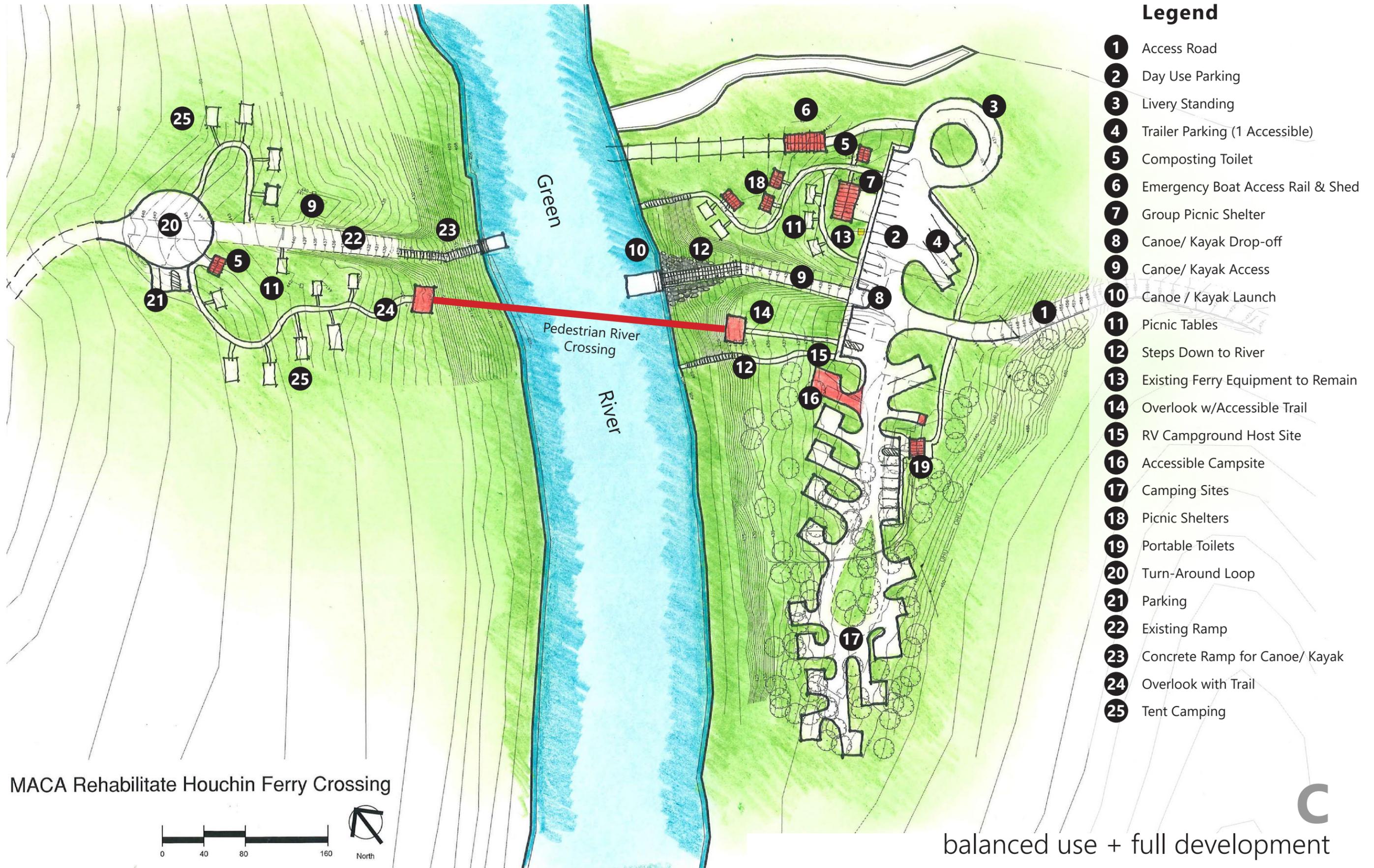


FIGURE 5. DIAGRAM ILLUSTRATING ALTERNATIVE C

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**Table 1. Summary of Alternatives**

<b>Location</b>	<b>Alternative A Continue Current Management (Take No Action)</b>	<b>Alternative B Balanced Day and Overnight Use with Moderate Level of Facility Improvements</b>	<b>Alternative C Balanced Day and Overnight Use with Enhanced Level of Facility Improvements</b>
<b>South Side</b>	12 parking spaces	20 parking spaces	25 parking spaces
<b>South Side</b>	No accessible parking spaces	2 accessible parking spaces (1 car, 1 van), included in about 20 parking spaces	2 accessible parking spaces (1 car, 1 van), included in about 25 parking spaces
<b>South Side</b>	No designated trailer spaces	4 trailer spaces (1 accessible)	6 trailer spaces (1 accessible)
<b>South Side</b>	No loop	Livery standing loop – two vans with trailers	Livery standing loop – two vans with trailers
<b>South Side</b>	12 campsites, with fire rings and picnic tables	9 campsites (1 accessible), with fire rings and picnic tables	12 campsites: 8 tent-only spaces (1 accessible), and 4 with water and electric hookups for vehicles 20-feet long or less; dump station
<b>South Side</b>	No RV campground host campsite	1 RV campground host campsite with water and electric	1 RV campground host campsite with water and electric
<b>South Side</b>	Water spigot at picnic area only	Water spigot at picnic area only	Water spigots/hookups at picnic area and 4 vehicle camping spaces
<b>South Side</b>	No electric at campsites	No electric at campsites	4 spaces for vehicles 20 ft. or less with water and electric hookups
<b>South Side</b>	Some picnic tables	3-5 picnic tables (accessible)	6–8 picnic tables (accessible), at least 50% to have shelters
<b>South Side</b>	Large group picnic shelter	Group shelter with 5-6 picnic tables (accessible)	Group shelter with 7–8 picnic tables (accessible)
<b>South Side</b>	N/A	Portable toilets (accessible) and composting toilet	Portable toilets (accessible) and composting toilet
<b>South Side</b>	No emergency boat launch	Emergency boat launch	Emergency boat launch
<b>South Side</b>	No permanent canoe/kayak launch	Canoe/kayak launch with two rails	Canoe/kayak launch with two rails
<b>South Side</b>	N/A	Steps to river edge in day-use area	Steps to river edge in day-use area
<b>South Side</b>	No trail to overlook	Trail to overlook (accessible)	Trail to overlook (accessible)

<b>Location</b>	<b>Alternative A Continue Current Management (Take No Action)</b>	<b>Alternative B Balanced Day and Overnight Use with Moderate Level of Facility Improvements</b>	<b>Alternative C Balanced Day and Overnight Use with Enhanced Level of Facility Improvements</b>
<b>South Side</b>	No overlook or pedestrian bridge	Overlook (accessible)	Overlook (accessible)
<b>South Side</b>	N/A	N/A	Pedestrian suspension bridge over river
<b>North Side</b>	Currently closed to visitors, except canoes/kayaks pulling out of Green River	Open primarily for river users, with primitive riverside camping	Open for river users and walk-in campers, with primitive riverside camping
<b>North Side</b>	N/A	Simple turnaround	Simple turnaround
<b>North Side</b>	N/A	2 parking spaces (1 for park staff)	3 parking spaces (1 for park staff, 1 accessible)
<b>North Side</b>	N/A	Trail leading to overlook (accessible)	Trail leading to overlook (accessible)
<b>North Side</b>	N/A	2 picnic tables	3–4 picnic tables (accessible)
<b>North Side</b>	N/A	1 composting toilet	1 composting toilet
<b>North Side</b>	N/A	Primitive canoe/kayak launch without a rail	Primitive canoe/kayak launch without a rail
<b>North Side</b>	N/A	No water on site	No water on site
<b>North Side</b>	N/A	Walkways to recreational sites.	Slightly longer walkways to recreational sites.
<b>North Side</b>	N/A	3–5 primitive campsites with fire rings and picnic tables (reservable)	6–9 primitive campsites with fire rings and picnic tables (3–5 reservable, others first come, first served)

## **ALTERNATIVES CONSIDERED BUT DISMISSED**

Discussed below are alternatives that were considered by the planning team but ultimately dismissed from further analysis. These alternatives were dismissed because they are not technically feasible; do not meet the purpose and need of the project; would create unnecessary or excessive adverse impacts on natural or cultural resources; or would conflict with the overall management of the park of the park or its resources.

- Ramp for motorized boats – After the removal of Lock and Dam No. 5, the river elevation is estimated to drop another 3 to 5 feet. The former ferry ramps that were used for launching boats into the Green River will then be approximately 11 or more feet above the river with a riverbank slope from 35% to 40% on the south side and 16% to

48% on the north side from where the ramp ends down to the river. Ideally, the range for a ramp where a boat with a motor is launched from a trailer is 12% to 15%. This requires removal of the existing ramps and construction of new, longer ramps at a lower elevation to accommodate the grade change from the new river elevation. The construction of a new motorized boat ramp at either site would have unacceptable resource impacts and would compromise the functionality of each site. For these reasons, a ramp for launching motorboats is not feasible for this site. It will be recommended that visitors use nearby boat launches, such as the Brownsville Boat Ramp, the ramp at Green River Ferry, and in the future, when improved, the new Lock 6 Site. The National Park Service will have boat access to the river for emergency situations, and at such times the park boat will be lowered into the river using a boat railing system and a winch.

- Vehicular Ferry – For similar reasons as the boat ramp, the slope needed to construct a ramp to the water’s edge for a vehicle to access a ferry would have unacceptable resource impacts and would compromise the functionality of each site. Most vehicles traveling from Brownsville to the north side of the park, and vice-versa, save about six minutes by driving around the west side of the park as compared to using the former ferry. Less than 10,000 people a year were using the ferry when it closed.
- Vehicular Bridge (including low-water crossing) – Several times since the 1980s, the park has evaluated the feasibility of a vehicular bridge at both Houchin Ferry and at Green River Ferry. The idea was most recently rejected during a planning process that concluded in 2013. Such a bridge is not feasible because of the significant cost and because of unacceptable resource impacts. Additionally, the park has twice evaluated a low water crossing (in 2013 for Green River Ferry and in 2019 for Houchin Ferry). In both evaluations, the low water crossing was deemed not feasible, most recently because of the tremendous negative impacts that would result with the landscape changes related to the elevations. Also, a low water crossing presents significant safety issues.

## **MITIGATION MEASURES**

Best management practices and mitigation measures would be used to prevent or minimize potential adverse impacts associated with this project. These practices and measures would be incorporated into the project construction documents and plans.

Resource protection measures undertaken during project implementation would include, but would not be limited to, those listed in below in table 2 below. The impact analyses in the “Affected Environment and Environmental Consequences” section (see below) were performed assuming that these best management practices and mitigation measures would be implemented as a part of the action alternative.

**Table 2. Mitigation Measures and Best Management Practices**

<b>Potential Adverse Effect</b>	<b>Mitigation Measure or Best Management Practice</b>
<b>Historic Properties</b>	<p>To minimize ground disturbance, all staging areas, materials stockpiling, vehicle storage, and other construction-related facilities and areas would be located in a previously disturbed area or on hardened surfaces such as the existing parking areas.</p> <p>Ground-disturbing activities would be carefully planned because some areas may harbor presently unknown archeological resources. Special care must be taken in areas where excavation will be one meter or more below ground surface, as archeological resources may exist below this horizon. Construction documents would include stop-work provisions should archeological resources be uncovered, and the contractor would be apprised of these protective measures during the pre-construction conference.</p> <p>Work limits would be established and clearly marked to protect resources, and all protection measures would be clearly stated in the construction specifications. Workers would be instructed to avoid conducting activities beyond the construction zone and their compliance monitored by the project Contracting Officer's Technical Representative.</p> <p>Archeological monitoring of ground disturbance in currently inaccessible paved areas or areas beneath and adjacent to existing structures (walkways, steps, flooring, etc.) would help ensure that all cultural resources were identified and documented during the construction process.</p> <p>If previously unknown archeological resources were discovered, work would be stopped in the area of any discovery, protective measures would be implemented, and procedures outlined in 36 CFR 800.13 would be followed. Resources would be evaluated for their National Register of Historic Places significance, and adequate mitigation of project impacts (in consultation with appropriate agencies) and adjustment of the project design would take place to avoid or limit the adverse effects on resources.</p> <p>To reduce unauthorized collecting, construction personnel would be educated about cultural resources in general and the need to protect any cultural resources encountered. Work crews would be instructed regarding the illegality of collecting artifacts on federal lands to avoid any potential Archeological Resources Protection Act violations. This would include instructions for notifying appropriate personnel if human remains were discovered.</p>
<b>Construction-related effects on soils</b>	<p>Standard best management practices to limit erosion and control sediment release would be employed. Such measures include use of silt fencing, limiting the area of vegetative disturbance, use of erosion mats, and covering banked soils to protect them until they are reused.</p>

Potential Adverse Effect	Mitigation Measure or Best Management Practice
<p><b>Public Health and Safety</b></p>	<p>An accident prevention program would be a required submittal. This Plan would include job hazard analyses associated with each major phase of the proposed project and would emphasize both worker and public safety. It would include planning for emergency situations, including fires, tornados, building collapse, explosions, power outages, rainstorms, and flooding.</p> <p>The Plan would also take into consideration the nature of the construction, site conditions, including seasonal weather conditions and the degree of risk or exposure associated with the proposed activity. Regular project inspections and safety meetings would ensure the safety of the premises both to construction staff and visitors.</p> <p>A defined work area perimeter would be maintained to keep all construction-related impacts within the affected area. All paved areas that are subject to vehicular and pedestrian traffic would be kept clean of construction debris and soils. Sweeping of these areas would be implemented as necessary.</p> <p>Visitor safety would be ensured both day and night by fencing of the construction limits of the proposed action. Areas not safe for public entry would be marked and signed for avoidance. Unsafe conditions would be inspected for and corrected as soon as practicable to minimize the potential for staff or visitor injury.</p> <p>To the degree possible, impacts would be mitigated by the use of best management practices to reduce generation of dust and by limits on the types of chemicals (e.g., ones with high Volatile Organic Compound ratings) used in new construction and the rehabilitation.</p>
<p><b>Visitor Experience</b></p>	<p>Specific provisions would ensure that the majority of material deliveries were made during the week, rather than on weekends or holidays. By the same token, most of the disruptive work would not occur on weekends or holidays. Disruptive early morning or late evening deliveries would be minimized to the extent possible. The contractor would be encouraged to deliver the majority of materials in the early morning hours, before 10:00 a.m.</p> <p>All construction equipment would be equipped with mufflers kept in proper operating conditions, and when possible, equipment would be shut-off rather than allowed to idle. Standard noise abatement measures would include the following elements: a schedule that minimizes impacts to adjacent noise-sensitive areas, use of the best available noise control techniques wherever feasible, use of hydraulically or electrically powered impact tools when feasible, and location of stationary noise sources as far from sensitive public use areas as possible.</p>
<p><b>Sustainability and Conservation Potential</b></p>	<p>Shipment of materials in full loads would be encouraged, and vehicles and equipment would be maintained to minimize pollution generation.</p> <p>All new buildings would incorporate energy efficient and sustainable design to minimize energy consumption.</p>

## INDICATORS, THRESHOLDS, AND VISITOR USE MANAGEMENT STRATEGIES

This Plan establishes indicators and thresholds using the framework created by the Interagency Visitor Use Management Council (IVUMC). Indicators measure conditions that are related to visitor use, and monitoring is conducted to track those conditions over time. The results of monitoring are used to inform and select strategies to be used by park managers to not exceed the maximum amount of visitor use that can be accommodated for a site (visitor capacity). This iterative practice of monitoring, implementing potential management strategies, and then continuing to monitor to gauge the effectiveness of those actions allows park managers to maximize benefits for visitors while achieving and maintaining desired conditions for resources and visitor experiences in a dynamic setting.

Indicators that will be implemented as a result of this planning effort are described below and are considered part of the preferred alternative. For a complete discussion including thresholds, triggers, rationale, and associated potential management strategies, see appendix A.

*Indicator* - Number of complaints related to boat ramp crowding or use conflicts

*Threshold* - No more than five validated complaints per month related to visitor use of the boat ramp.

*Indicator* - Number of incidences of unauthorized roadside parking

*Threshold* - No more than five incidences of unauthorized parking per month within a ½ mile of boat ramp / campground.

## VISITOR CAPACITY

This section provides information about the visitor capacity identification as it relates to the VUM framework. One of the goals of this Plan is to preserve the fundamental resources and values of the park. By managing the number of people at one time, the National Park Service can help ensure that resources are protected and that visitors have the opportunity for a range of high-quality experiences.

The Interagency Visitor Use Management Council defines visitor capacity as the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area was established. The visitor capacity will be used to inform and implement the management strategies selected as part of this Plan. Identifying visitor capacity is also directed by legal mandates that require the National Park Service to identify and implement commitments for visitor capacities for all areas of a park unit per the National Parks and Recreation Act of 1978 (IVUMC 2016). The visitor capacity was identified using best practices and examples from other plans and projects across the National Park Service. Table 3 below is a summary of the visitor capacities (which vary by alternative). Appendix A outlines the considerations and process used to identify visitor capacity for Houchin Ferry.

**Table 3. Visitor Capacity Determinations by Alternative**

<b>Analysis Area</b>	<b>Alt A Current Condition</b>	<b>Alt B Visitor Capacity</b>	<b>Alt C Visitor Capacity</b>
<b>South Side Campground</b>	12 sites x 8 people = 96 People at One Time (PAOT)	9 sites x 8 people = 72 PAOT	12 x 8 people = 96 PAOT
<b>Campground Host Site</b>	-	2 PAOT	2 PAOT
<b>South Side Day Use (Boat ramp, picnic area)</b>	12 parking spaces x 1.7 People Per Vehicle (PPV) = 21 PAOT + 4 PAOT canoe / kayaking. = 25 PAOT	24 parking spaces (20 standard spaces + 4 trailer spaces) x 1.7 PPV = 41 PAOT + 8 PAOT canoe / kayaking. = 49 PAOT	31 parking spaces (25 standard spaces + 6 trailer spaces) x 1.7 PPV = 53 PAOT + 8 PAOT canoe / kayaking. = 61 PAOT
<b>South Side Total</b>	121 PAOT	123 PAOT	159 PAOT
<b>North Side Campground</b>	0	3-5 sites x 4 people = 12-20 PAOT	6-9 sites x 4 people = 24-36 PAOT
<b>North Side Day Use</b>	0	1 parking space for visitors x 1.7 PPV = 2 PAOT + 1 parking space for park staff = 1 PAOT = 3 PAOT	2 parking spaces for visitors x 1.7 PPV = 4 PAOT + 1 parking space for park staff = 1 PAOT = 5 PAOT
<b>North Side Total</b>	0	15-23 PAOT	29-41 PAOT

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CHAPTER THREE  
**ENVIRONMENTAL CONSEQUENCES**



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## CHAPTER 3: ENVIRONMENTAL CONSEQUENCES

### BACKGROUND

Mammoth Cave National Park is located in south-central Kentucky, in the counties of Edmonson, Barren, and Hart. The Park encompasses 52,830 acres. Mammoth Cave National Park contains the world's longest known cave system and offers internationally renowned examples of karst topography and one of the most diverse cave ecosystems in the world.

In addition to the world-renowned cave system, the park is noted for its outstanding scenic rivers, valleys, bluffs, forests, and abundant wildlife. The park includes 25 miles of the Green River and seven miles of the Nolin River. The Green River supports a diverse freshwater mussel population including 11 federally listed endangered species. It is also the master stream controlling the geologic development of Mammoth Cave and its unique ecosystem.

### PURPOSE OF ENVIRONMENTAL ASSESSMENT

According to the Council on Environmental Quality's regulations regarding the National Environmental Policy Act, there are three primary purposes of an environmental assessment: (1) to help determine whether the impact of a proposed action or alternative could be significant, thus indicating that an environmental impact statement is needed; (2) to aid in compliance with NEPA policy when no environmental impact statement is necessary by evaluating a proposal that would have no significant impacts, but that may have measurable adverse impacts; and (3) to facilitate preparation of an environmental impact statement if one is necessary. This environmental assessment is being prepared to analyze the environmental effects of the two alternatives described in chapter 2 above.

### DIRECT VERSUS INDIRECT EFFECTS OF ALTERNATIVES

The following definitions of direct and indirect effects were used in this evaluation.

**Direct.** An effect that is caused by an action and occurs at the same time and place.

**Indirect.** An effect that is caused by an action, but is later in time or farther removed in distance, but still reasonably foreseeable. These would be caused, for example, by growth that is induced by the project. For purposes of this environmental assessment, however, it is assumed that because the proposed site-redevelopment is so small in overall scope, it would not have any indirect effects related to induced growth or other factors. The indirect effects of the project are therefore not referenced again in this impact analysis.

### CUMULATIVE EFFECTS ANALYSIS METHOD

The Council on Environmental Quality (CEQ 1978) regulations for implementing the National Environmental Policy Act requires assessment of cumulative effects in the decision-making process for federal projects. Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects are considered for

both the no action and the two action alternatives and are presented at the end of each impact topic discussion analysis.

Cumulative effects were determined by combining the predicted effects of an alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other past, ongoing, or reasonably foreseeable future actions at the park and in the surrounding area.

Mammoth Cave National Park is located in a remote, rural area that is subject to relatively minimal new development pressures. Past damage to cultural and natural resources is largely associated with land clearing, cultivation, and the construction of dwellings and farm structures. Within the park itself, natural terrestrial resources are in many respects recovering from past land disturbing activities. Similarly, historic properties (archeological resources, historic structures, cultural landscapes) have benefited from decades of protection and absence of substantial development activity. The greatest resource threats to the park stem from degraded air and water quality, invasive species, and the continuing impact on the river from the impoundment of Lock and Dam No. 5. Cultural resource threats include continued looting of historic and prehistoric sites. The cumulative effects of the proposed action are considered to be almost identical to existing conditions with respect to these threats. However, other specific activities could have a bearing on the cumulative impacts of the project, including the projected removal of Lock and Dam No. 5; the town of Brownsville's recent achievement of Trail Town status and associated increase in tourism; the anticipated future Green River National Water Trail designation; and future trail-planning efforts to be undertaken by the park. These activities will be taken into account in assessing the cumulative impacts of the proposed action.

## **IMPACTS TO SOILS**

### **Affected Environment**

Soils on the south bank are a Nolin silt loam consisting of a brown silt loam at the surface to yellowish brown silt loam to a depth of 80 inches below surface. Shovel/posthole tests at the site encountered dark yellowish brown to yellowish silt loam with very little visible difference between the top and bottom of tests in color and consistency of soil. There is no evidence of a plow zone in tested areas, which might normally be expected on a floodplain typically used for cultivation. The lack of a visible plow zone and the buried pieces of cement in one sample suggests that topsoil may have been graded off during construction of the ferry, campground, and picnic pavilion.

Soils on the north bank are Chagrin loam, which, like the Nolin soils on the opposite bank, are frequently flooded and consist of a loam to silty loam throughout the soil column. Tests suggest that the soils on the north side are less disturbed by construction of the ferry and access road.

### **Environmental Consequences**

**Impacts from Alternative A.** Under alternative A, the old ferry ramps and existing recreational facilities would remain in place. There would be no new construction and no new ground-disturbing activity. As a result, no new adverse impacts to soils would occur. This alternative would not contribute to ongoing cumulative adverse impacts to soils.

**Impacts from Alternative B.** Construction of the proposed canoe/kayak launch and other new/updated recreational facilities would result in localized disturbance to soils within the

existing recreational area. Disturbance would result from both excavation activities (associated with installing foundations, etc.) and soil compaction (resulting from the operation of heavy equipment on exposed soils). For the most part, soil disturbance would take place on flat ground and would result in minimal erosion, especially in light of the silt fences and other best management practices required by the “Mitigation Measures” portion of this environmental assessment (see “Mitigation Measures” section in chapter 2). Soil functions would be lost under the footprint of all new buildings and parking areas. On balance, impacts to soils would be limited because of the small area affected and the fact that much of the soil in the recreational area is already disturbed and compacted.

Alternative B would add to the ongoing loss of soils at the local and regional level resulting from human land disturbing activities and projected increases in visitation to the park because of local and regional recreation initiatives. The contribution of this alternative to such ongoing soil loss would be minimal due to the small amount of land affected. Alternative B would thus contribute only minimally to ongoing cumulative adverse impacts to soils.

**Impacts from Alternative C.** Under alternative C, direct, indirect, and cumulative impacts to soils would be similar to those in alternative B but marginally greater in extent due to somewhat more extensive land disturbance, especially on the north side of the river. Nevertheless, the increase in disturbance is marginal and impacts to soils would be minor, especially considering much of the soil in the affected area is already disturbed and compacted.

## **IMPACTS TO VEGETATION**

### **Affected Environment**

Mammoth Cave National Park contains portions of both the Oak-Hickory Forest Region to the west, and the Mixed Mesophytic Forest Region to the east and north. With over 1,200 species of flowering plants, including 84 species of trees, the diversity within plant communities is high. Forest communities in the patchwork of karst terrain largely differentiate along moisture gradients governed by proximity to surface streams and ponds, which is largely determined by bedrock geology and soil structure. Physiographic factors such as slope and aspect also govern the range of moisture extremes through the seasons. Cedar Glades and Barrens naturally occur on steep dry limestone slopes that face south and southwest, and also on disturbed sites. On moderately dry sites near ridgetops, Chestnut Oak and Red Maple are found. Under the mesic conditions found on lower slopes, in the bottoms of narrow karst valleys, and the relatively level terrain on top of plateau fragments, oaks, Hickories, American Beech, Tulip Poplar, and Maples sort according to local conditions. Juniper, Virginia Pine, and Blackjack Oak largely dominate former farm fields. At the wettest end of the moisture spectrum, Hemlock and Umbrella Magnolia occur in deep sandstone gorges, and on river floodplains Sycamore, Box Elder, and River Birch occur. Most of the forest growth within the park is secondary, and very similar in size and age structure.

## **Environmental Consequences**

**Impacts from alternative A.** Under alternative A, the old ferry ramps and existing recreational facilities would remain in place. There would be no new construction and no new ground-disturbing activity. As a result, no new adverse impacts to vegetation would occur. This alternative would not contribute to ongoing cumulative adverse impacts to vegetation.

**Impacts from Alternative B.** Alternative B would generate new impacts to vegetation due to construction of the proposed canoe/kayak launch and other new/updated recreational facilities. Vegetation would be lost outright (removed and replaced with hardened surfaces) in the case of the new structures and new parking areas. However, the amount of vegetation to be removed is small and would consist mostly of grasses (including nonnative species) and some individual trees.

Virtually all of the areas affected would be considered already disturbed. Heavy equipment may cause temporary disturbance in adjacent areas beyond the footprint of the construction sites. There would also be localized vegetation disturbance from foot traffic during vegetation clearing and construction activities. Repeated disturbance of vegetation (i.e., due to vehicle passes or foot traffic) during construction in areas where plants are not cleared would cause damage to plants and disturbance to ground cover.

Exotic plants or seeds could be brought to the site with fill material or on construction machinery. New introductions could allow for exotic plants to become established and spread, especially in areas where the ground is disturbed by construction activities, and their proximity to native vegetation communities would represent a new threat to native habitats. Exotic plants currently growing in the area can also become established and spread on newly disturbed substrates. However, mitigation to ensure that imported material does not contain exotic plant material would be implemented, and contractual documents would require that heavy equipment should be cleaned so that it is weed-free before entering the project area.

Federal or State-listed plant species, or their habitats, would not be impacted as none occur in the vicinity of the project areas.

Alternative B would add to the ongoing loss of vegetation at the local and regional level resulting from human land disturbing activities and projected increases in visitation to the park as a result of local and regional recreation initiatives. The contribution of this alternative to such ongoing loss of vegetation would be minimal due to the small amount of land affected. Alternative B would thus contribute only minimally to ongoing cumulative adverse impacts to vegetation.

**Impacts from Alternative C.** The nature of the direct, indirect, and cumulative impacts to vegetation under alternative C would be generally the same as under alternative B, but the extent of the impacts would be somewhat greater due to the more extensive level of development.

## **IMPACTS TO WETLANDS AND FLOODPLAINS**

### **Affected Environment**

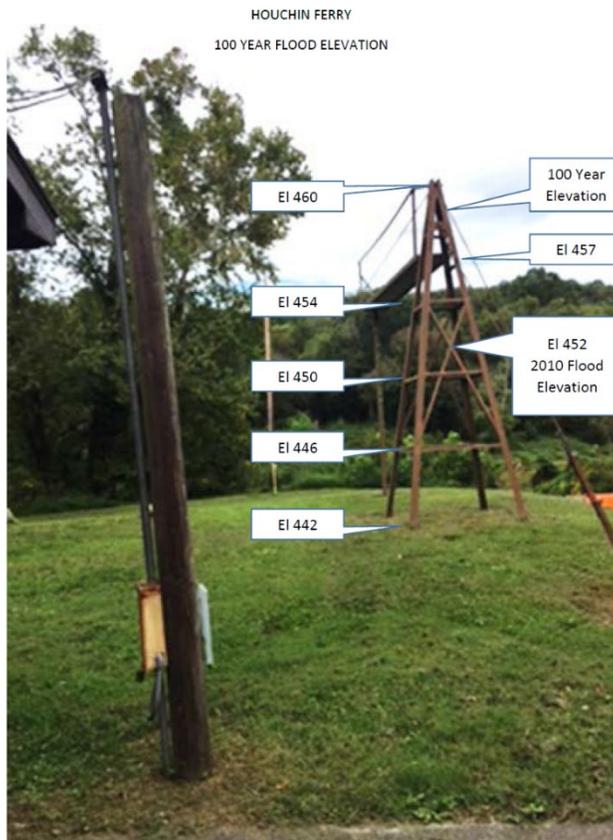
A wetland delineation conducted by the National Park Service at the Houchin Ferry site found the total wetland acreage of the area, both sides of the river combined, is 38,870 square feet, or 0.89 acres. Of this total, 0.78 acres occurs on the south side, and 0.11 acres occurs on the north. These riparian wetlands occur in thin strips along the riverbank on both sides of the river. See figure 6.



**FIGURE 6. WETLAND DELINEATION AT HOUCHIN FERRY SITE. LEGEND: RED LINE IS OUTLINE OF WETLAND AREAS AS DELINEATED. FERRY SOUTH = 33,773 SQUARE FEET/ 0.78 ACRES; FERRY NORTH = 5,097 SQUARE FEET/ 0.11 ACRES**

The 100-year flood elevation for the Green River at Houchin ferry is approximately 459 feet. Calculations by NPS staff indicate that this has been the 100-year flood elevation both before and after the removal of Lock and Dam No. 6, which caused a river elevation drop of approximately 8 to 10 feet. The height of the former lock and dam was sufficiently low that the dam had no appreciable upstream impacts during periods of high water. It is anticipated that the 100-year flood elevation will remain at approximately 459 feet even after the projected removal of Lock and Dam No. 5.

Both the south and north sides of the Houchin Ferry recreation site lie within the 100-year floodplain. A narrow band of wetlands line the river along both banks. The following figure shows the 100-year floodplain elevation in relation to the ferry towers on the south side of the river. Note that the bottom of the ferry tower (442 feet) is roughly the same elevation as the existing campground and picnic area.



**FIGURE 7. FLOOD ELEVATIONS, SOUTH SIDE OF THE HOUCHIN FERRY SITE, ON COUNTERED BENCH ABOVE RIVER**

As is evident from figure 7, the Houchin ferry site is, and has been, susceptible to flooding during 100-year flood events. This will remain the case under both the no-action and action alternatives.

### **Environmental Consequences**

**Impacts from Alternative A.** Under alternative A, the old ferry ramps and existing recreational facilities would remain in place. There would be no new development and thus no new impacts to wetlands or floodplains. Existing recreational and support facilities would remain in the 100-year floodplain and would be susceptible to damage during floods.

**Impacts from Alternative B.** The only parts of this project to be constructed in wetlands are the canoe/kayak launches on the south and north banks of the Green River. These launches would be constructed within the footprint of the existing ferry ramps using concrete and riprap for site stabilization. Together, the launches would impact less than 1/10-acre of wetlands. Impacts to wetland function and values would thus be minor. Due to the small extent of impact, this project is exempt from the requirement to prepare a Wetland Statement of Findings under Executive Order 11990 (Protection of Wetlands). NPS Procedural Manual 77-1 provides that small boat ramps/launches, piers, or docks with total long-term wetland impact for the entire project (both onsite and offsite) of 0.1 acre or less are exempt from the requirement to prepare a Wetland Statement of Findings.

Under alternative B, the existing recreational facilities on the 4-acre site south side of the river would remain in place or be upgraded. In addition, some new facilities would be added on the south side, and the 1-acre site on the north side of the river would be newly developed. Facilities would consist of additional parking, new picnic tables, canoe/kayak launch, emergency boat launch, short walking trails, overlook, portable and composting toilets. All facilities, current and new, would be in the 100-year floodplain. The facilities cannot be moved out of the 100-year floodplain because (a) they support park functions often located near water for the enjoyment of visitors, and (b) the steep adjacent topography prevents moving the facilities farther up-slope.

The nature of the facilities, old and new, is such that they would not impede flood waters to any appreciable extent. The additional pavement and structures called for by this alternative are unlikely to negatively affect flood storage or groundwater recharge to a measurable degree or to degrade overall riparian services, because (a) the paving footprint would still be small even after expansion, (b) the proposed boat launch would be designed so as to minimally impede floodwaters, and (c) the portable toilets could be removed from the 100-year floodplain during flood events. Those facilities that could not be moved could be subject to flood damage, but here again, the nature of the facilities is such that any damage would likely be minor. The existing campground and picnic area have been in place for many years and experienced a number of flooding incidents. Damage to property/facilities has been minor.

The National Park Service manages floodplains in parks in accordance with Executive Order 11988 (Floodplain Management). NPS Procedural Manual 77-2 provides that when floodplain sites are used for overnight occupation, including camping, the National Park Service must take various steps to protect life, property, and park resources. Specifically, flood conditions and associated hazards must be quantified; appropriate actions (an alternative site or effective mitigation and/or warning and/or evacuation planning) must be taken to manage floodplain conditions and flood hazards; and a formal Statement of Findings must be prepared. A Floodplain Statement of Findings is attached to this document as appendix B.

Cumulative impacts to wetlands and floodplains would be minimal due to the very limited amount of upstream development within and adjacent to floodplains in the park.

**Impacts from Alternative C.** Apart from the suspension bridge proposed in this alternative, impacts to floodplains under alternative C would generally be the same as under alternative B, both in nature and extent. The footprint of development for new parking spaces, campsites, picnic areas, and boat launches would be only marginally greater under this alternative than under alternative B where flooding impacts are concerned. The biggest impact to floodplains posed by this alternative would come from the suspension bridge. No piers supporting the bridge would be placed in the active river channel or along the riverbanks, but the bridge supports, although constructed on existing contoured bluffs/benches above the river, would nevertheless be within the 100-year floodplain. Likewise, the bridge's proposed elevation of 450 feet above sea level is less than the 100-year flood elevation of 459 feet. The bridge would thus be subject to damage during the 20-year flood events (since flooding has occurred multiple times above the 445-450 elevation in the past 100 years and damage from fast floating large trees is of concern). Also, the proposed bridge could marginally affect river flow during such events. Impacts to floodplains under this alternative would be greater than under alternative B, but the bridge would be designed to minimize obstruction to floodwaters and as well as damage to the structure itself. For additional information, please refer to the Floodplain Statement of Findings in appendix B.

## **IMPACTS TO PUBLIC HEALTH AND SAFETY**

### **Affected Environment**

Existing facilities at the Houchin Ferry are safe overall, but the inclined ferry ramps provide some risk of injury, and the usual risks associated with outdoor recreation exist (e.g., insect bites, poisonous plants, campfire injuries, etc.). Some of the facilities are aging and present slightly increased safety issues (i.e., splinters from old benches, uneven surfaces, etc.). Also, the campground and day-use areas are prone to flooding when the river rises to approximately 40 feet, though usually this is gradual and there are typically no visitors present during these flood events. In addition, the lower water levels associated with the removal of Lock and Dam No. 6 have exposed the edge of the concrete ferry ramps and part of the formerly active riverbed, resulting in uneven surfaces and new potential tripping, slipping, and falling hazards for people accessing the river.

### **Environmental Consequences**

**Impacts from Alternative A.** Under alternative A, the old ferry ramps and existing recreational facilities would remain in place. The existing risks and existing safety measures would remain in place.

**Impacts from Alternative B.** The new and updated facilities proposed under alternative B would include limited new plumbing and electrical availability on the south side of the river. These modifications would increase visitor safety at the site to a minor degree. All new facilities, structures, and installations would comply with applicable building and safety codes/standards, thereby improving safety for park visitors and staff. Overall impacts to public health and safety would be beneficial.

**Impacts from Alternative C.** Impacts to visitor health and safety would be generally the same as under alternative B. However, the proposed suspension bridge would pose risks of injury not present in the other action alternative. Experience at other parks has shown that the bridges, if not designed properly, could entice people to jump into the river, at great risk to themselves and possibly others. Accordingly, the suspension bridge would be designed specifically to minimize this risk, though some risk would likely remain. A second risk would be when the river exceeds the 445-foot elevation during 20-year flood events (since flooding has occurred multiple times above the 445-450 elevation in the past 100 years and damage from fast floating large trees is of concern). Furthermore, the bridge would be at risk of failure if the river level reaches 450 feet even if it is designed to minimize damage with its design. Finally, though rare, the river is still used at high river levels, so the suspension bridge could pose a small level of risk in these instances.

## **IMPACTS TO VISITOR USE AND EXPERIENCE**

### **Affected Environment**

Houchin Ferry is located on the western end of the park, approximately 15 miles (by road) from the Green River Ferry crossing and approximately 2.5 miles from the town of Brownsville, KY. The park operated a vehicle ferry at Houchin Ferry from 1979 to 2013. Since 2013, access to the north side is approximately 26 miles from the Houchin Ferry Campground via routes 259/70 to Route 1827 to the intersection of Ollie Ridge Road and Ollie-Houchin Ferry

Road. When Houchin Ferry was operational, the distance to travel between these points was shorter; however, the driving time was approximately the same.

Currently, there is only one operating vehicle ferry within the park, the Green River Ferry. This ferry serves as the primary north-south vehicular route from the core visitor services area on the south side and the north side of the park along with communities outside the north side. With current ramp improvements, service hours and operations will be enhanced once this project is complete in 2020.

The Houchin Ferry area offers opportunities for a variety of recreational activities including boating, camping, picnicking, fishing, birdwatching, motor-touring, and photography. The visitor experience within the Houchin Ferry area is closely related to the scenery of the park which includes scenic woodlands, rivers, streams, waterfalls and cascades, rock outcrops, bluffs, scenic landscape and river vistas (particularly in winter) wildflowers, birds, and wildlife. There are currently no trails located on the south side of the Green River, within the vicinity of Houchin Ferry campground. On the north side, the closest trails are located near Temple Hill, approximately 2 miles north by way of the Ollie-Houchin Ferry Road. Trail opportunities from Houchin Ferry will be considered in the upcoming Trail Management Plan that the park is planning to prepare.

Unlike the park's other front-country campgrounds, Houchin Ferry campground is open year-round. It offers visitors a simpler camping experience that contrasts with the more developed Mammoth Cave Campground. It has 12 primitive tent-only sites, each with a picnic table and fire ring. Potable water is available as are portable toilets. The campground is used by both Kentucky and out-of-state residents. Park visitation and revenue data indicate that the campground is busiest from March through October, with much of the use occurring on weekends (figure 8).

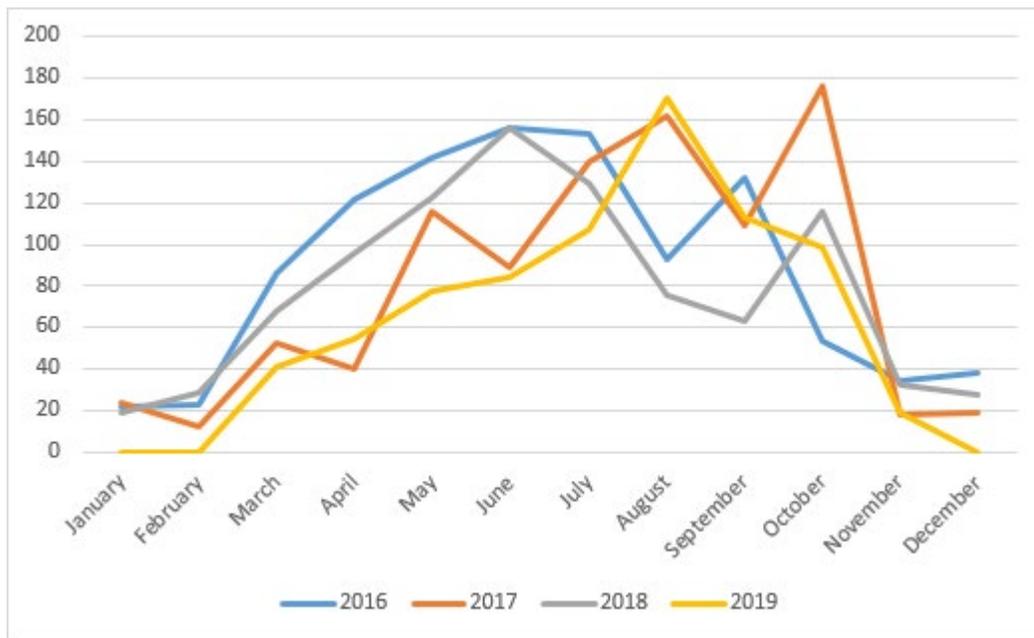


FIGURE 8. CAMPGROUND USAGE (NUMBER OF PEOPLE) BY MONTH AND YEAR

Houchin Ferry accommodates day use from visitors who come to picnic, fish, or enjoy the scenic natural beauty of the site and the river. The covered picnic shelter receives day-use from nearby Brownsville residents for birthday parties, family reunions, though the area also receives visitation from a broader area.

In addition to the campground and picnic shelter, visitors use the Houchin Ferry boat ramp for the launch and take-out of canoes and kayaks. As previously mentioned, the Green River flows 25 miles through the park. It is considered a Kentucky Wild River and Outstanding State Resource Water, exposing visitors who boat it to majestic trees, abundant wildlife, and dramatic bluffs. Islands along the river are used for picnicking and camping. Visitors can rent canoes and kayaks from three commercial companies located outside of the park. These companies also shuttle visitors to launch and takeout locations. At this time, the most popular section of the river is the Dennison Ferry to Green River Ferry, approximately 7.5 miles or a three to four hour float. The second most popular trip is from Green River Ferry to Houchin Ferry. This trip is 12 miles, and can take five to six hours to paddle, depending on the river level and an individual's pace. The park has installed a temporary ramp from rock for canoes and kayaks on the south side of the river at Houchin Ferry, which at times can become muddy. When water levels are low, river users must also walk through mud and dirt to access the river. See figures 9 and 10.

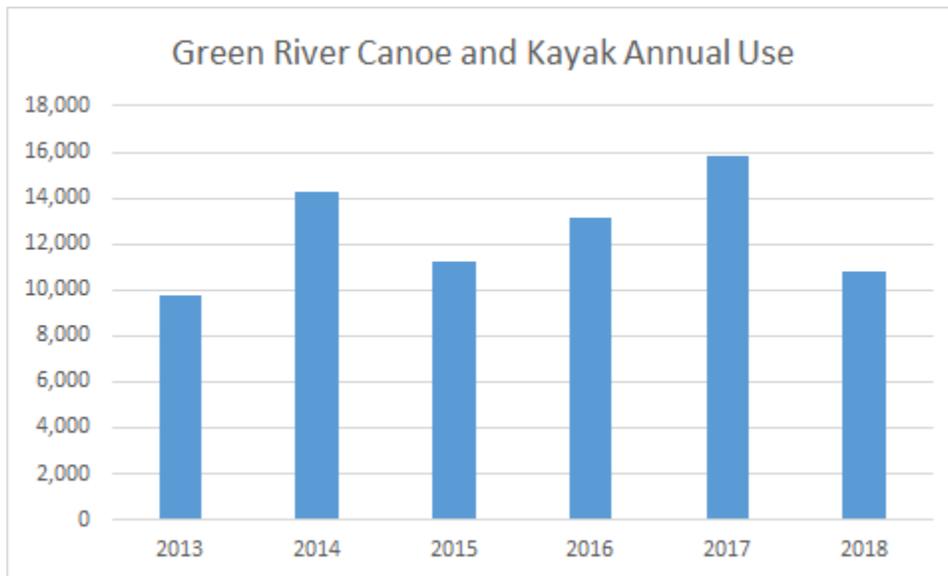


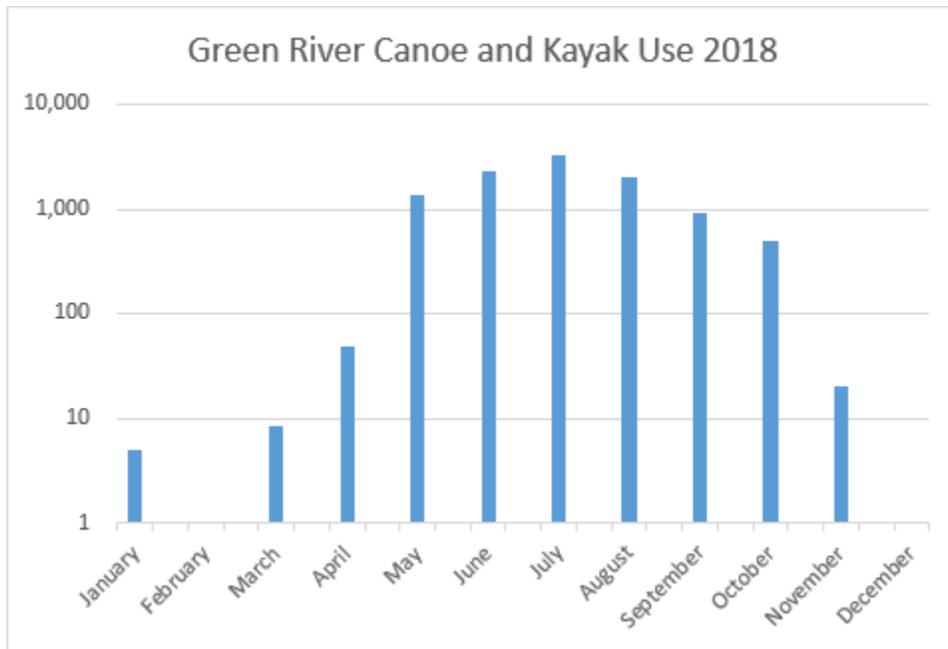
**FIGURE 9. EXISTING SOUTH FERRY RAMP WITH GRAVEL**



**FIGURE 10. EXISTING SOUTH FERRY RAMP DURING SUMMER LOW FLOW PERIOD**

Since the removal of Lock and Dam No. 6, canoe and kayak use on the Green River has remained steady. As with camping, the warmer months are the most popular for paddling, with May through August typically being the busiest. The following charts (figure 11) show canoe and kayak use data collected upstream from Houchin Ferry by the Green River ferry operator. It is indicative of general river use trends within the park.





**FIGURE 11. CANOE AND KAYAK USE ON THE GREEN RIVER**

With 10 additional river miles that are now free flowing on the Green River, use is expected to rise even higher. The west side of the park is expected see increased use because of additional free-flowing mileage on the Green River and because of the largely untapped potential river use of the Nolin River. In the future, the Lock 6 Site could become an improved river access location.

Mammoth Cave National Park along with three partners (Cave Country Trails, Edmonson County, and Nolin River Lake) are currently working on an application to designate the Green and Nolin Rivers Blueway as a National Water Trail. This proposed National Water Trail would include 36 river miles. On the Green River, it would begin at Dennison’s Ferry and end at the Alexander Boat Ramp in Edmonson County. It would also include all of the Nolin River, beginning at the Nolin River Lake Tailwater and ending at the confluence with the Green River.

Water trails are managed through public-private partnerships with the philosophies of environmental stewardship, environmental education, and accessibility for all users. A water trail designation, in conjunction with more free-flowing miles of water since the lock and dam removal, could combine to attract more river users to the area.

### **Environmental Consequences**

**Impacts from Alternative A.** Under alternative A, the existing canoe and kayak ramp, related outbuildings and campground layout would remain in place. Visitor activities would remain unchanged. As a result, there would be no new impacts to visitor use and experience.

**Impacts from Alternative B.** Visitor use and experience would be moderately enhanced under this alternative. Day use visitors using the south side would have access to more parking spaces (20 vs. the 12 that currently exist), two of which would be built to ABAAS standards. There would also be four parking spaces for trailers and a standing loop area for the commercial canoe and kayak companies to use when picking up or dropping off customers. In addition to the

group picnic shelter, there will be individual picnic tables, with and without shelters, for visitors to use. A permanent canoe and kayak ramp (with two rails to place boats on top) would improve the experience of launching and taking out a boat. An ABAAS trail leading to an overlook would be built on each side of the river and would allow visitors to view the river from above. The number of campsites would be reduced from 12 to 9, which would result in beneficial impacts to visitors seeking quiet and solitude and an adverse impact to those visitors who may not be able to secure a site on busy weekends and holidays. Campers would continue to have to use the one existing water spigot currently located at the picnic area, and there would be no electric hook-ups provided.

On the north side, there would be numerous beneficial impacts to the visitor experience. Currently, there are no existing facilities at this site. Under alternative B, modest improvements would include a walk-in, primitive campground with three to five sites. Visitors would either drive in and park in the one available parking space and then walk to the camp sites, park up the Ollie-Houchin Road a distance and walk to the campsites or access it via boat while on a multi-day floating trip. The sites would not have water or electric but would have a composting toilet. The sites would be available on a first come, first-served basis with no reservation system. There would be a couple of picnic tables for visitors to use as well. Overall, there would be more opportunities to experience nature in a quiet setting, with fewer people present, on this side of the river.

**Impacts from Alternative C.** The impacts to the visitor experience under alternative C would be much the same as the impacts under alternative B. On the south side, there would be a few more parking spaces available than those proposed in alternative B, with 25 regular parking spaces and 6 trailer spaces. There would also be a few more individual picnic tables with shelters available for visitors. The campground would have 12 total sites (as it currently does), and 8 of those would be kept for tent-only camping. Four sites would be equipped with water and electric hookups, for use by vehicles 20 feet or less. This would be a beneficial impact to visitors who are looking for a less primitive camping experience. On the north side, there would be six to nine camp sites for four people or less, with half of the sites available on a first come, first served basis, and the other half would be made available by reservation. This would allow visitors to either plan ahead and reserve a site or to pick an available site when they arrive. Since it would allow for both types of trip planning, it is a beneficial impact to the visitor experience. Under this alternative, twice as many people would be able to camp on the north side as under alternative B. The potential loss of solitude and quiet would be an adverse impact to the visitor experience.

The addition of a pedestrian foot bridge connecting the north and south sides would have both beneficial and adverse impacts on the visitor experience. Visitors would be able to walk between the north and south sides of the river, thereby experiencing a connectivity that is otherwise only available by driving approximately 15 miles to the east via the Green River Ferry Crossing in the park or by driving across the Brownsville bridge 4 miles away. The bridge (and overlooks) would provide a more dramatic view of the river from above. The bridge could also have an adverse impact on river users and the river viewshed with the addition of a new man-made feature within the river corridor. Impacts to visitor safety are outlined in an earlier section. Visitors that have previously experienced infrastructure at Houchin Ferry would most likely not be adversely impacted by the addition of this new bridge.

**Cumulative Impacts.** Some form of river crossing has been in place at Houchin Ferry since prior to the creation of the park in 1941. The vehicle ferry was operated at this location until 2013. The ferry provided connectivity between communities on both the north and south sides of the park. When the park ceased operation of the ferry in 2013, it created a minimal hardship on those who frequently used it to travel between Brownsville and the communities to the north as the drive time utilizing the Brownsville Bridge is about the same as was using the ferry. While a pedestrian bridge will not restore the ability for visitors to drive back and forth, it will still provide a basic level of connectivity that many visitors would see as a beneficial impact to their experience.

The removal of Lock and Dam 5, the designation of Brownsville as an official Kentucky Trail Town (a town adjacent to an extensive hiking or water trail system), local and regional tourism promotion of the area, and designation of the Green River as a National Water Trail would all contribute to possible increased use of the Green River and Houchin Ferry. Alternatives B and C include more infrastructure which would enable the area to accommodate more people without impacting the resources. This would be a beneficial impact.

## **IMPACTS TO SOCIOECONOMIC CONDITIONS**

The primary local profile is rural, with economies based on agriculture, local manufacturing, and tourism. Cave City, Park City, and Brownsville are the gateway communities to the park, though many park visitors overnight in Bowling Green as well. Mammoth Cave has been a major tourist attraction in Kentucky for more than 200 years. The park generates a significant contribution to the economy of gateway communities and is important on a statewide level. While no specific quantitative assessment has been undertaken, it is anticipated that improving the Houchin Ferry site will have a beneficial impact on the local economy in the Brownsville area, with alternative C having the greatest beneficial impact.

## **COMPLIANCE WITH FEDERAL AND STATE REGULATIONS**

The implementation of alternatives A, B, or C will not impact air quality, water quality, or most wildlife, or produce hazardous or toxic waste. Accordingly, the project will not require additional compliance with federal or state environmental regulations governing these resources. However, the park will need to secure wetland / floodplain permits from the U.S. Army Corps of Engineers and the State of Kentucky once construction details are in place for the canoe/kayak launches and the administrative boat access. Likewise, the park will need to obtain a permit from the U.S. Coast Guard for the pedestrian suspension bridge.

CHAPTER FOUR  
**CONSULTATION AND COORDINATION**



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## **CHAPTER 4: CONSULTATION AND COORDINATION**

Scoping is defined as the effort to involve agencies and the general public in determining the scope of issues to be addressed in the environmental document. Among other tasks, scoping determines important issues and eliminates issues that are not important; allocates assignments among the interdisciplinary team members and other participating agencies; identifies related projects and associated documents; identifies other permits, surveys, and consultations required by other agencies; and creates a schedule which allows adequate time to prepare and distribute the environmental document for public review and comment before a final decision is made. Scoping includes any interested agency or any agency with jurisdiction by law or expertise to obtain early input.

### **PLANNING TEAM**

The following NPS personnel have been involved in internal scoping, document preparation, and throughout the planning process:

- Barclay Trimble, Superintendent, Mammoth Cave National Park
- Bruce Powell, Deputy Superintendent, Mammoth Cave National Park
- Brandon Brown, Administrative Officer, Mammoth Cave National Park
- Steve Kovar, Facility Manager, Mammoth Cave National Park
- Tim Pinion, Chief, Science and Resources Management, Mammoth Cave National Park
- Rick Toomey, Cave Management Specialist, Mammoth Cave National Park
- Edward Jakaitis, Cultural Resources Management Specialist, Mammoth Cave National Park
- Dave Wyrick, Chief, Division of Interpretation and Visitor Services, Mammoth Cave National Park
- Molly Schroer, Management Assistant, Mammoth Cave National Park
- Lora Peppers, Retired Chief Ranger, Mammoth Cave National Park
- John Cornelison, Archeologist, NPS Southeast Archeological Center
- Robert Hellmann, Archeologist, NPS Southeast Archeological Center
- Rachel Brady, Outdoor Recreation Planner, NPS Southeast Regional Office
- Mark Ford, Wetlands Specialist, NPS Southeast Regional Office
- Mark Kinzer, Environmental Protection Specialist, NPS Southeast Regional Office
- Amy Wirsching, Community Planner, NPS Southeast Regional Office
- VHB Design (site design figures)

### **TRIBAL CONSULTATION**

Letters were sent to affiliated tribal leaders on April 27, 2018, to document consultation with the tribes. The letters informed the tribes of the proposed action and described the resulting ground disturbance. These letters invited comments or questions, and/or the opportunity to initiate formal consultation.

The following affiliated tribes received this letter:

- Absentee Shawnee Tribe of Oklahoma
- Cherokee Nation
- Chickasaw Nation
- Eastern Band of Cherokee Indians
- Shawnee Tribe
- Eastern Shawnee Tribe of Oklahoma
- United Keetoowah Band of Cherokee Indians

## **CIVIC ENGAGEMENT**

Civic engagement was accomplished in 2018, with a formal public comment period from June 20, 2018, through July 20, 2018. During this period, the park held a public meeting at the Edmonson County Library, which was attended by approximately 72 people. Three initial concepts were presented to the public to generate additional ideas and public input on the future of Houchin Ferry. At the public meeting, six display boards were available for public review along with a newsletter describing the planning process. NPS staff were available to interact with the public on the future of Houchin Ferry as part of this planning process. A total of 48 written comments were received and provided significant and beneficial input to the planning process. These comments provided the basis for updating the concepts into much more fully developed alternatives in this draft environmental assessment document.

## **AGENCY CONSULTATION**

The park has contacted the Kentucky State Historic Preservation Officer regarding this project. A letter was sent to the Kentucky SHPO on April 18, 2018.

The U.S. Fish and Wildlife Service was notified of this project by letter dated September 13, 2018.



CHAPTER FIVE  
**REFERENCES**



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## CHAPTER 5: REFERENCES

Prentice, Guy

- 1994 *A Settlement Pattern Analysis of Prehistoric Sites in Mammoth Cave National Park, Kentucky*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Florida, Gainesville.

Hellmann, Robert

- 2018 *Trip report of archeological testing at the Houchin's Ferry Crossing at Mammoth Cave National Park, April 18, 2018, SEAC Acc. 3003*. National Park Service, Southeast Archeological Center, Tallahassee.

Interagency Visitor Use Management Council

- 2016 *Visitor Use Management Framework: A Guide to Providing Sustainable Outdoor Recreation. Edition One*. Lakewood, CO. <https://visitorusemanagement.nps.gov/VUM/Framework>.
- 2019 *Monitoring Guidebook: Evaluating Effectiveness of Visitor Use Management*. Denver, CO. <https://visitorusemanagement.nps.gov/VUM/Framework>.
- 2019 *Visitor Capacity Guidebook: Managing the Amounts and Types of Visitor Use to Achieve Desired Conditions*. Lakewood, CO. <https://visitorusemanagement.nps.gov/VUM/Framework>.

National Park Service

- 1983 *General Management Plan. Mammoth Cave National Park*. On file at park headquarters.
- 2014 *Foundation Document. Mammoth Cave National Park*. [https://www.nps.gov/macal/learn/management/upload/MACA\\_FD\\_SP\\_Low-Resolution.pdf](https://www.nps.gov/macal/learn/management/upload/MACA_FD_SP_Low-Resolution.pdf)
- 2019 *Rehabilitate Houchin Ferry Crossing Site, Supplemental Concept Study Report*.

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## APPENDIXES



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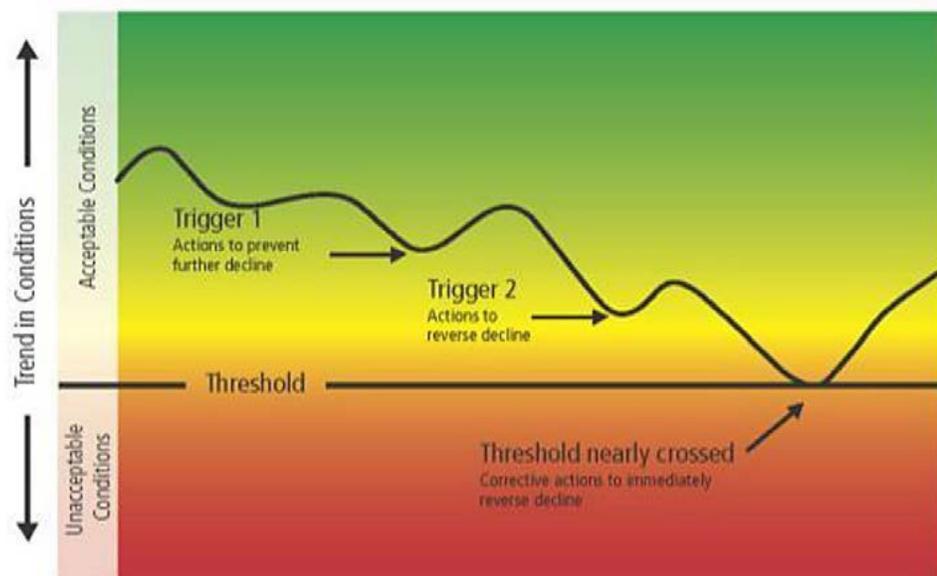
# APPENDIX A: INDICATORS, THRESHOLDS, AND VISITOR CAPACITY

## INDICATORS AND THRESHOLDS

The visitor use management framework created by the Interagency Visitor Use Management Council includes a series of elements by which planning decisions are made concerning visitor use management. Establishing indicators and thresholds and determining visitor capacity are key components of this framework as applied by the National Park Service. Indicators measure conditions that are related to visitor use, and monitoring is conducted to track those conditions over time. Potential management strategies are described for each indicator and would be applied together with the actions and intents of the preferred alternative presented in this Plan. This iterative practice of monitoring, implementing corrective strategies, and then continuing to monitor to gauge the effectiveness of those actions allows park managers to maximize benefits for visitors while achieving and maintaining desired conditions for resources and visitor experiences in a dynamic setting. In this section, the indicators to be monitored at Mammoth Cave National Park are presented, and the associated thresholds and strategies are used to inform the visitor capacity determination.

Indicators translate the broad description of desired conditions into measurable attributes (e.g., number of people per viewshed) that can be tracked over time to evaluate change in resources or conditions that relate to visitor experience. The planning team considered many potential issues and related indicators that would identify impacts of concern, but those described in this section are considered the most noteworthy, given the importance and vulnerability of the resources or visitor experiences affected by visitor use. In identifying meaningful indicators, the planning team also reviewed the experiences of other park units with similar issues. Indicators are applied to the preferred alternative within the Plan.

Thresholds that represent the minimum acceptable condition for each indicator were then assigned, taking into consideration the qualitative descriptions of the desired conditions, data on existing conditions, relevant research studies, and staff management experience. Although defined as “minimally acceptable,” thresholds still represent acceptable conditions. Also, establishing thresholds does not imply that no action would be taken prior to reaching the threshold. One goal of visitor use management is to strive to make progress toward desired conditions. Thresholds identify when conditions are about to become unacceptable and accordingly serve as a “line in the sand,” letting managers and the public know that corrective action must be taken to keep conditions acceptable so that progress toward desired conditions can be achieved over time. For some indicators, triggers have been developed. A trigger reflects a condition of sufficient concern for an indicator to prompt a management response to ensure that desired conditions continue to be maintained before the threshold is crossed (see figure A-1).



**FIGURE A-1. MANAGEMENT TRIGGERS AND THRESHOLDS IN RELATION TO TREND IN CONDITIONS**

Potential management strategies identified below represent the range of actions in addition to those found within the preferred alternative that the National Park Service may take to meet the goals and desired conditions of this Plan. The potential impacts of these actions are included in chapter 3 of this Plan. If it is determined through monitoring that thresholds are being approached or exceeded, the National Park Service would employ one or more of these management strategies. Details of potential management strategies would be developed at the time they are needed to ensure that the most effective approach is identified. Some management strategies are currently in use at the park and may be increased in response to changing conditions. If additional strategies are needed as outlined in the potential management strategies, details of their application would be developed as thresholds are exceeded or approached and would be informed by monitoring results.

Visitor use management is an iterative process in which management decisions are continuously informed and improved through monitoring to determine the most effective way to manage visitor use to attain desired visitor experience and resource conditions. As monitoring of conditions continues, managers may decide to modify or add indicators if better ways are found to measure important changes in resource and experiential conditions. Information on NPS monitoring efforts, related visitor use management actions, and any changes to the indicators and thresholds would be available to the public.

*Indicator:* Number of complaints related to boat ramp crowding or use conflicts.

*Threshold:* No more than five (5) validated complaints per month related to visitor use of the boat ramp.

- **Rationale** - The rationale for this indicator is directly related to the desired condition that visitors will have high quality experiences in settings with a low visitor density

without crowding, congestion, or visitor conflict. This indicator is important to maintaining and improving the quality of the visitor experience. Information from this indicator will also inform park staff about where additional education is needed. Visitors may experience crowding or conflicts with other user groups at the boat ramp and inform the park of it at later time.

- **Potential Management Strategies** - Implement better signage and education about ramp etiquette for specific user groups (e.g., livery companies, private boaters). Directly manage the number of canoe / kayak trips through the livery Commercial Use Authorizations.
- **Monitoring Strategy** - Number of validated complaints tracked at visitor center / Superintendent's office. The park will document complaints from visitors including time, location, and type of complaint. This documentation system could take form in many ways (e.g., visitor use forms that will provide feedback to park managers about visitor experiences, opportunities, and issues). The park will also explore new ways to seek input from visitors. This monitoring provides feedback that is important for managers to ensure desired conditions are maintained.

*Indicator:* Number of incidences of unauthorized roadside parking.

*Threshold:* No more than five (5) incidences of unauthorized parking per month within a ½ mile of boat ramp / campground.

- **Rationale** - This indicator will reflect issues of crowding / congestion on the boat ramp, in the day-use areas, and the campgrounds. In addition, it is directly related to the desired conditions that the park's natural and cultural resources are protected from visitor-related impacts. This indicator will support an increased understanding in the relationship between the amount of visitor use and impacts to park resources.
- **Potential Management Strategies** - Increase ranger presence or patrol. In addition, utilize materials (large rocks, logs, etc.) to make it physically impossible for people to park where they should not. Increase enforcement. Educate visitors on the sensitivity of and need to protect resources. This could be completed through educational signs or directional signage for visitors to park only in designated spaces.
- **Monitoring Strategy** - Park staff and volunteers will document and record the number of incidences of unauthorized roadside parking, more frequently during the busiest months.

## **VISITOR CAPACITY**

This section of the Plan identifies visitor capacities for the Houchin Ferry area. The visitor capacities are identified based on the principles described in the IVUMC "Visitor Use Management Framework" and "Visitor Capacity Guidebook."

The Interagency Visitor Use Management Council defines visitor capacity as the maximum amounts and types of visitor use that an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area was established. By identifying visitor capacities and managing the amounts and types of use within those capacities, the National Park Service can ensure that resources are protected and that visitors have opportunities for high-quality experiences. Identifying visitor capacities is also directed by the National Parks and Recreation Act of 1978, which requires the

National Park Service to identify and implement commitments for visitor capacities for all areas of a park unit.

Following guidance from the Interagency Visitor Use Management Council, the level of analysis that occurs during VUM planning and visitor capacity identification is determined on a sliding scale depending on the complexity and context of the Plan. For the Houchin Ferry area, desired conditions are being met under current use levels and therefore, a lower level of analysis is being used. The level of detail provided in the rationales for each capacity determination is commensurate with the level of complexity related to visitor capacity at that site.

As strategies and actions directly influence how many people can access the site, the action alternatives therefore influence the visitor capacity. For this reason, visitor capacities can vary between the alternatives depending on management strategies of that individual alternative. For instance, in alternative C the site would be expanded with additional facilities, therefore resulting in a visitor capacity determination at or above current use levels.

### **Methodological Considerations**

To determine the appropriate amount of use at one time at analysis areas, a variety of data was reviewed to understand current conditions compared to desired conditions. Visitation data collected annually by NPS staff to track levels of visitor use parkwide and by area was used as a data source. The National Park Service also collects annual data including counts of fees, commercial canoe and kayak company monthly use numbers, and number of boaters on the Green River. Where necessary, approximations have been made. For instance, a persons-per-vehicle (PPV) multiplier of 1.7 has been used to estimate the average number of people who come to a site by private vehicle. While some vehicles may include more or less than the multiplier used it represents an average.

Visitor capacities are most frequently expressed as people at one time (PAOT) increments. PAOT refers to the total number of people that are present at a site at any given point in time. Delineations of sites may vary depending on the specific location, and monitoring can be done in a variety of ways, but should serve to approximate as best as possible the total number of people present at a location. In some instances, visitors may more fluidly move from one site to another. This determination approximates use levels that are likely to occur at one time within a general area that could easily be associated with each listed location.

Visitor capacities were identified using best practices and examples from other plans and projects across the National Park Service. The process for identifying capacity follows four guidelines: Step 1) determine the analysis area, Step 2) reviewing existing direction and knowledge, Step 3) identifying the limiting attribute, and Step 4) identifying visitor capacity.

*Step 1) Determine the Analysis Area*— The amount, timing, distribution, and types of visitor use at Houchin Ferry influence both resource conditions and visitor experiences. Currently, Houchin Ferry can accommodate visitor demand for recreational opportunities, with the exception of some weekends and holidays during the summer. The primary activities associated with the fundamental values of the Houchin Ferry area are camping, picnicking, enjoying the natural beauty, canoeing, kayaking, and fishing the river.

The sites listed below are where the majority of users are likely to congregate (i.e., campgrounds, parking areas, and the canoe and kayak ramps). Together, the areas comprise the majority of the areas where visitor use issues may occur, and where plan actions are directly related to visitor use levels. These locations are as follows:

- South side day-use areas (parking spaces, livery standing loop, canoe and kayak ramp)
- South side campground
- North side day-use areas (parking spaces, canoe and kayak ramp)
- North side campground

The surrounding areas of the park (backcountry trails and the Green River) are also subject to this legal requirement to define visitor capacity. However, as decisions about management of these areas are out of scope for this Plan, these capacity determinations will be addressed in subsequent planning.

*Step 2) Reviewing Existing Direction and Knowledge*— Both the 1983 General Management Plan and the Foundation Document address visitor opportunities and experiences. The Foundation Document states that two of the park’s Fundamental Resource and Values are an Opportunity for Connection to the Resources, and that “The Green River is designated as an Outstanding State Resource Water and a state Wild River, providing significant scenic and recreational opportunities” (NPS 2014). The park general management plan denotes Houchin Ferry as part of the Recreation Subzone, and states “Campsites with minimal facilities will be provided for canoeists and hikers along a 20-mile stretch of Green River at the site of Dennison Ferry (south bank), and Houchin Ferry. Portable comfort facilities will be provided, but there will be drinking water only at Houchin Ferry. Each of these primitive camping sites is accessible by road for servicing by park maintenance personnel. Boat launching ramps at Mammoth Cave Ferry and Houchin Ferry will be retained” (NPS 1983).

Future monitoring of use levels and indicators will inform the National Park Service if use levels are at or near visitor capacities. If so, adaptive management strategies as outlined in this Plan would be taken (see “Indicators and Thresholds” section). For both the north and south sides of Houchin Ferry, the following indicators will be monitored 1) number of complaints related to boat ramp crowding or use conflicts, and 2) number of incidents of unauthorized parking.

South Side - Currently, there are 12 parking spaces for day users on Houchin Ferry’s south side. When the persons-per-vehicle factor of 1.7 is applied, this translates to 21 PAOT. Those visitors who wish to use the picnic areas and the canoe and kayak ramp must park in one of these available parking spaces, therefore 21 PAOT applies to most private day users of the site. In addition to visitors arriving by vehicle, same day use visitors are brought to the site by liveries that are dropping people off or are picking people up for boat rental. The National Park Service collects day use numbers from liveries that operate in the park and takes visual counts of the number of boaters at the Green River Ferry. Numbers collected in 2018 and 2019 indicate that the three main liveries result in an average of four additional PAOT being at the site. When combined with personal vehicle parking, this results in 25 day use PAOT. A maximum of eight people are permitted to camp in each campsite, and when multiplied by the number of campsites (12), the result is 96 PAOT. When combined with the day use PAOT of 25, the current visitor capacity for the South side is 121 PAOT.

North Side – Currently there are no amenities or established parking spaces on the north side of Houchin Ferry; therefore, the visitor capacity is 0 PAOT.

*Step 3) Identifying the Limiting Attribute*— This step requires the identification of the limiting attribute(s) that most constrain the analysis area’s ability to accommodate visitor use. This is an important step given that a key area could experience a variety of challenges regarding visitor use issues. The limiting attributes constraining the amounts and types of visitor use that can be accommodated are the visitor experience and the physical constraints of the sites. Visitor experience is affected by crowding including the people in an area at one time. The desired condition is that visitors have opportunities for high quality experiences in natural, tranquil settings with a low visitor density without crowding, congestion, or visitor conflict. Therefore, the visitor capacity at Houchin Ferry needs to ensure that the use of the area provides for the desired condition for the visitor experience.

The other limiting attribute is the physical constraints of the sites on the south and north sides. On the south side, the existing 4-acre site is situated on a narrow bluff above the river with very little opportunity for a large-scale expansion of the site. This is due to the severe slope conditions that surround the site to both the east and west along the river. Beyond the immediate footprint of the existing parking area and campground improvements, most of the slopes surrounding the site vary in range from 25% to 40%. Any improvements to expand the footprint of the existing facility between the existing parking lot and Green River would be cost prohibitive without impacting the natural resources and wooded steep slopes. On the north side, the site is also limited by the severe slope conditions that surround the site to the east and west, restricting potential site expansion. The existing 1-acre site has very little level area since its primary purpose was for vehicular access to the river and ferry crossing.

*Step 4) Identifying Visitor Capacity*— To ensure the continued protection of the resources and experiences at Houchin Ferry, visitor use of this area will be managed to the capacity of the parking lots and campgrounds, as these will be designed to accommodate an appropriate level of use on nearby resources. The direct managed access strategies applied in alternative B will allow for 123 PAOT on the south side and 15-23 PAOT on the north side. Alternative C will allow for 155 PAOT on the south side and 29-41 PAOT on the north side.

## **Alternative B**

South Side - Under this alternative, a maximum of eight people are permitted to camp in each campsite, and when multiplied by the number of campsites (9), the result is 72 PAOT. This alternative also includes a campground host site, which would see an average of 2 PAOT. In addition, this alternative proposes expanding the parking lot, which would add additional spaces, thereby totaling 24 parking spaces (20 standard spaces + 4 trailer spaces). When the persons-per-vehicle factor of 1.7 is applied this translates to 41 PAOT. Those visitors who wish to use the picnic areas and the canoe and kayak ramp must park in one of these available parking spaces, therefore 41 PAOT applies to most private day users of the site. Redesigning portions of the canoe and kayak ramp will allow for slightly higher levels of visitors to be accommodated at the site. For this reason, the number of people being dropped off or picked up by the canoe and kayak livery companies has been identified slightly above the current use and is 8 PAOT. When the day use PAOT of 49 is combined with the overnight use of 74, the visitor capacity for the south side under this alternative is 123 PAOT.

North Side – This alternative includes a campground that would have three to five sites, with a maximum of four people at each site. This would result in 12 to 20 PAOT in the campground. There would also be one parking space for visitors to use and one parking space for park staff. The visitor parking space is multiplied by the PPV multiplier, thereby accommodating 2 PAOT. On average, one park staff would service the campground. Therefore, the parking on the north side would allow for 3 PAOT, and the total PAOT for the north side would be 15-23 PAOT.

### Alternative C

South Side - This alternative proposes keeping the same number of campsites as currently exist on the south side but adding a site for campground hosts that would accommodate two additional PAOT. Therefore, the PAOT in the campground would increase to 98 PAOT. Furthermore, a total of 31 parking spaces (25 standard and 6 trailer) would allow for an increase to 53 PAOT. When combined with the 8 PAOT being dropped off or picked up by the canoe and kayak livery companies, the total for the south side would be 159 PAOT.

North Side - Alternative C also includes the addition of a campground with six to nine sites of four people at each site, which results in 24 to 36 PAOT. A total of three parking spaces (two for visitors and one for park staff) allows for 5 PAOT. Therefore, the total PAOT for the North Side is 29 to 41 PAOT.

**Table A-1. Visitor Capacity Determinations by Alternative**

Analysis Area	Alt A Current Condition	Alt B Visitor Capacity	Alt C Visitor Capacity
<b>South Side Campground</b>	12 sites x 8 people = 96 PAOT	9 sites x 8 people = 72 PAOT	12 x 8 people = 96 PAOT
<b>Campground Host Site</b>	-	2 PAOT	2 PAOT
<b>South Side Day Use (Boat ramp, picnic area)</b>	12 parking spaces x 1.7 PPV = 21 PAOT + 4 PAOT canoe / kayaking. = 25 PAOT	24 parking spaces (20 standard spaces + 4 trailer spaces) x 1.7 PPV = 41 PAOT + 8 PAOT canoe / kayaking = 49 PAOT	31 parking spaces (25 standard spaces + 6 trailer spaces) x 1.7 PPV = 53 PAOT + 8 PAOT canoe / kayaking = 61 PAOT
<b>South Side Total</b>	121 PAOT	123 PAOT	159 PAOT
<b>North Side Campground</b>	0	3-5 sites x 4 people = 12-20 PAOT	6-9 sites x 4 people = 24-36 PAOT
<b>North Side Day Use</b>	0	1 parking space for visitors x 1.7 PPV = 2 PAOT + 1 parking space for park staff = 1 PAOT = 3 PAOT	2 parking spaces for visitors x 1.7 PPV = 4 PAOT + 1 parking space for park staff = 1 PAOT = 5 PAOT
<b>North Side Total</b>	0	15-23 PAOT	29-41 PAOT

*Visitor Capacity Monitoring and Implementation Strategy* – Visitor capacity monitoring will be done in conjunction with the monitoring of indicators (such as the number of incidences of unauthorized parking). By monitoring conditions with visitor capacities at Houchin Ferry along with the indicators, a full monitoring program related to visitor use is established. Park staff and volunteers will intermittently count the number of visitors at one time, within the day use and campground areas of both sides of the river. As future monitoring and information collection for this and other indicators is conducted, the capacities may be further refined to reflect that new information.

#### Potential Management Strategies

- Collect further information or data for the area when more information on visitor use patterns, levels, and behaviors could further inform thresholds. This information would be collected and used to refine thresholds before taking actions to more directly manage visitor use levels.
- Develop and implement a public information effort about the desired conditions for the park, actions the National Park Service is taking to achieve those conditions, and how visitors can best experience the park. This information could be distributed through direct visitor contact, park publications, wayside exhibits, social media, websites, innovative technology, and through park partners. The goal would be to have visitors self-disperse or come during lower-use times of the day or season to accommodate similar levels of use without concentrating that use during peak periods.
- Ensure that informational materials are available outside of visitor center hours and locations and cover a wide variety of topics such as locations for permitted activities, park rules and regulations, and Leave No Trace practices are available to visitors in a variety of languages and locations.
- Use press releases / media to promote activities available at various times of the year and to disperse visitor use to multiple sites or areas.
- Increase maps and signage about various destinations within and outside highly developed sites so that visitors are more easily able to reach them.
- Increase the amount of staff presence.
- Place fences or other barriers along areas where unauthorized parking occurs near key destinations.
- Separate when and where visitor use occurs at a location. Separation could be done by allowing private and commercial entities to access a location at different times or by physically separating where one type of use occurs from another.
- Consider physical changes to site design to influence visitor behavior in a way that is intuitive and encourages compliance with park rules and regulations.

## **APPENDIX B: FLOODPLAIN STATEMENT OF FINDINGS**

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DRAFT

STATEMENT OF FINDINGS

FOR

EXECUTIVE ORDER 11988 FLOODPLAIN MANAGEMENT

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EXISTING AND PROPOSED SITE DEVELOPMENT

Houchin Ferry Recreation Site

MAMMOTH CAVE NATIONAL PARK

Kentucky

Recommended: \_\_\_\_\_  
Superintendent, Mammoth Cave National Park Date

Certification of Technical Adequacy and Servicewide Consistency:  
\_\_\_\_\_  
Chief, Water Resources Division Date

Approved: \_\_\_\_\_  
Director, Interior Region 2 Date

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# FLOODPLAIN STATEMENT OF FINDINGS

## INTRODUCTION

Executive Order 11988, “Floodplain Management” requires the National Park Service (NPS) and other federal agencies to evaluate the likely impacts of actions in floodplains. The objectives of the executive order are to avoid, to the extent possible, the long-term and short-term adverse impacts associated with occupancy, modification, or destruction of floodplains and to avoid indirect support of development and new construction in such areas wherever there is a practicable alternative. The National Park Service administers floodplain policy through Directors Order 77-2 Floodplain Management (DO 77-2), and Procedural Manual 77-2 Floodplain Management (PM 77-2).

It is NPS policy to preserve floodplain functions and values and minimize potentially hazardous conditions associated with flooding, including threats to human health/life, risk to capital (NPS) investment, and impacts to natural and beneficial floodplain values. If a proposed action is found to be in an applicable regulatory floodplain and relocating the action to a non-floodplain site is considered not to be a viable alternative, then a formal floodplain “Statement of Findings” must be prepared. The “Statement of Findings” must (a) quantify flood conditions and associated hazards as a basis for management decision making, (b) describe the rationale for selection of a floodplain site, (c) disclose the resources and amount of risk associated with the chosen site, and (d) explain flood mitigation plans. The “Statement of Findings” must be available for public review and comment, generally by including it in an applicable National Environmental Policy Act compliance documentation.

This “Draft Floodplain Statement of Findings” presents the rationale for the continued use of existing park infrastructure and development within the 100-year floodplain of the Green River at the Houchin Ferry recreation site, Mammoth Cave National Park, Kentucky. It also presents the rationale for adding new improvements at this location, including expansion of existing parking, camping, and picnicking areas, a canoe/kayak launch, a pedestrian suspension bridge, and other related improvements (described below). This Floodplain Statement of Findings quantifies the flood hazard associated with the proposed action, documents the anticipated negative impacts of these improvements on human health/life, capital investment, floodplain functions and values, and presents mitigations to these impacts. All of the elements of the proposed action are included as components of alternative C (preferred alternative) of the *Houchin Ferry Development Concept Plan and Environmental Assessment*.

## PROPOSED ACTION

The Houchin Ferry site consists of a 4-acre site situated on a narrow bluff on the south side of the Green River at River Mile 185.2, together with a 1-acre site on the north side of the river. Existing site facilities are aging and need improvements. The purpose of the *Houchin Ferry Development Concept Plan* (Plan) is to address the site’s deficient facilities and re-establish safe river access at Houchin Ferry. The Plan also seeks to restore connectivity between the south and north sides of the river now that the ferry has been permanently discontinued. The Plan seeks to re-establish the Houchin Ferry site as a destination dedicated to a variety of user groups and

recreational activities, including safe access to the river. It requires evaluating the site to accommodate these user groups and provide facilities to allow for the anticipated increase in recreational use at the site.

The catastrophic failure of Lock and Dam No. 6 in November 2016 and its subsequent removal in 2017 caused a river elevation drop of approximately 8 to 10 feet at the Houchin Ferry site. Both the north and south side concrete ramps at Houchin Ferry no longer reach the river. Lock and Dam No. 5 is slated for removal as well which will result in a projected loss of 3 to 5 feet of river elevation. Initially after the breach, the park discontinued river access at Houchin Ferry due to the lower water level. As a result, no permanent take-out locations existed anywhere along the 17 river miles downstream of the Green River Ferry crossing within the park. However, the park has recently installed a temporary canoe/kayak access launch on the south side of the river until a permanent solution can be installed.

Given the foregoing site conditions, the National Park Service proposes to implement alternative C (preferred alternative) of the Plan. The elements of alternative C are described in the following sections.

### **South Side**

Alternative C would balance day and overnight use, with an enhanced level of facility improvements. The campground would have 12 camping sites, each with a fire ring and picnic table. Of the 12 sites, 8 would be tent-only spaces (1 accessible) at the west end of the campground, and 4 spaces would have water and electric hookups for vehicles 20-feet long or less. An additional RV campsite with water and power would be provided to serve a campground host. A dump station with holding tank would be available for vehicles. There would be one accessible group picnic shelter holding about 7-8 picnic tables for group activities, plus about 6-8 accessible picnic tables for individual or family gatherings. At least half of the individual/family picnic tables would have shelters. Water and electric hookups would be provided in the picnic area, together with a composting toilet.

Steps to the river's edge would be constructed in the day-use area, away from the campground.

The number of parking spaces would be increased to 25, to include 2 accessible spaces (1 car, 1 van). Up to seven of the spaces would be located in front of a portable toilet station (accessible) near the eastern edge of the campground. In addition, there would be 6 trailer spaces (1 accessible). Vehicular circulation would be improved by adding a turnaround to the east end of the site, which would include a livery staging loop for two vans with trailers. This turnaround would also provide access to an emergency boat launch. A concrete canoe/kayak launch would be provided at the river, with two rails (no chairlift). This launch would require removing a portion of the former ferry ramp. Also included is an accessible trail to an overlook (accessible) which would allow dramatic views of the river from above. The overlook would be located near the picnic shelters.

### **North Side**

The north side would be open primarily for river users and hikers seeking primitive riverside camping but would have limited vehicle access.

Alternative C would provide a simple turnaround for vehicles, including vehicles with trailers. Three parking spaces would be provided. One of these spaces would be accessible and one would be for park staff. More walking paths would be provided than under alternative B. An

accessible trail would lead to a north-side overlook above the river. This trail would also serve three to four accessible picnic tables. There would be about 6-9 primitive tent campsites, 3 to 5 of which would be reservable, with the rest being first come, first served. Boaters paddling the planned Green River National Water Trail could use the campsites as a stopover on a multi-day floating trip. The campsites would have fire rings and picnic tables. There would be a canoe/kayak launch similar to the one on the south side, but about 50% smaller and without a rail. No water would be provided at the site.

Alternative C would also provide a pedestrian suspension bridge over the Green River to connect recreational facilities on the south and north sides of the river. The bridge would have a deck elevation of around 450 feet and would be reached either by stairs or ramps extending from the ground surface to the bridge deck. The bridge would be approximately 370 feet in length, with the actual distance depending on whether the bridge was served by stairs or ramps. The principal bridge supports would be located on the benches above the riverbanks, thereby eliminating obstructions at the river's edge.

The following schematic (figure B-1) details the facilities contemplated by the preferred Schematic of the preferred alternative.

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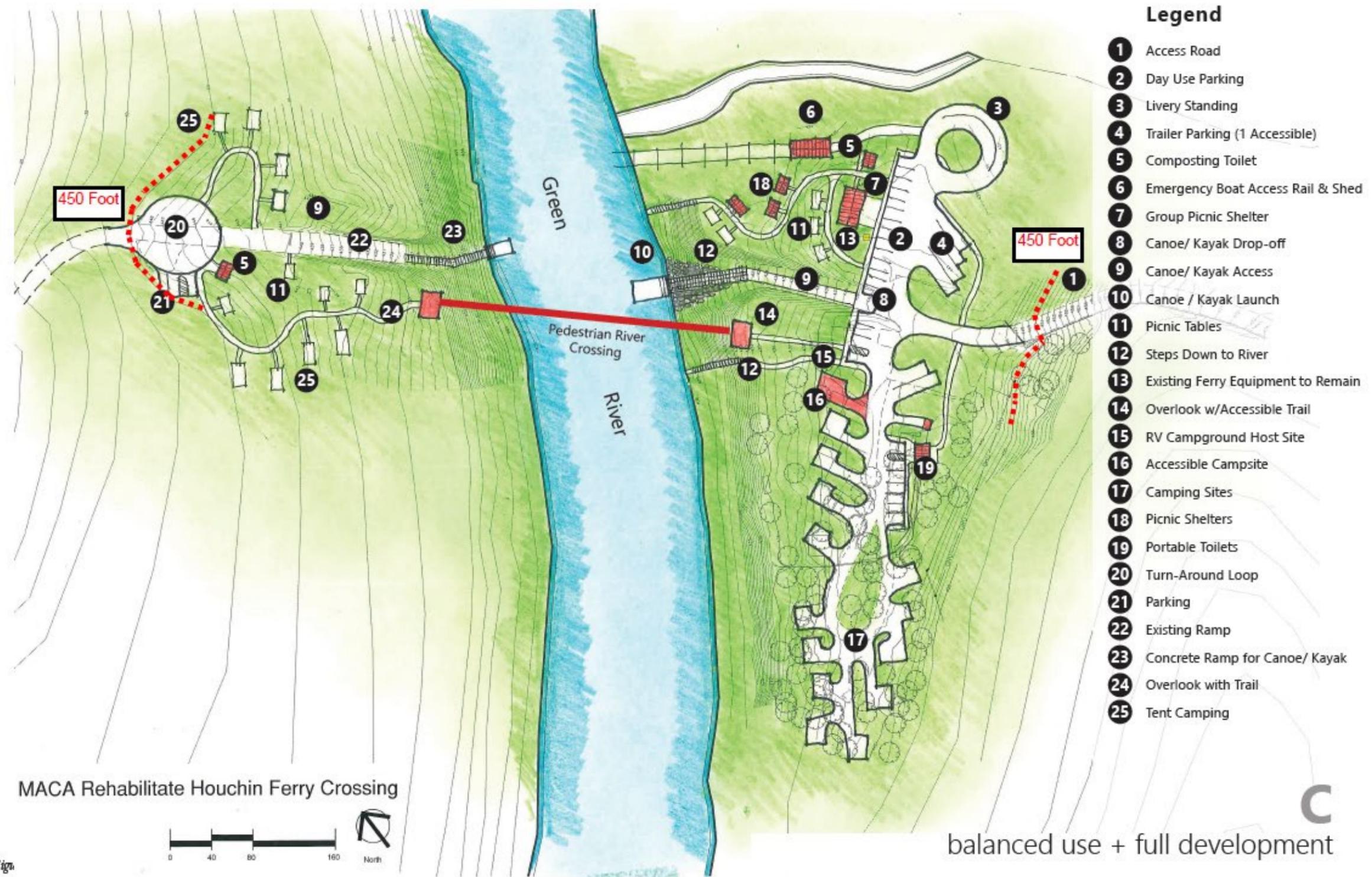


FIGURE B-1. SITE SCHEMATIC OF PREFERRED ALTERNATIVE SHOWING 450-FOOT FLOOD ELEVATION (100-YEAR FLOOD IS 459 FEET)

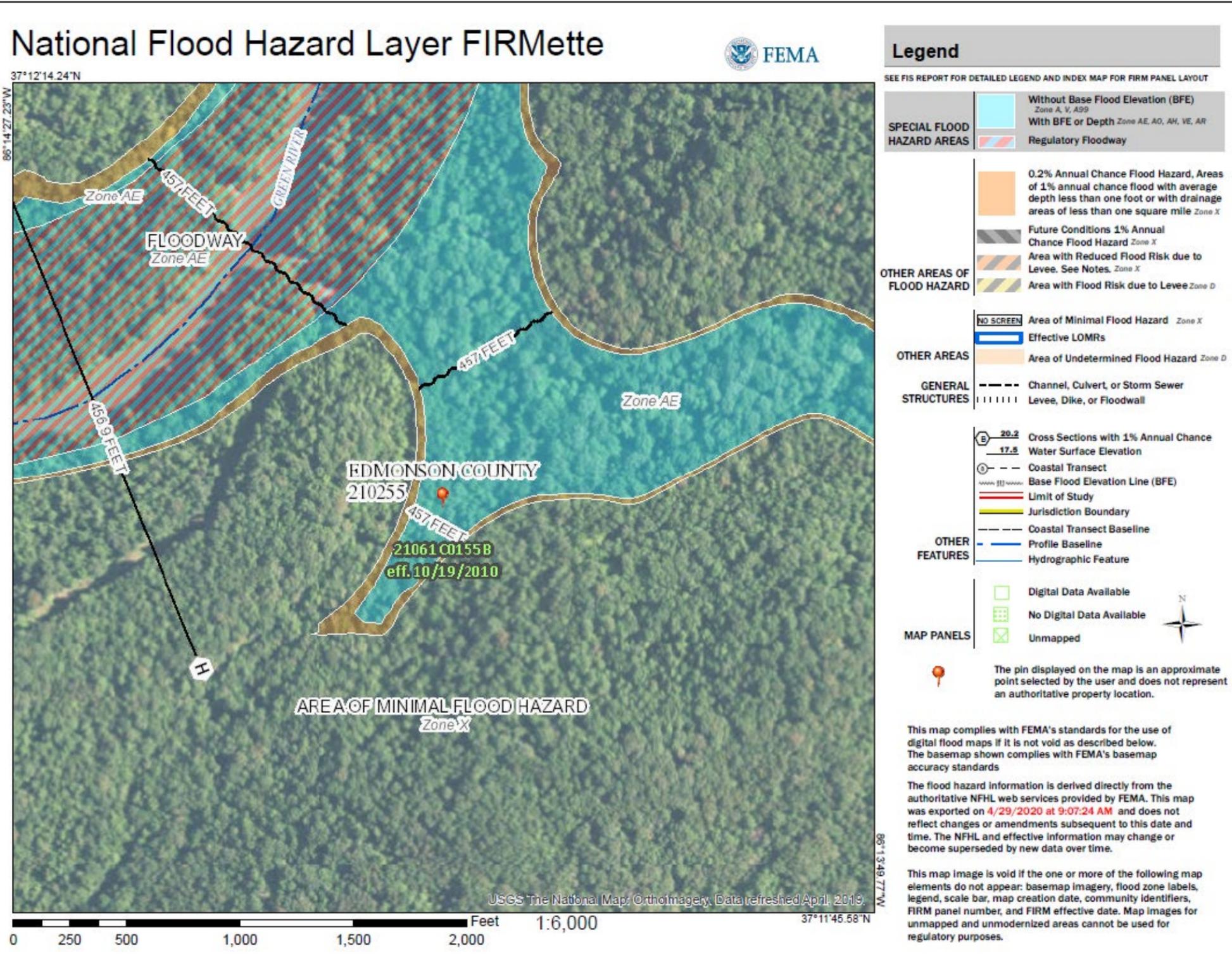
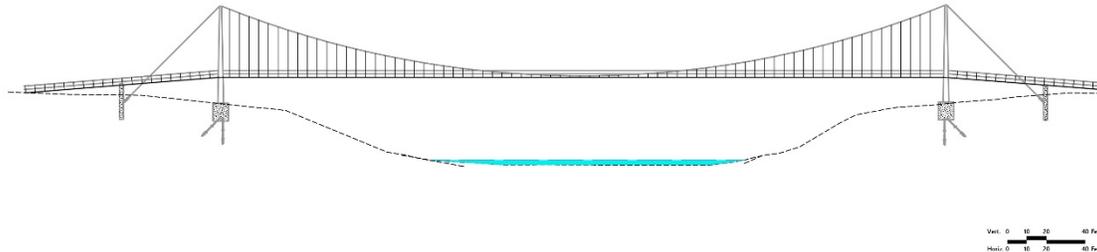


FIGURE B-2. FEMA FIRMETTE OF PROJECT AREA

The proposed bridge design is shown in figure B-3 below.



- APPROXIMATE SPAN TRUSS TYPE LENGTH 370 FT
- TRUSS TYPE WITH RAMPS
- APPROXIMATE DECK ELEVATION 450 FT
- RAMP LENGTHS
  - EAST 80' @ 8.0%
  - WEST 100' @ 8.0%
- ESTIMATED 100-YR FLOOD ELEVATION IS 459' (9' ABOVE BRIDGE DECK)

**FIGURE B-3. PEDESTRIAN SUSPENSION BRIDGE**

The following table compares the levels of development in the no-action and preferred alternatives.

**Table B-1. Comparison of No-Action and Preferred Alternatives**

Location	Alternative A Continue Current Management (Take No Action)	Alternative C Balanced Day and Overnight Use with Enhanced Level of Facility Improvements
<b>South Side</b>	12 parking spaces	25 parking spaces
<b>South Side</b>	No accessible parking spaces	2 accessible parking spaces (1 car, 1 van), included in about 25 parking spaces
<b>South Side</b>	No designated trailer spaces	6 trailer spaces (1 accessible)
<b>South Side</b>	No loop	Livery standing loop – two vans with trailers
<b>South Side</b>	12 campsites, with fire rings and picnic tables	12 campsites: 8 tent-only spaces (1 accessible), and 4 with water and electric hookups for vehicles 20-foot long or less; dump station
<b>South Side</b>	No RV campground host campsite	1 RV campground host campsite with water and electric

<b>Location</b>	<b>Alternative A Continue Current Management (Take No Action)</b>	<b>Alternative C Balanced Day and Overnight Use with Enhanced Level of Facility Improvements</b>
<b>South Side</b>	Water spigot at picnic area only	Water spigots/hookups at picnic area and 4 vehicle camping spaces
<b>South Side</b>	No electric at campsites	4 spaces for vehicles 20 ft. or less with water and electric hookups
<b>South Side</b>	Some picnic tables	6-8 picnic tables (accessible), at least 50% to have shelters
<b>South Side</b>	Large group picnic shelter	Group shelter with 7-8 picnic tables (accessible)
<b>South Side</b>	N/A	Portable toilets (accessible) and 1 composting toilet
<b>South Side</b>	No emergency boat launch	Emergency boat launch
<b>South Side</b>	No canoe/kayak launch	Canoe/kayak launch with two rails
<b>South Side</b>	N/A	Steps to river edge in day-use area
<b>South Side</b>	No trail to overlook	Trail to overlook (accessible)
<b>South Side</b>	No overlook	Overlook (accessible)
<b>South Side</b>	Closed ferry; existing ramps above water line; no pedestrian bridge	Pedestrian suspension bridge over river
<b>North Side</b>	Currently closed to visitors, except canoes/kayaks pulling out of Green River	Open for river users and walk-in campers, with primitive riverside camping
<b>North Side</b>	N/A	Simple turnaround
<b>North Side</b>	N/A	3 parking spaces (1 for park staff, 1 accessible)
<b>North Side</b>	N/A	Trail leading to overlook (accessible)
<b>North Side</b>	N/A	3-4 picnic tables (accessible)
<b>North Side</b>	N/A	1 composting toilet
<b>North Side</b>	N/A	Primitive canoe/kayak launch without a rail
<b>North Side</b>	N/A	No water on site
<b>North Side</b>	N/A	Moderate walking trails
<b>North Side</b>	N/A	6-9 primitive campsites with fire rings and picnic tables (3-5 reservable, others first come, first serve)

The preferred alternative is designed to meet the needs of the increasing numbers of visitors to the Houchin Ferry area of the park, to enhance the quality of their experiences there, and to ensure safety and improved efficiency of management and operations. Moving recreation activities away from the Houchin Ferry site was considered and rejected because it would not be as cost-effective or efficient operationally as the proposed project.

## **FLOODPLAINS WITHIN THE HOUCHIN FERRY PROJECT AREA**

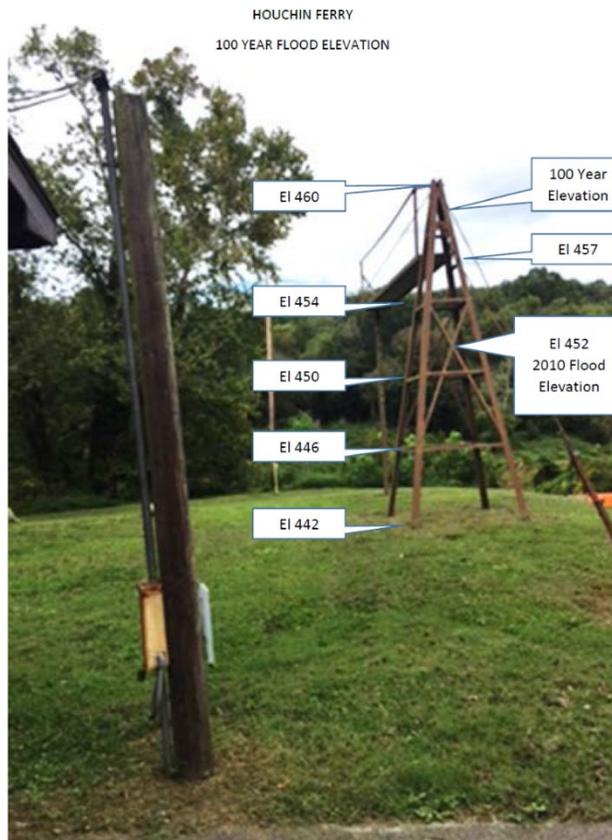
Under the preferred alternative, the Houchin Ferry recreation site would consist of a 5-acre site on the western side of Mammoth Cave National Park (4 acres on the south side of the river; 1 acre on the north side). This site had been used as an automobile ferry for many years until budget sequestration in 2013 prompted the National Park Service to close it. The south side of the site has also long been used as a National Park Service campground. The campground is situated on levelled land on a low bluff above the Green River. The ferry ramps are incised through this bluff (and corresponding high ground on the north side of the river) to reach the former water level. The campground is reached by a single paved road that descends through steep terrain to reach the levelled area that contains all existing visitor use facilities.

All of the Actions associated with the proposed alternative are Class I Actions, and therefore, the Regulatory Floodplain is that associated with the One-Percent Annual Chance Flood, also referred to as the 100-year Flood or the Baseflood (DO 77-2).

The Base floodplain at the Houchin Ferry site near Brownsville, Edmonson County, Kentucky, was mapped in 2010 by the Federal Emergency Management Agency. The entire site, on both sides of the river, is within the base elevation for 100-year flooding, which is estimated to be 459 feet above sea level at this location.

The figure below shows the 100-year floodplain elevation in relation to the ferry towers on the south side of the river (figure B-4). Note that the bottom of the ferry tower (442 feet) is roughly the same elevation as the existing campground and picnic area.

As is evident from figure B-4, the Houchin ferry site is, and has been, susceptible to flooding during 100-year flood events. In recent years several floods have required equipment evacuation and closure of facilities at Houchin Ferry. These events have caused minor flooding at the Houchin Ferry site. Most of the damage to the facilities at Houchin Ferry has been floodwater induced. Minor flooding would continue to occur from time to time under both the no-action and preferred alternatives. The proposed action will occur well within the 100-year floodplain, which is the Regulatory Floodplain for this type of action, and that flood is expected to have an elevation of 459 feet.



**FIGURE B-4. FLOOD ELEVATIONS, SOUTH SIDE OF HOUCHIN FERRY SITE, AS MEASURED AGAINST FORMER FERRY TOWER. THE TOWER IS ON A CONTOURED BENCH ABOVE RIVER, WHICH FLOWS PAST THE TOWER IN THE BACKGROUND. THE PEDESTRIAN SUSPENSION BRIDGE WOULD BE AT THE 450-FOOT ELEVATION, WHICH IS BELOW THE 100-YEAR FLOOD ELEVATION.**

It is expected that similar levels of flooding will continue in the future despite the removal of Lock and Dam No. 6 and the anticipated removal of Lock and Dam No. 5. Both of these dams were constructed with low dam heights, meaning that although they worked to back water up into the Green River valley, their impact on water levels during major flood events was and is (in the case of Dam No. 5) essentially undetectable. Based on the “Green River – Kentucky Existing Condition—Percent Change Exceedance Floods” graph in the *Green and Barren River Navigation Disposition Study* (USACE 2014, Appendix C), projected flood levels at Houchin Ferry before removal of Lock and Dam No. 6 were as follows (based on the discharge versus elevation graph for Brownsville, KY). See table B-2.

**Table B-2. Projected Flood Levels at Houchin Ferry Before Removal of Lock and Dam No. 6**

Flood (percent chance exceedance)	Elevation
500 yr. (0.2%)	464.5 ft.
100 yr. (1%)	459 ft.
50 yr. (2%)	456 ft.
20 yr. (5%)	452 ft.
10 yr. (10%)	449.5 ft.
5 yr. (20%)	446.5 ft.
2 yr. (50%)	443.5 ft.

However, the report indicates that the elevation models the same prior to and after removal of Lock and Dam No. 6 for discharges above 16,000 cubic feet per second (cfs). And, according to the Brownsville graph, an annual flood (exceedance frequency 100 per 100 years) has a discharge of 24,900 cfs. Therefore, the flood levels above should be valid even after removal of Lock and Dam No. 6. Stated another way, flood levels at Houchin Ferry should be the same with or without Lock and Dam No. 6 for all but the smallest floods. The park is therefore working on the assumption that flooding will continue along historic lines notwithstanding the substantial drop in the Green River's normal water elevation at Houchin Ferry.



**FIGURE B-5. VIEW OF CURRENT PICNIC SHELTER AREA, LOOKING IN DIRECTION OF GREEN RIVER**

This photograph, and those on the following page (figures B-5 and B-6), were taken on February 26, 2019, when water reached the approximately 440-foot elevation level (about 19 feet below the 100-year flood level). The river commonly floods to this level every few years.



View of Top of Existing Ramp Down to Green River



View Towards Western End of Camp Sites

**FIGURE B-6. FLOODING ON FEBRUARY 26, 2019**

## **JUSTIFICATION FOR USE OF THE FLOODPLAIN**

As noted above, the Houchin Ferry site generally, and the south bank campground in particular, have been in place for many years. Under the preferred alternative, the existing recreational facilities on the 4-acre site south side of the river would remain in place. In addition, some new facilities would be added on the south side, and the 1-acre site on the north side of the river would be newly developed. No areas outside of the Regulatory Floodplain for this type of action were considered by the study team. The incised nature of the Green River valley means that the terrain near the river is too steep for recreational development except in those locations flat enough to have been used historically for ferry crossings. Even in these locations, developable land is at a premium, and the Houchin Ferry site is no exception. The artificial, contoured bench on the south side of this site was created many years ago to make possible the present recreation area. The north side is less steep than the south side, but a developable area that is both outside the Regulatory Floodplain and acceptably close to the river is not available.

The justification for retaining, upgrading, and augmenting existing structures in the 100- year floodplain is as follows:

- As noted above, the steep adjacent topography prevents moving the existing facilities farther up-slope on the south side.
- The Houchin Ferry site is needed to provide park visitors with opportunities for land and water-based recreation in the western part of the park. Most of the park's recreational facilities are located in the central and eastern part of the park. Demand for recreational facilities is increasing on the west end and there is no place other than Houchin Ferry to provide these facilities safely and at reasonable cost. Demand for canoe and kayaking opportunities has been growing especially quickly in this part of the park, with Houchin Ferry being projected as a stop on the Green and Nolin Rivers National Water Trail.
- Existing facilities need to be retained and improved because they support park management activities that require access to the Green River. At present, the only available river access points are (a) the Green River Ferry crossing area, located 12 river miles upstream from the Houchin Ferry site, and (b) the Brownsville boat ramp, located down river and outside of the park. Improving the Houchin Ferry site will greatly improve access to the river for all park staff but will be of particular benefit to law enforcement rangers, who will be able to reduce response times and thereby enhance visitor safety. Under current river conditions, park staff must either access the river at the Green River Ferry access point or else use a canoe or kayak to obtain local access to areas between Houchin Ferry and Lock 6.
- Retaining facilities at Houchin Ferry will allow the park to take advantage of a previously disturbed site with existing, albeit limited utilities.
- The pedestrian bridge needs to be built in the Regulatory Floodplain because it is fundamental to the viability of the proposed action. The bridge is needed to meet strong local sentiment for the National Park Service to restore connectivity between the two sides of the Green River at the former ferry site. Moreover, the bridge is also needed to make it feasible for the National Park Service to develop and maintain visitor facilities on the north side of the river. The driving distance between the south and north Houchin Ferry sites is such that without a bridge it would not be feasible in terms of either time or cost for the National Park Service to operate recreational facilities on the north bank of the river. The National Park Service has looked at alternative crossing methods (e.g., a low-water bridge) but all have proved too costly, both financially and in the nature and amount of environmental impacts. The pedestrian bridge is the most cost-effective and environmentally friendly approach to meeting anticipated recreational demand at the Houchin Ferry site.

## **FLOOD HAZARDS**

Flood risks associated with the proposed action include risk to human health and life due to overnight occupation and risk to capital investment resulting from damage to existing and expanded infrastructure. As shown in Figures B-1 and B-4 above, virtually all existing and new infrastructure at the Houchin Ferry site would be subject to inundation during the Regulatory Flood. Infrastructure would be subject to flood depths ranging from as little as 1 foot to as much as 17 feet during the Regulatory Flood. Electrical transformers would be located on poles outside the Regulatory Floodplain.

Planned construction activities would occur in areas of the site already impacted by development, but the extent of new construction means that new impacts to property and to floodplain functions and values would occur. Additional pavement would have to be installed to accommodate new parking spaces and the livery standing area. Other new facilities affecting the floodplain and subject to flood damage include the emergency boat launch, increased number of picnic tables, and composting and portable toilets. However, the additional pavement and structures are unlikely to negatively affect flood storage or groundwater recharge to a measurable degree, or degrade overall riparian services, because (a) the paving footprint will still be small even after expansion, (b) the boat launch will be designed so as to minimally impede floodwaters, and (c) the portable toilets can be removed from the 100-year floodplain during flood events.

The principal flood risk associated with the preferred alternative comes from the proposed suspension bridge. Although no piers supporting the bridge would be placed in the active river channel or along the riverbanks, and although the bridge supports would be constructed on contoured benches on low bluffs above the river, the supports would still be within the 100-year floodplain. Likewise, the bridge deck's proposed elevation of 450 feet above sea level is less than the 100-year flood elevation of 459 feet. Portions of the bridge would thus be subject to damage during 1%- Chance Annual Flood events. However, even though portions of the footbridge will be within the Regulatory Flood, the effect on flow is not expected to increase the associated flood hazard, as floods are not "flashy" in this area and floodwaters are typically slow to rise. To address risks associated with the bridge, the bridge would be designed to minimize both obstruction to floodwaters and damage to the structure itself (see the "Mitigation" section below).

The flood hazard to capital investment at Houchin ferry is moderated by the fact that typical basin lag times for flood events are approximately one day. A basin lag of one day suggests that after a significant regional rainfall event, approximately one day will elapse before flood conditions occur at the Houchin Ferry site, providing ample time for evacuation of removable property as well as park visitors. Furthermore, the experience of park personnel is that smaller, local rainfall events typically do not produce flood conditions at the site. More regional rainfall is typically needed to produce flooding conditions at the site.

There is no evidence of scour on the terrace level that the development would occur on. This suggests low velocities of flow, and the main risk on the terrace is sedimentation (getting covered by mud) rather than removal by scouring. Water depths are typically shallow when it does reach the floodplain, but water depths during extreme flood events could reach 20 feet.

Regarding risk to human health and safety, ample notice of severe weather is provided by the National Weather Service and other agencies, making warning and evacuation a practical option for protection of human life both at the bridge and the entire Houchin Ferry site.

## **MITIGATION**

The situations that lead to storm-caused high-water events, and the scope and duration of these events, are known by park staff, making warning and evacuation a practical option for protection of human life. Mammoth Cave National Park will continue to maintain an active floodplain evacuation protocol. This protocol entails removing or securing park property during a flood; monitoring communications during floods; and conducting rescue and salvage

operations if necessary. This protocol has proven effective in maintaining safety and reducing property damage during storms, and it will continue to be reviewed and updated.

Some site infrastructure, including portable toilets, could easily be moved in advance of flooding. One composting toilet would remain in place on each side of the river below the 100-year flood level and could not be moved. These and other facilities that cannot be moved would be subject to flood damage. However, based on historical precedent, the nature of the facilities is such that damage would either be minor or the items, being of low value, could easily be replaced. The existing campground and picnic area have been in place for many years and have experienced a number of flooding incidents. Damage to property/facilities has been minor.

The design of new structures throughout the Houchin Ferry site would incorporate methods for minimizing storm damage as contained in the National Flood Insurance Program's Floodplain Management Criteria for Flood-Prone Areas (44 CFR section 60.3) and in accordance with local, county or state requirements for flood-prone areas. For the pedestrian suspension bridge, bridge decking would consist of metal slats spaced so as to minimize resistance to flood waters while still ensuring human safety during regular use. Periodic damage to the bridge would still likely occur given that the bridge decking is 9 feet below the Regulatory Flood. Still, the footbridge is sufficiently important to the project that the park is willing to accept periodic flood damage to the structure as the price of providing recreational facilities on both sides of the river.

The environmental analysis contained in the Plan and this Statement of Findings constitute the environmental compliance necessary to implement the Houchin Ferry development should the preferred alternative be selected.

## **SUMMARY**

Through the FSOF process the National Park Service has determined that there are no practicable, non-floodplain locations for the proposed action. Potential impacts to human life and health will be mitigated through the existing MACA Flood Evacuation Plan. The potential impacts to the proposed capital investment will be mitigated through a combination of implementing design standards consistent with the National Flood Insurance Program's Floodplain Management Criteria for Flood-Prone Areas (44 CFR section 60.3) and in accordance with local, county or state requirements for flood-prone areas, and selecting movable or sacrificial infrastructure such as the bridge deck, picnic tables, and fire rings, portable toilets, etc. Despite an increase in parking spaces, trailer spaces, other paved areas, and the emergency boat launch, the natural and beneficial floodplain values are not expected to be negatively impacted to any measurable extent because the cumulative amount of additional paving to the site will be small and above-ground structures, when not removable, will be designed to minimally impede flood water flows. The replacement, restoration, or development of facilities and infrastructure within the site would not expand beyond the currently disturbed campground/ferry footprint. Therefore, the National Park Service finds that the proposed action would not have any material additional adverse impacts on floodplains and their associated values.

## Statement of Findings References

Executive Order 11988, "Floodplain Management" (May 28, 1980). Executive Order of the President of the United States.

### National Park Service

2003 Director's Order 77-2: *Floodplain Management*. Washington Office, Washington, D.C.

2006 *Management Policies 2006*. National Park Service, Washington, D.C.

### United States Army Corps of Engineers

2014 *Green and Barren River Navigation Disposition Study: Green and Barren Rivers, Kentucky: Civil Works Review Board: Green River Locks and Dams 3, 4, 5, 6 and Barren River Lock and Dam 1 Disposition, Kentucky*.



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

MACA 135/170224  
June 2020



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