Mint Springs Creek Invasive Fish Species Eradication

Environmental Assessment
August 24, 2006

TABLE OF CONTENTS

I. PURPOSE AND NEED FOR ACTION

Vicksburg National Military Park (VNMP) preserves and interprets the site of the Civil War Siege of Vicksburg, Mississippi, that occurred during the summer of 1863. The main body of the park is located about four miles due east of the Mississippi River in Warren County, adjacent to the city limits of Vicksburg, and encompasses approximately 1,800 acres (including Vicksburg National Cemetery).

Three main watersheds exist within the boundary of VNMP: Mint Springs Creek, Glass Bayou Creek, and Stout's Bayou Creek. Of these, Mint Springs Creek is the main waterbody and flows from east to west in the northern section of the park, emptying into the Yazoo River Diversion Canal three miles upstream from the Mississippi River (Figure 1). Aside from being the park's longest wetland, and thus possessing its greatest concentration of biodiversity, Mint Springs Creek was also a significant feature of the Siege of Vicksburg, as it and its tributaries provided a principal water source for both Union and Confederate troops and their pack animals during siege operations. A quarter mile upstream from Mint Spring's confluence with the Yazoo River Diversion Canal, there exists a 25-foot waterfall (Figure 2 and Figure 3), one of a relatively few of such size in the state. This waterfall acts as a natural barrier to fish and other aquatic organisms from moving up stream, effectively splitting the creek into an upper and lower portion. Mint Springs Creek becomes intermittent approximately 1.15 miles from its confluence with the Yazoo River Diversion Canal, and approximately 1.0 miles upstream of the waterfall.

Sometime in the past, someone introduced the non-native and invasive fathead minnow (*Pimephales promelas*) into Mint Springs Creek. The fathead minnow population in Mint Springs Creek represents one of Mississippi's six introduced transplanted species (a species native to Mississippi, but transplanted outside its native range within the state) and an unnatural population creating an environmental risk to other species (Ross 2001). This invasive species reproduces rapidly, grows fast, and is capable of altering aquatic communities. Fathead minnows tend to migrate downstream (Schlosser 1995), and individuals from the naturalized population currently in the upper reach of Mint Springs Creek continues to disperse downstream and contaminate the native fish community below. In the 1.0 miles of stream above the waterfall, no natural native fish populations exist. Inventories performed annually since 1997 have failed to turn up any fish species but the transplanted minnow (Dibble 2003).

Fathead minnows are native to the upper and western portions of the Mississippi River watershed, but not to the state of Mississippi (Pflieger 1975, Robison and Buchanan 1992, Ross 2001). The fathead minnow is commonly used by fisherman for bait and their release by fishermen has resulted in numerous introductions in many instances outside of their native range (Plieger 1975, Robison and Buchanan 1992). This species is tolerant of poor water quality conditions, often inhabiting sluggish streams and stagnant pools of intermittent systems. Reproduction occurs from April though August, with females spawning every 2 to 16 days. A reproductive season may result in up to 4,000 offspring per female spawner. Early spawned fish may mature in one season, reproducing later that

season. Life span is approximately 3 years and maximum length is approximately 3 inches.

The purpose of this proposed action is to eradicate a non-native and invasive fish species (fathead minnows) from the upper reach of Mint Springs Creek. Mississippi Department of Wildlife, Fisheries, and Parks, and the Mississippi State Natural Science Museum would assist in this elimination effort.

Impact Topics Considered for Analysis

There are a number of issues (or impact topics) that this EA will examine in detail. In terms of this assessment, an "issue" arises when there is a relationship (either good or bad) between a proposed course of action and an environmental, cultural, or human resource. An issue provides an alert as to what the environmental consequences might be if an action is taken, and provides an opportunity for further investigation and explanation. As a result of internal scoping by an interdisciplinary team of VNMP personnel, two issues were identified as being relevant to the proposed action's effect on the natural, cultural, and human environment.

- **Wildlife and Habitat (Including T&E)-** This Impact Topic was included because the project intends to eliminate one species of fish through direct actions and may temporarily reduce several species of aquatic insects through indirect actions. The park also is near areas that harbor state and federally-listed species which may or may not be affected by what transpires at the project area.

- **Water Quality and Wetlands-** This Impact Topic was included because a linear wetland exists within the project area and federal law specifically addresses potential impacts to wetlands as a result of federal actions.

By instituting either of the action alternatives, tangible effects would be discernable in the above areas of concern.

Each of the impact topics will be discussed in greater detail in the "**ENVIRONMENTAL ANALYSIS OF IMPACTS TO THE AFFECTED ENVIRONMENT**" section of this document.

Impact Topics Considered and Dismissed for Analysis

As a result of internal scoping by an interdisciplinary team of VNMP personnel, the remaining twelve issues were considered but dismissed as not being relevant to the proposed action's effect on the natural, cultural, and human environment.

- **Cultural Resources (Cultural Landscape) -** This Impact Topic was not included because the project will not affect the park's overall cultural landscape.

- **Visitor Use and Experience**- This Impact Topic was not included because park visitors do not regularly visit Mint Springs Creek, and their use and experience of the park will not be affected by whichever management scenario is chosen.

- **Vegetation (Including Exotics)** - This Impact Topic was not included because the various management scenarios being considered in this document do not affect the vegetation in the project area.

- **Soils**- This Impact Topic was not included because the implementation of any of the management scenarios under consideration would not have an effect on the relatively unique loess soils making up the terrain in the project area.

- **Park Operations**- This Impact Topic was dismissed because the implementation of any of the management scenarios under consideration would not have an influence on the workload of several of the divisions who work to maintain the park on a day to day basis.

- **Public Health and Safety**- This Impact Topic was dismissed because project execution will be short-lived, the public will be excluded from the project area for the duration of the alternative implementation phase, and the stream is not used for any water supply.

- **Critical Habitat (For T&E Species)** - This Impact Topic was dismissed because VNMP does not contain any critical habitat.

- **Natural Soundscape**- This Impact Topic was dismissed because the implementation of either of the action alternatives would be relatively short-lived and not engender any significant or long-term noise intrusions.

- **Air Quality**- This Impact Topic was dismissed because the implementation of either of the action alternatives would not impact air quality and would be relatively short-lived.

- **Wilderness**- This Impact Topic was dismissed because VNMP does not contain any designated or potential wilderness.

- **Paleontology**- This Impact Topic was dismissed because the project will not disturb any soils that might contain paleontological resources.

- **Economic Effects**- This Impact Topic was dismissed because the proposed project is limited in scope and implementation of any of the alternatives under consideration would be very unlikely to affect the local economy in any way.

Any action or inaction taken will either not change the condition of the above issues as they pertain to the project area, or the effects will be so transitory and negligible as to be

insignificant. Institution of either of the action alternatives or the no-action alternative would not produce tangible effects in any of these areas.

II. ALTERNATIVES

The National Park Service has considered four alternatives to eliminate the presence of the exotic and invasive fish species, fathead minnow (*Pimephales promelas*). These are: 1) to eliminate the presence of invasive fish through the use of the piscicide Antimycin (Preferred Alternative), 2) to eliminate the presence of invasive fish through the use of another fish toxicant, Rotenone, 3) to eliminate the presence of invasive fish through the use of electrofishing equipment, and 4) to take no action with regards to the presence of invasive fish.

Alternatives considered but rejected include: netting or seining, as these devices cannot be used effectively in streams for complete elimination of fish populations; and the use of explosives, because of concerns for non-target aquatic organisms, low probability of total removal of all fish, and potential non-desirable habitat impacts.

Alternative 1—Elimination of invasive fish species through the use of Antimycin (Preferred Alternative).

Under this alternative, approximately 1 mile (1.6 km) of Mint Springs Creek, upstream of a waterfall at an elevation 104 ft MSL (mean sea level) and approximately 0.25 miles from the mouth at the Yazoo River Diversion Canal (Figure 3), would be treated with the fish toxin antimycin, a chemical compound fatally toxic to fish, but less toxic to aquatic animals other than scaled fish. The toxicity of antimycin below the treatment site would be neutralized (detoxified) with the use of potassium permanganate ($KMnO_4$).

Antimycin is an antibiotic produced in cultures of *Streptomyces* and sold under the trade name of Fintrol. It is EPA approved for fishery use and it kills fish by inhibiting cellular respiration. The toxicity of antimycin is diminished by high alkalinity, temperature, sunlight, and the metabolic activity of aquatic organisms. Antimycin has a half-life of only a few hours in fast moving non-acidic waters, generally being naturally neutralized in streams within 1,500 feet of the point of application (American Fisheries Society 2006). Antimycin, when used in proper concentration, is less harmful than the recommended killing concentration of Rotenone (Alternative 2) to aquatic animals other than fish. Lennon et al. (1971) stated that antimycin is the ideal fish toxicant because of its selective effects, its effectiveness at low concentrations in a short exposure time in a wide range of water qualities, it is not repulsive to fish, it is effective on all size classes, and it leaves no residue. To ensure a high mortality (near 100%) in 8 hours (1/3 the time of a 24-hour trial), we would use a dosage of up to 10 µg/L (i.e., ppb), which has been shown to be effective in similar systems for this species (Gilderhus et al. 1969). To determine the dosage needed, we would perform a field bioassay by placing 5 fathead minnows in buckets containing water from Mint Springs Creek and dosages of 0, 6, 9, and 10 ppb of

antimycin for 8 hours (American Fisheries Society 2006). The lowest dosage of antimycin that kills all fathead minnows in the 8-hour time period would be the dosage used for treatment of the stream. Above the waterfall, we would place cages of captive fathead minnows every 325 feet in the middle of the stream to monitor and adjust the concentration of antimycin. This alternative is anticipated to have the least overall environmental impact with the highest potential for success.

Prior to treatment, flow (discharge) would be determined at six to eight locations along the length of stream to be treated to determine the amount of antimycin needed to maintain a concentration of 10 parts per billion (ppb) for 8 hours in the section being treated (American Fisheries Society 2006). Treatment would begin at the upstream end of the project area and proceed downstream. During treatment, potassium permanganate ($KMnO_4$), a detoxifying agent, would be applied to the stream below the waterfall. This chemical would be applied for a minimum of eight hours each day of treatment to insure that all of the toxicant has been neutralized. Up to three treatments may be required, but would be determined through bioassays.

Dye tracers would be used to estimate the length of time required for the chemical to travel from one treatment station to the next and to coordinate the release of chemical at each station.

Dead and dying fish would be collected with dip nets and buried in the nearby forest. "No-entry" signs would be posted for 48-hours to keep visitors out of the treated area.

Quarterly sampling by electrofishing for one year would determine the effectiveness of the eradication, but would be dependent on budgetary constraints. Should any invasive fish species remain, another application would be conducted.

The NPS is interested in restoring native fish species to the affected site after treatment, but not until specific native species have been determined to have resided in the reach prior to the establishment of the invasive species. Once this determination has been made, the NPS would proceed under a categorical exclusion according to NPS Director's Order 12, section 3.4 E (2): Restoration of non-controversial native species into suitable habitats within their historic range.

Detoxification of Antimycin

Potassium permanganate ($KMnO_4$) is a strong oxidizing agent that has been used for various purposes in agriculture, industry, medicine, and water treatment (Rose and Rose 1966). $KMnO_4$ is evacuated from the environment rapidly, with a half-life of < 10 minutes in water of pH 6.5 to 9.5 (Marking and Bills 1975). Walker (1967) pointed out that $KMnO_4$ could be used to detoxify the fish toxicant Antimycin, however Marking and Bills (1975) show that $KMnO_4$ is toxic to fish at varying concentrations (0.75 mg/L for channel catfish to 3.60 mg/L for goldfish). Lawrence (1956) showed that 5 mg/L was lethal to fathead minnows. Most stream applications call for $KMnO_4$ concentrations of $\leq$ 3 mg/L,

which is the level we anticipate to use for this project. Below the waterfall, we would place cages of various native species every 325 feet for 1,300 feet in the middle of the stream to monitor and adjust the concentration of $KMnO_4$ to ensure that lethal doses are not attained. The tumbling action of the waterfall above would also help neutralize the Antimycin, limiting the amount of $KMnO_4$ needed.

Alternative 2—Elimination of invasive fish species through the use of Rotenone.

The only other EPA approved and commonly used alternative to Antimycin is Rotenone. Rotenone kills fish by blocking oxygen transport across the gill membrane. Rotenone can also be detoxified by the application of potassium permanganate, but is more difficult to neutralize and would hold its toxicity for several days depending on the field conditions encountered. Data from Finlayson et al. (2000) and Holcombe et al. (1987) demonstrate that the amount of rotenone needed to achieve similar results as antimycin would require a dosage of at least 100X higher. As a result, more rotenone must be used to obtain the same effect as with antimycin. Furthermore, rotenone works slowly in colder water temperatures, if at all, and fish can detect its presence and move to upwellings of ground water, springs, and tributaries to escape, thus lowering the potential for successful elimination of invasive fish. While Rotenone is generally non-toxic to most mammals and birds at concentrations used to sample fish, these concentrations are generally lethal to zooplankton and many aquatic invertebrates. Magnum and Madrigal (1999) found that aquatic insect populations had not returned to pre-treatment levels five years after a Rotenone treatment in the Strawberry River, Utah. It is anticipated that the use of Rotenone would result in a higher potential for impact to the non-target aquatic organisms within the system. It would also be more difficult to control unwanted impacts to non-target organisms than if antimycin was used. Because fish can detect the presence of Rotenone and move to refuge areas, the probability of success is much lower.

If Rotenone was used it would be applied in the same locations and generally under the same methods and control procedures as have been described for antimycin (Alternative 1).

The NPS is interested in restoring native fish species to the affected site after treatment, but not until specific native species have been determined to have resided in the reach prior to the establishment of the invasive species. Once this determination has been made, the NPS would proceed under a categorical exclusion according to NPS Director's Order 12, section 3.4 E (2): Restoration of non-controversial native species into suitable habitats within their historic range.

Alternative 3—Elimination of invasive fish species through the use of electrofishing equipment.

Electrofishing is a commonly used method of temporarily stunning fish to allow their capture and removal from aquatic habitats (Reynolds, 1996). It involves establishing an electrical current between two electrodes placed in the water. Fish encountering the

electrical current are temporarily stunned, roll over and are easily captured. Once captured, fish would be euthanized and buried in the nearby forest.

This approach would have the least amount of impact on non-target aquatic organisms, but is not likely to be successful in the full elimination of invasive fish species. Electrofishing in streams of the Great Smoky Mountains National Park has been proven to be about 75% successful in elimination of non-native trout (Salmonidae) from small streams receiving multiple removals in one year or treated annually for five to seven years (Kulp and Moore 2000, Moore and Larson 1989, West et al. 1990). Past electrofishing efforts in larger streams with numerous deep pools (> 1.0 m) have never been successfully reclaimed, even when multiple removals were conducted. The use of electrofishing to eradicate small-bodied fish such as fathead minnows would likely be less effective than what has been observed for large-bodied fish such as trout because small-bodied fish are more numerous and can utilize smaller areas as refuge from the electric field.

The NPS is interested in restoring native fish species to the affected site after treatment, but not until specific native species have been determined to have resided in the reach prior to the establishment of the invasive species. Once this determination has been made, the NPS would proceed under a categorical exclusion according to NPS Director's Order 12, section 3.4 E (2): Restoration of non-controversial native species into suitable habitats within their historic range.

Alternative 4—No Action

If the Park were not to implement the proposed action, it is anticipated that fathead minnows would remain unchecked in this stretch of the stream, and continue to contaminate the lower portion of the stream through emigration.

Under a no-action alternative, the National Park Service would not be meeting its mandate to preserve and protect the natural resources of the Park un-impacted for present and future generations. No action would mean a willful disregard for scientifically viable remedial actions and failure to successfully manage Park resources. The temporary limited environmental impacts to habitat and native aquatic species that would occur under the preferred alternative are not sufficient to justify no action.

The NPS is interested in restoring native fish species to the affected site, but cannot do so effectively until the non-native invasive fathead minnow population has been eradicated. Restoring native species could proceed under a categorical exclusion according to NPS Director's Order 12, section 3.4 E (2): Restoration of non-controversial native species into suitable habitats within their historic range.

Environmentally Preferred Alternative

The National Park Service is required to identify the environmentally preferred alternative for any of its proposed projects. The alternative chosen must promote the national

environmental policy expressed in NEPA (Section 101 (b)). This includes alternatives that:

1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In essence, the environmentally preferred alternative would be the one that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (National Park Service, Director's Order 12).

In this case, Alternative 1 (Elimination of invasive fish species through the use of antimycin) is the environmentally preferred alternative for Vicksburg NMP since it best meets goals 1, 2, 3, 4, and 6 described above. Under this alternative, important natural resources would be protected. This alternative best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

III. ENVIRONMENTAL ANALYSIS OF IMPACTS TO THE AFFECTED ENVIRONMENT

Cumulative Impacts

The cumulative effects analysis of this environmental assessment considers the past, present, and reasonably foreseeable future actions on wildlife communities that could add to (intensify) or offset (compensate for) the effects on the resources examined by the various alternatives.

Other pesticides are in use throughout the park. Herbicides are routinely used in the park to control exotic plants through the Exotic Plant Management Program and insecticides are occasionally used to control exotic and invasive fire ants.

A freshwater mussel survey is planned for FY 2007, which may yield some data regarding mussel presence in the target area, but the results of which are not expected to be affected by any of the action alternatives. The NPS is interested in restoring native fish species to the affected site, but not until specific native species have been determined to have resided in the reach prior to the establishment of the invasive species. Once this determination has been made, the NPS will proceed under a categorical exclusion according to NPS Director's Order 12, section 3.4 E (2): Restoration of non-controversial native species into suitable habitats within their historic range. The mussel survey may help identify those species that naturally occurred in the target reach because many mussel species require specific fish hosts for successful reproduction. No other activities are anticipated in the future that would lead to a cumulative impact.

Impairment of Park Resources or Values

In addition to requiring NPS to determine the environmental consequences of the preferred and other alternatives, the 2001 NPS *Management Policie*s and Director's Order 12 require analysis of potential effects to determine if actions would impair park resources or values.

The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, is to conserve the resources and values of each unit of the system. Although Congress has given NPS management discretion to allow certain impacts within individual units, that discretion is limited by statutory requirement that the NPS must leave resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of unit resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values. Impairment may result from NPS activities in managing the unit, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the unit.

To determine whether actions and management prescriptions involving park resources would result in impairment, each alternative was evaluated to determine if it would have a major adverse effect on a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation of the park;
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- identified as a goal in the General Management Plan or other relevant NPS planning documents.

Impact Topic Threshold Definitions

Specific impact definitions apply to each of the impact topics addressed in this environmental assessment. The definitions are defined in terms of intensity (negligible, minor, moderate, and major) and duration (short-term and long-term).

- **Wildlife and Habitat (Including T&E)**

Negligible: Aquatic wildlife and their habitats would not be affected or the effects would be at or below the level of detection and would not be measurable or of perceptible consequence to wildlife populations.

Minor: Effects to wildlife or habitat would be measurable or perceptible, but localized within a small area. While the mortality of an individual animal might occur, the viability of wildlife populations would not be affected and the community, if left alone, would recover.

Moderate: A change to aquatic wildlife populations or habitat would occur over a relatively large area. The change would be readily measurable in terms of abundance, distribution, quantity, or quality of population. Mitigation measures would be necessary to offset adverse effects, and they would likely be successful.

Major: Effects to aquatic wildlife populations or habitat would be readily apparent, and would substantially change wildlife populations over a large area in and out of the national park. Extensive mitigation would be needed to offset adverse effects, and the success of mitigation measures could not be assured.

Duration: Short-term- Recovers in less than 1 year.
Long-term- Takes more than 1 year to recover.

- **Water Quality and Wetlands**

Negligible: Impacts would not be detectable. Water quality parameters would be well below all water quality standards for the designated use of the water. Both quality and quantity of flows would be within historical conditions.

Minor: Impacts would be measurable, but water quality parameters would be well within all water quality standards for the designated use. Both quality and quantity of flows would be within the range of historical conditions.

Moderate: Changes in water quality would be readily apparent, but water quality parameters would be within all water quality standards for the designated use. Water

quality or flows would be outside historic baseline on a limited time and space basis. Mitigation would be necessary to offset adverse effects, and would likely be successful.

Major: Changes in water quality would be readily measurable, and some quality parameters would periodically be approached, equaled, or exceeded. Flows would be outside the range of historic conditions, and could include flow cessation or flooding. Extensive mitigation measures would be necessary and their success would not be assured.

Duration: Short-term- Recovery would take less than 1 year.
Long-term- Recovery would take longer than 1 year.

Analysis of Impacts on Affected Environment

- **Wildlife and Habitat (Including T&E)**

Affected Environment-

Macroinvertebrates - Surveys conducted by Dr. Eric Dibble of Mississippi State University (Dibble 2003) documented 31 taxa of macroinvertebrates inhabiting the streams of Vicksburg National Military Park. Most of these were species of Amphipoda, Chironomidae, Diptera, Ephemeroptera, and Gastropoda and were not identified below the family level (Order level in some instances). Some mussel species likely occur in the stream, but have never been fully documented. A mussel survey is planned for late 2006 and 2007.

Reptiles and Amphibians – The most recent herpetofaunal survey of Vicksburg National Military Park (Keiser 2002) found five species of salamanders, 12 species of frogs and toads, nine species of turtles, four species of lizards, and 14 species of snakes. An additional 34 species of reptiles and amphibians are likely to occur within park boundaries that were not documented by Keiser (2002).

Fish – Only the invasive fathead minnows, along with some green sunfish added to the reach as an unsuccessful experiment in biocontrol, exist above the waterfall in Mint Springs Creek. Below the waterfall, 16 species of fish occur (Dibble 2003) including bluntnose darter (*Etheostoma chlorosomum*), emerald shiner (*Notropis atherinoides*), Mississippi silvery minnow (*Hybognathus nuchalis*), swamp darter (*Etheostoma fusiforme*), and warmouth (*Lepomis gulosus*).

Terrestrial Animals - Mammals that would be expected to occur in the project site include raccoons (*Procyon lotor*), armadillos (*Dasypus novemcinctus*), opossums (*Didelphis virginiana*), red foxes (*Vulpes fulva*), striped skunks (*Mephitis mephitis*), coyotes (*Canis latrans*), domestic dogs (*Canis familiaris*) and cats (*Felis catus*) (Cooper et al. 2004). At least 35 bird species are associated with the Mississippi River and Yazoo River Diversion Canal, including the Federally Threatened bald eagle

(*Haliaeetus leucocephalus*) and Federally Endangered interior least tern (*Sterna antillarum athalassos*). These latter two bird species are not associated with habitats in Mint Springs Creek.

Threatened and Endangered Species – No federally threatened or endangered animal species are known to inhabit the park, although the federally threatened American alligator and bald eagle and the federally endangered interior least tern could inhabit areas near the park (Cooper et al. 2004).

Environmental Consequences-

Alternative 1 –Antimycin – Preferred Alternative

Except for the fish targeted for elimination, effects on wildlife populations would be minor and short-term. All fish are expected to be eliminated from the treated reach. Dibble (2003) provides data on native fish abundance to determine when native fish levels return to pre-treatment levels. Many of the aquatic insects in the treatment reach also may not survive the treatment. However, re-colonization from upstream reaches, tributaries, and untreated downstream reaches would begin almost immediately. Because aquatic insects have a mobile, flying adult stage, insects from non-treated areas would utilize the treated reach for reproduction, thus re-colonizing the reach. Experience in mid-west and western streams treated with antimycin (Jacobi and Deagan 1977; Minckley and Mihalick 1981), shows that the aquatic environment is strongly resilient and the treated reach would return to a stable habitat in a period of months. Results from Great Smoky Mountains National Park indicated short-term declines in aquatic macroinvertebrate species in species abundance but no loss of species diversity (Walker 2003). In all cases, species abundance was back to or above pre-treatment levels within four months of treatment (Walker 2003). Results from the eradication efforts in Crater Lake National Park indicate that initially mayfly and stonefly populations were significantly reduced in density but caddisflies were not significantly impacted (Mark Buktenica, Crater Lake National Park, personal communication). Based on limited monitoring data the aquatic insect community recovered to pre-treatment levels quickly (Mark Buktenica, Crater Lake National Park, personal communication).

Schnick (1974) indicates that 10–80 ppb of antimycin has little to no effect on the survival of herpetofauna, except for possibly tadpoles of frogs. During field toxicity tests in 1998 at Sams Creek, Great Smoky Mountains National Park, adult and larval (with gills) salamanders were placed in the 8 ppb test bucket with rainbow trout. All trout died within two hours but the salamanders were unaffected after eight hours of exposure (Steve Moore, Great Smoky Mountains National Park, personal communication). Therefore, it is highly unlikely that these faunal groups would be affected.

The addition of liquid antimycin to Mint Springs Creek may cause certain groups of aquatic macroinvertebrates to decline in the short term, especially Amphipoda, and then

rebound quickly (Schnick 1974). No loss of freshwater mussels is expected. The natural degradation of antimycin and the use of its neutralizer, $KMnO_4$, would limit the effect of the toxin to its intended reach and not affect these native species below the reach. The addition of liquid antimycin to Mint Springs Creek would not affect any T&E species by the proposed action.

Alternative 2 –Rotenone

Under this alternative, minor to moderate, short-term impacts to wildlife populations would occur. Studies in Utah (Magnum and Madrigal 1999) and Wyoming (Cerreto 2004) indicates that aquatic insect populations do not recover as quickly from Rotenone treatment. Detoxification is also more difficult although monitoring procedures would be the same as for Alternative 1. Dibble (2003) provides data on native fish abundance to determine when native fish levels return to pre-treatment levels.

Alternative 3 – Electrofishing

Under this alternative, impacts to wildlife populations would be minor and short-term. Restoration using backpack electrofishing techniques would be the least impacting to non-target organisms because non-target organisms can be released back alive immediately after capture. Some ancillary mortality of non-target organisms is expected, but below the level attained through the use of piscicides (i.e., Antimycin and Rotenone). Dibble (2003) provides data on native fish abundance to determine when native fish levels return to pre-treatment levels.

Alternative 4 - No Action

Under this alternative, there would be no impact to wildlife populations from direct action, rather through inaction, the invasive species would persist and continue to contaminate the downstream reaches. It is the professional opinion of several biologists that the non-native fathead minnow has led to the exclusion of native species through competitive interactions. Without removing the non-native species, the potential for recolonization by native species is not possible. As a result, long-term and major impacts would occur.

Conclusion

Selection of any of the action alternatives (1-3) would have minor to moderate, short-term impacts to wildlife populations. Selection of the no-action alternative would result in the most and longest-duration impact. No cumulative impacts are expected to occur by selection of any of the action alternatives.

Impairment

None of the alternatives analyzed in this EA would result in impairment to Wildlife and Habitat (including T & E).

- **Water Quality and Wetlands**

Affected Environment-

Water - Surrounding vegetative communities, soil chemistry and underlying geology primarily determine water quality in the Park. Mint Springs Creek annually fluctuates approximately 20° C, from a low of 10-12° C to a high of 28-33° C, and the average water temperature has increased approximately 3° C since 1995 (Dibble 2003). The pH fluctuates annually approximately 1.5 units, from 6.7 to 8.4.

Environmental Consequences-

Alternative 1 –Antimycin – Preferred Alternative

Antimycin breaks down quickly in water and impacts to water quality would be minor and short-term. Toxicity tests at the U. S. Fish and Wildlife Service laboratories indicate that water quality is not affected by the addition of antimycin (Schnick 1974). Finlayson et al. (2002) reviewed the environmental fate of antimycin and reported the half-life at 12° C to range from 310 hours at pH 6.0 to 1.5 hours at pH 10. The application of $KMnO_4$ would neutralize any effects downstream of the treatment area and both chemicals would become so dilute at the confluence with the Yazoo River Diversion Canal to become non-detectable.

Alternative 2 –Rotenone

Rotenone also breaks down quickly in water to undetectable levels within a month dependent on water chemistry, making environmental impacts to water quality minor and short-term. Rotenone often dissipates within 24-hours in flowing waters. The application of $KMnO_4$ would neutralize any effects downstream of the treatment area and both chemicals would become so dilute at the confluence with the Yazoo River Diversion Canal to become non-detectable.

Alternative 3 – Electrofishing

Electrofishing would have a negligible, short-term effect on water quality. Electrofishing teams would wade in the stream, temporarily stirring and suspending sediment, which would temporarily cloud the water. No direct effect from electricity would affect water quality.

Alternative 4 - No Action

The no-action alternative would have a negligible, long-term effect on water quality. By doing nothing, no chemicals would be added to the stream and no electrofishing teams would be wading in the stream. The non-native species would continue to persist,

affecting water quality through biochemical, food-web pathways (e.g., living, dying, ingesting, egesting).

Conclusion

The largest impact to water quality would only be minor and short-term. Selection of any of the alternatives would not impact water quality to any significant degree.

Impairment

None of the alternatives analyzed in this EA would result in impairment to Water Quality and Wetlands.

IV. PREPARATION AND CONSULTATION

Public Involvement

The public at large will be invited to review and comment on this document during a 30 Day Public Comment Period. Persons and entities who have expressed an interest in this proposed project (listed below) will be mailed a copy of the EA. An announcement will be taken out in the local newspaper (*The Vicksburg Post*) prior to the comment period letting the general public know that the EA is available at the park, or through the mail upon request, for their review. The EA will also be posted on the National Park Service Planning, Environment and Public Comment (PEPC) website: http://parkplanning.nps.gov/.

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Persons, Organizations, and Agencies Who Will Receive this Environmental Assessment During the Public Comment and Consultation Period

City of Vicksburg, Mayor and Board of Aldermen
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Mississippi Audubon Society
MS Department of Environmental Quality
MS Department of Wildlife, Fisheries, & Parks
Mississippi Wildlife Federation
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V. REFERENCES

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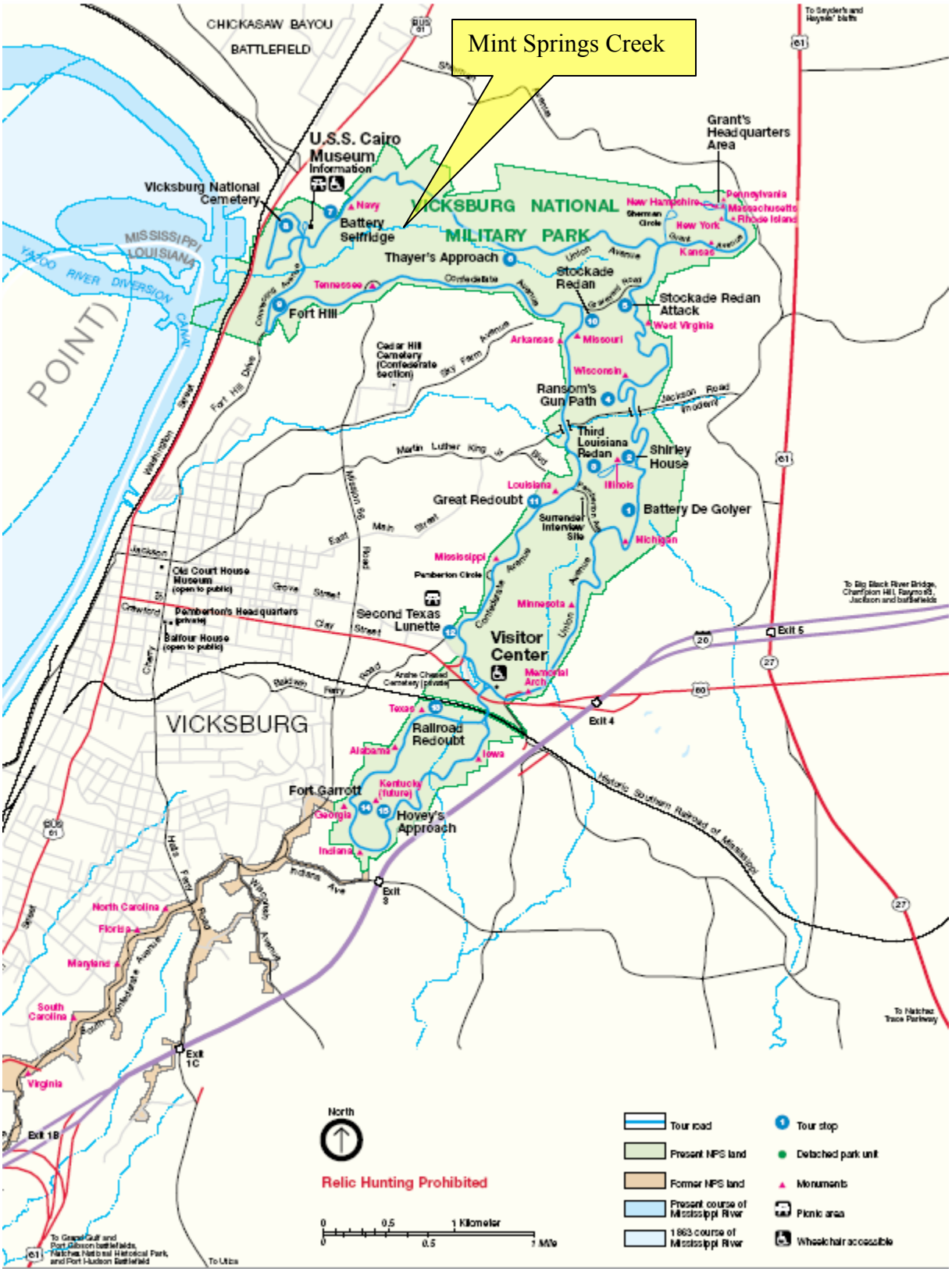

Figure 1.—Map of Vicksburg National Military Park depicting location of Mint Springs Creek where invasive fathead minnows are proposed for eradication.

Figure 2.—Photograph of waterfall on Mint Springs Creek above which invasive fathead minnows are the only fish species present and proposed for eradication.

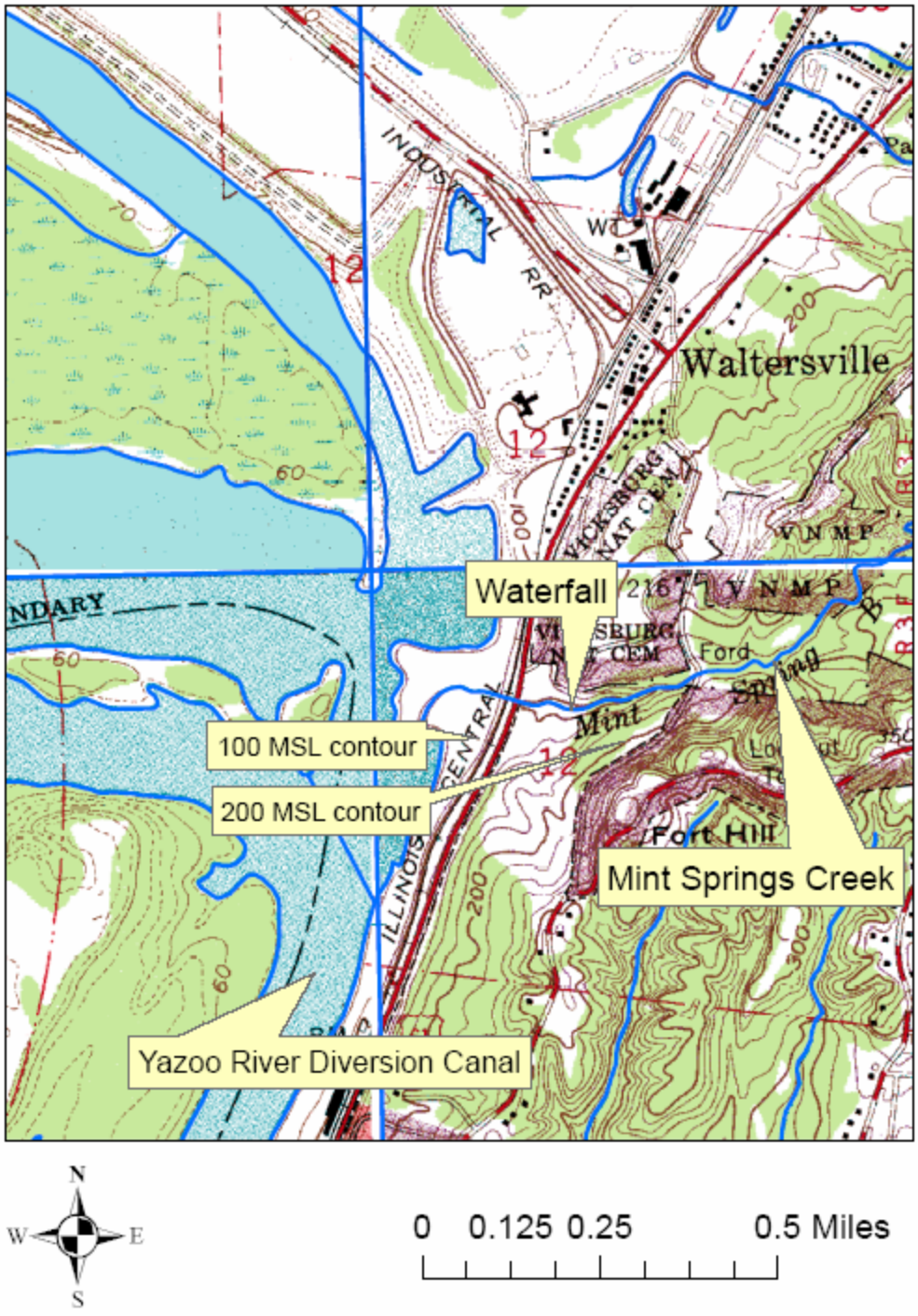

Figure 3.—Location of waterfall on Mint Springs Creek above which invasive fathead minnows are the only fish species present and proposed for eradication.