

# Carlsbad Caverns National Park

National Park Service  
U.S. Department of the Interior

Carlsbad National Park  
New Mexico

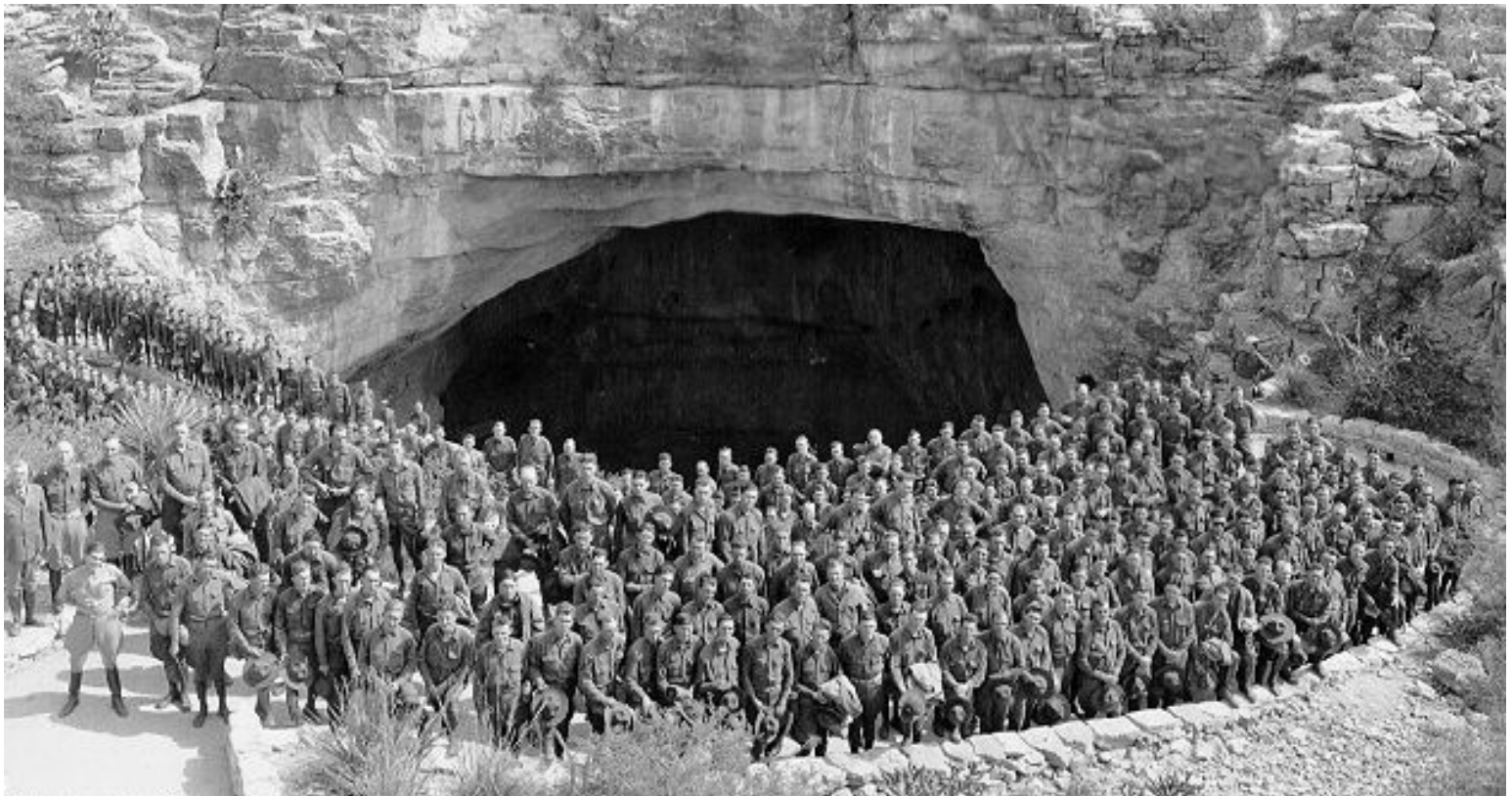


## Environmental Assessment

### Wastewater System Rehabilitation

Carlsbad Caverns National Park, Eddy County, New Mexico

March 2007





**ENVIRONMENTAL ASSESSMENT**  
**Wastewater System Rehabilitation**  
**Carlsbad Caverns National Park, Eddy County, New Mexico**

Prepared for:  
National Park Service



Prepared by:  
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**Carlsbad Caverns National Park**  
**New Mexico**



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

**ENVIRONMENTAL ASSESSMENT/ASSESSMENT OF EFFECT  
WASTEWATER SYSTEM REHABILITATION  
CARLSBAD CAVERNS NATIONAL PARK  
EDDY COUNTY, NEW MEXICO**

**EXECUTIVE SUMMARY**

The National Park Service, Carlsbad Caverns National Park (Park), located in Eddy County in southeastern New Mexico, proposes rehabilitation of the wastewater system that services Park facilities above Carlsbad Cavern. The existing sewage system, installed in 1972, collects waste from Park facilities via approximately 3,000 feet of 4–6-inch galvanized metal pipe and, with the help of a lift station located at the Bat Cave Draw restrooms, carries the waste through 4,800 feet of 6–8-inch galvanized metal sewer pipe to waste disposal ponds at the foot of a steep escarpment south of the Park facilities. The purpose of the Wastewater System Rehabilitation project is to prevent further contamination of groundwater and the significant Park resources located in Carlsbad Cavern below the Park facilities. The proposed action is needed to address continued maintenance problems and prevent further deterioration of groundwater quality, in conformance with the Carlsbad Caverns Final General Management Plan (NPS 1996) and the Carlsbad Cavern Resource Protection Plan (NPS 2002a).

This environmental assessment examines two alternatives: no action and the National Park Service preferred alternative. The preferred alternative would replace all existing galvanized metal collection and outfall lines with 8-inch outside diameter High Density Polyethylene pipe; rehabilitate the existing lift station; reroute and replace the forcemain and gravity sewer lines; repair eroded embankments; replace worn inlet/outlet valves; and replace the lining in two empty, dry ponds with High Density Polyethylene lining. The existing below-grade gravity sewer line would be abandoned in place, and new aboveground piping would be installed on pylons.

Under the no action alternative, impacts to groundwater resources would be moderate, adverse, and long term from continued deterioration of and recurring plugs and leaks in the existing wastewater system, leading to contamination of groundwater in the infiltration zone above Carlsbad Cavern. No impairment of Park resources or values related to special status plant or animal species would occur under the no action alternative. Minor and long-term cumulative impacts would occur to special status plants from other Park projects. The no action alternative would result in a long-term, negligible, adverse impact to the visitor experience due to persistent odor, with cumulative impacts to visitors resulting in long-term, minor, adverse impacts. No action would result in frequent malfunctions and increased maintenance needs, and long-term, moderate, adverse impacts to Park operations. Cumulative impacts to Park operations would be short term and negligible. Under the no action alternative, there would be no impairment of Park resources or values relating to historic building resources, and no adverse effect under Section 106.

Under the preferred alternative, groundwater contamination from sewage would be eliminated by replacing the old, leaking pipes, eliminating important sources of system failure, and replacing the liners of the waste disposal ponds. Cumulatively, the Park roads rehabilitation project and sewage rehabilitation project would reduce the contaminants entering Carlsbad Cavern. Impacts to special status animal species would be mitigated and would be temporary and negligible. With mitigation, adverse impacts to special status plants would be minor and long term, and cumulative impacts to special status plants would be minor, adverse, and long term. Impacts to Park operations would result from increasing Park staff duties to mitigate construction effects, and cumulative impacts of other Park projects would create additional short-term, localized, moderate adverse effects by lengthening time of construction and creating further necessity for Park staff to monitor or mitigate construction impacts to Park resources. However, the long-term effects would be beneficial to Park operations. Rehabilitation of the Park's wastewater system would result in negligible to minor, long-term adverse impacts to the historic structures of the Caverns Historic District. The preferred alternative would not result in impairment of Park resources or values.

The public is invited to comment on the environmental assessment during the 30-day comment period. If you wish to comment on the environmental assessment, you may mail comments to the address below or you may post your comments electronically to the National Park Service's Planning, Environment and Public Comment (PEPC) website (<http://parkplanning.nps.gov/cave>). Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Wastewater System Rehabilitation Environmental Assessment  
Carlsbad Caverns National Park  
3225 National Parks Highway  
Carlsbad, New Mexico 88220-5354

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# **PURPOSE AND NEED**

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## **PROPOSED ACTION**

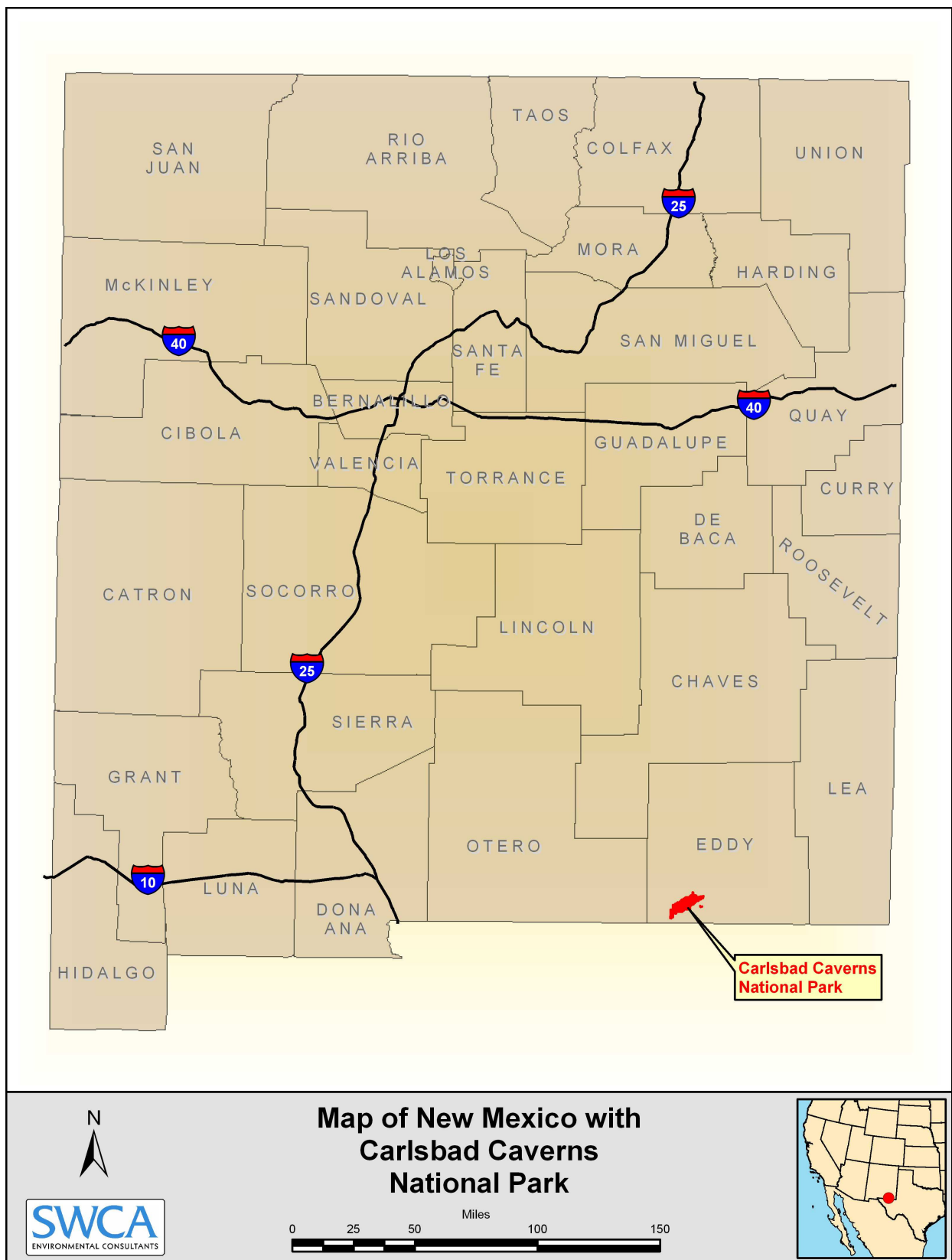
The National Park Service (NPS), Carlsbad Caverns National Park (Park), located in Eddy County in southeastern New Mexico (Figure 1), proposes modification and rehabilitation of the wastewater system that services Park facilities above Carlsbad Cavern. The project area includes a linear utility corridor 30 feet wide by 9,255 feet long running around the main facilities at the Park, down the Guadalupe Escarpment south of the Visitors Center and Carlsbad Cavern entrance, and east along the escarpment base, terminating at existing sewage disposal ponds (Figure 2).

## **PURPOSE OF AND NEED FOR THE PROPOSED ACTION**

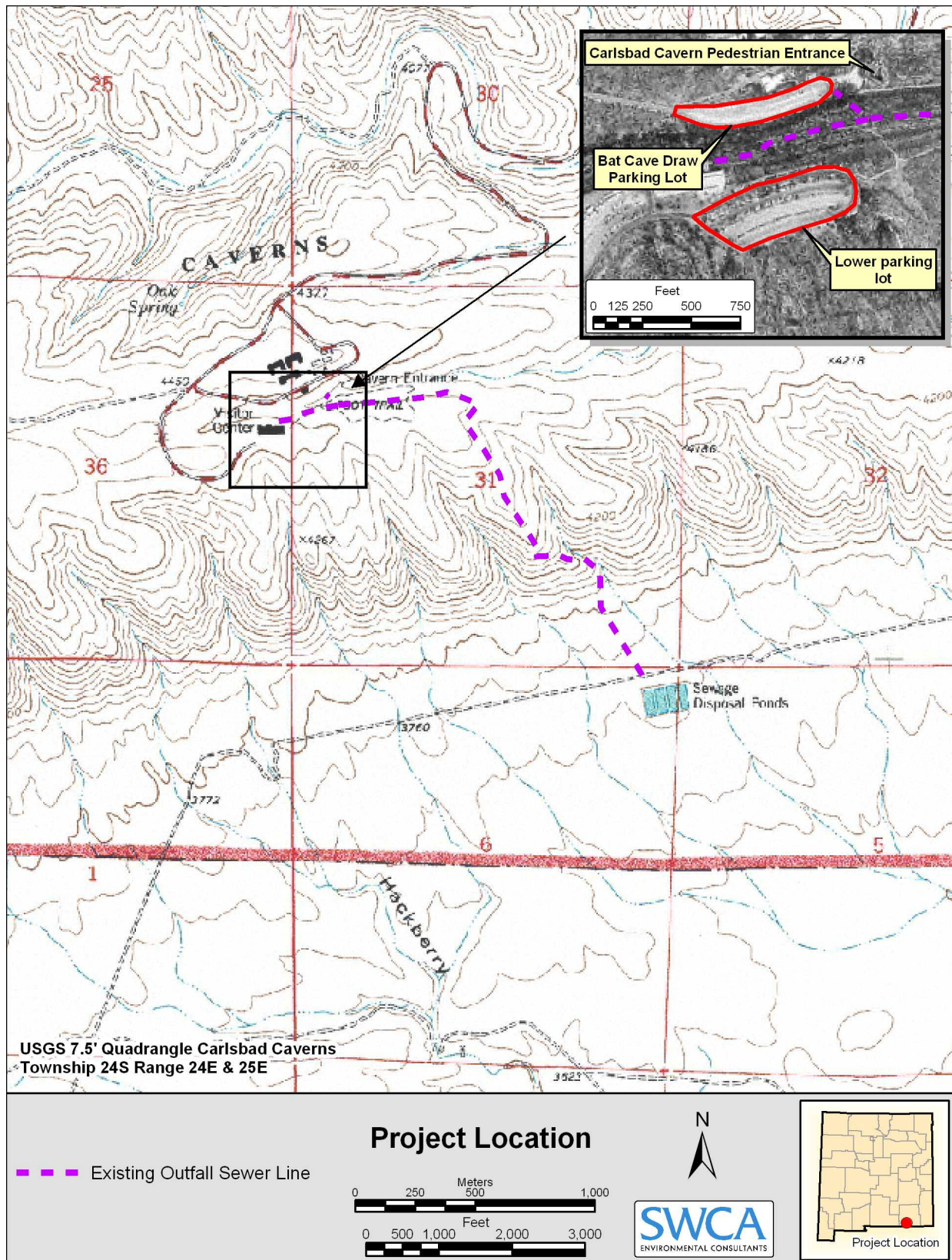
The purpose of the proposed Park Wastewater System Rehabilitation is to prevent contamination of groundwater and significant Park resources in Carlsbad Cavern located below the project area by replacing or rehabilitating the outdated and leaking sewage system that currently collects and treats waste from the Visitor Center, offices, residences, Bat Cave Draw restrooms, and maintenance buildings. The proposed action would address a deteriorating system that experiences periodic plugs and leaks and the continued risk of further releases of effluent over the cavern system.

The existing sewage system, installed in 1972, collects waste from Park facilities via approximately 3,000 feet of 4–6-inch galvanized steel pipe and, with the help of a lift station, carries the sewage through a 4,800-foot-long line of 6–8-inch galvanized metal gravity sewer line down a steep escarpment and into treatment storage ponds.

Rehabilitation of the system is needed to address continued maintenance problems and to prevent further deterioration of groundwater quality. The entire system lies in the groundwater infiltration zone that leads to the underground caverns. The existing sewer lines have deteriorated and become damaged due to settling and abrasion of loose rock fill against the underground galvanized metal pipes. The current system of sewage waste collection pipes, pump station, main sewer line, and treatment storage ponds has been identified as a primary source of contamination of groundwater that poses a contamination risk for the Main Corridor, Left-hand Tunnel, and Quintessential Right in Carlsbad Cavern (NPS 1996). The lines are currently leaking and have become plugged, backed up, and overflowed an average of four times per year since 2003. Maintenance and repair are very difficult due to the below-grade placement of the pipes and the rugged terrain.



**Figure 1.** Project location map.



**Figure 2.** Project area location.

## **ENVIRONMENTAL ASSESSMENT**

An environmental assessment (EA) analyzes a project's preferred alternative and other alternatives and their impacts on the environment. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1508.9); the National Park Service's Director's Order (DO)-12—Conservation Planning, Environmental Impact Analysis, and Decision-Making (NPS 2001); and the National Historic Preservation Act (NHPA) of 1966 (as amended [16 United States Code (U.S.C.) §470]).

## **PURPOSE AND SIGNIFICANCE OF THE PARK**

An essential part of the planning process is to understand the purpose, significance, and mission of the park for which an EA is being prepared. In the case of Carlsbad Caverns National Park, this understanding will allow determination of the best alternative for the sewer line replacement proposed in this EA.

### **PARK PURPOSE**

Park purpose statements are based on national park legislative history and NPS policies. They reaffirm the reasons for which a national park was set aside as a unit of the national park system and provide the foundation for national park management and use.

The purpose of Carlsbad Caverns National Park, as stated in the Final General Management Plan/Environmental Impact Statement (General Management Plan) (NPS 1996:4), is to:

- preserve and protect cave resources, the Chihuahuan Desert ecosystem, and the Capitan Reef in Carlsbad Caverns National Park, as well as associated natural and cultural resources
- provide a range of opportunities for public use, enjoyment, and understanding, while minimizing impacts on Park resources and natural processes
- facilitate research to provide a continuum of information in support of Park interpretation and management decisions and add to the general body of scientific knowledge

### **PARK SIGNIFICANCE**

Park significance statements capture the essence of a national park's importance to the natural and cultural heritage of the United States. Significance statements do not inventory a park's resources; rather, they describe the park's distinctiveness and help place the park within its regional, national, and international context. Defining national park significance helps park managers make decisions that preserve the resources and values necessary to accomplish the purpose of the park. According to the Park's General Management Plan,

The significance of Carlsbad Caverns National Park explains why the Park is important to our natural and cultural heritage. Together with the purpose

statements, the significance statements establish the foundation for this general management plan's recommendations for how the Park should be managed and used [NPS 1996:4].

Carlsbad Caverns National Park, a designated World Heritage Site, contains the deepest limestone cave in the United States and one of the largest easily accessible cave rooms in the world. The Park also has other unique features:

- Carlsbad Cavern, one of 113 known caves in the Park, reveals surprisingly large chambers with formations unsurpassed in variety and beauty.
- Lechuguilla Cave contains some of the world's most spectacular speleothems (cave formations), including features found nowhere else in the world.
- The caves of the Park have been formed through sulfuric acid dissolution, a process distinctly different from that taking place in most caves in the world.
- The Park provides a sanctuary for an easily viewed, world-famous colony of Brazilian (Mexican) free-tailed bats, as well as other faunal species, some of which are rare and endangered.
- The Park preserves one of the best exposures of Permian-age fossil reefs in the world.
- Remarkable new species of microbes continue to be discovered in the caves of the Park, offering great potential for research and understanding.
- The nature and extent of cave speleothems provides opportunities to understand past and present climates in the southwestern area of the United States, including Pleistocene-era and more recent environments.
- The Park protects a wide range of important fossil resources, including one of the continent's most diverse assemblages of Pleistocene faunal remains.
- The Park protects an intact portion of the Chihuahuan Desert ecosystem, the most biologically diverse desert ecosystem in North America.
- Over 71 percent of the Park is federally designated as Wilderness, where visitors can experience a natural sound environment, clear night skies, expansive vistas, and opportunities for solitude.
- The entire Park enjoys Class I air quality, the highest category recognized under the 1963 Clean Air Act.
- The cultural resources of the Park include two National Register of Historic Places (NRHP) historic districts (the Caverns Historic District [the District] and the Rattlesnake Springs cultural landscape), 30 historic structures, and nearly one million museum objects, reflecting enduring and diverse use of this desert landscape.
- The Park protects more than 250 archeological sites, including many surface pictograph sites and at least one example of cave dark zone rock art.
- Fourteen Native American tribes have longstanding and ongoing relationships with the landscape that is now Carlsbad Caverns National Park.



- Surrounded by desert, Rattlesnake Springs is an important riparian area and is populated by a rich diversity of birds and other fauna.

## **PROJECT BACKGROUND, PREVIOUS PLANNING, SCOPING, AND VALUE ANALYSIS**

### **PREVIOUS PLANNING**

Previous planning has been completed for the Park. The Carlsbad Caverns National Park Final General Management Plan (NPS 1996) gave rise to a study of the effects of development on groundwater infiltration and cave resources. The infiltration study identified sewage leaks as a main source of contamination. In 2002, the Carlsbad Cavern Resource Protection Plan (NPS 2002a) presented the preferred alternative discussed in this document and summarized seven rejected alternatives. Natural Heritage New Mexico, a program of the University of New Mexico, was contracted to perform a rare plant survey of the proposed sewer outfall route (Tonne 2004).

### **SCOPING**

Scoping is the effort to involve agencies and citizens in determining the nature and extent of issues to be addressed in an EA. Scoping determines important issues and eliminates issues that are not important; allocates assignments among the interdisciplinary team members and/or other participating agencies; identifies related projects and associated documents; identifies permits, surveys, consultations, and other requirements of oversight agencies; and creates a schedule that allows adequate time to prepare and distribute the EA for public review and comment before a final decision is made. Scoping provides an opportunity for early input from any interested agency, or any agency with project area jurisdiction by law or expertise.

Internal scoping was conducted by the staff of Carlsbad Caverns National Park and resource professionals from the NPS's Santa Fe and Denver support offices on October 26 and 27, 2004. This interdisciplinary process defined the purpose and need, identified potential actions to address the need, determined what the likely issues and impact topics would be, and identified the relationship, if any, of the proposed action to other planning efforts at the Park.

The American Indians traditionally associated with the lands of the Park (the Apache Tribe, Comanche Nation, Fort Sill Apache Tribe, Kiowa Indian Tribe, and Pawnee Nation, Oklahoma; the Jicarilla Apache Nation, Mescalero Apache Tribe, Pueblo of Isleta, Pueblo of Zia, and Zuni Tribe, New Mexico; Ysleta del Sur Pueblo, Texas; and the San Carlos Apache Tribe, White Mountain Apache Tribe, and Hopi Tribe, Arizona) were notified by letter of the proposed project on May 24, 2005. Representatives of these groups have expressed no concerns regarding rehabilitation of the wastewater system. In addition, in March 2006, Mescalero Apache Elders visited the Park and identified several locales of significance to them. However, the proposed action would not impact any of the identified areas. Each of the park's associated tribal groups will be notified of the EA's availability for review and comment.



The undertakings described in this document are subject to Section 106 of the NHPA, as amended in 2004 (16 U.S.C. 470 et seq.). The New Mexico State Historic Preservation Officer (SHPO) was notified by letter of the proposed project on April 27, 2005, and this EA will be submitted to the SHPO for review and comment.

The U.S. Fish and Wildlife Service (USFWS) was notified by letter of the proposed project on May 18, 2005. The New Mexico Ecological Service Field Office (Albuquerque) responded by letter on July 28, 2005, with a list of special status species potentially found in Eddy County. This EA will also be submitted to the USFWS.

The Park evaluated eight options for rehabilitation of the sewage system, because of the risk of contamination from the current pump station at Bat Cave Draw and leaks and plugs in the old sewer line that could contaminate the Main Corridor, Left-hand Tunnel, and Quintessential Right in Carlsbad Cavern. The eight options ranged from replacing or relining the existing system along its current alignment to replacing the outfall system with a biological wastewater treatment facility near the visitor center. All the options included replacing the old clay lines with new plastic line (CAVE 2002).

## **ISSUES AND IMPACT TOPICS**

NEPA, the national charter for the protection of the environment, calls for an examination of impacts on all components of affected ecosystems. NPS policy is to protect the natural abundance and diversity of all naturally occurring communities in national parks. The 2006 NPS Management Policies (NPS 2006c), NPS 77 (Natural Resources Management), and the Carlsbad Cavern Resource Protection Plan (NPS 2002a), among other NPS and Park policies, provide general direction for the protection of the natural and cultural resources, processes, systems, and values associated with Carlsbad Caverns National Park.

### **ISSUES AND DERIVATION OF IMPACT TOPICS**

The primary issues related to the project are the trade-offs between the continuing impacts to cave resources caused by the deteriorating sewer system (no action alternative) and the potential impacts to other resources that would be caused by rehabilitation of the sewer system (action alternative). Sewage leaks are the cause of impacts under the no action alternative, and ground disturbance during construction would be the primary cause under the action alternative.

Specific impact topics were developed as a focus for discussions and to allow comparison of the environmental consequences of each alternative. These impact topics were identified based on federal laws, regulations, Executive Orders, the 2006 NPS Management Policies, and NPS knowledge of limited or easily impacted resources. Impact topics were preliminarily screened for potential effects from the proposed project, as summarized in Table 1 and discussed in the following sections.

**Table 1.** Derivation of Impact Topics to be Included for Further Study

<b>Impact Topic</b>	<b>Potential Concern for this Project</b>	<b>Considered in Environmental Consequences Analysis</b>
Cave Resources and Groundwater Quality	Both alternatives have the potential to affect water quality and sensitive cave resources in the project area	Yes
Special Status Species	The project may affect special status species located in or near the project area	Yes
Visitor Experience	Both alternatives may potentially affect aesthetics and visitor experience	Yes
Park Operations	Park operations could be affected by either alternative	Yes
Historic Structures	Short-term, negligible impacts during construction phase	Yes
Wildlife	Affected species might be temporarily displaced, but no permanent negative effects are anticipated	No. However, special status wildlife species and their habitats are evaluated.
Vegetation	Impacts will be negligible under both alternatives	No
Geohazards	No likely effects	No
Geological Resources	The proposed alternative would have negligible adverse, long-term affects	No
Soils	Impacts would be short-term, localized, and negligible under both alternatives	No
Air Quality	Short-term, negligible, adverse, impacts from construction	No
Soundscapes	Temporary and negligible effects only	No
Surface Water Resources	Minimal effects with implementation of required Best Management Practices (BMPs)	No
Wetlands and Floodplains	None in project area	No
Habitats, Rare or Unusual Vegetation	Except for special status plants, rare or unusual vegetation is not likely to be affected	No. However, special status plant species and their habitats are evaluated.
Unique or Important Terrestrial Wildlife or Wildlife Habitat	No designated critical wildlife habitat areas within the construction limits	No. However, special status wildlife species and their habitats are evaluated.
Socioeconomics	No likely effects	No
Environmental Justice	No likely effects	No
Wilderness Values	No direct impact to any of the designated wilderness areas	No
Visual Resources	May be minimally affected during construction phase; minor long-term impacts to view of escarpment	No
Indian Trust Assets	None present	No
Archeology	No likely effects	No
Ethnographic Resources	No likely effects	No
Museum Collections	No likely effects	No
Cultural Landscapes	Short-term, negligible impacts during construction phase	No

Issues and concerns related to the proposed project were identified during resource management planning and through input from Park employees, Native American pueblos and tribes, and state and federal agencies. Those impact topics with potential for significant direct, indirect, long-term, or short-term impacts from the project were carried forward.

## **IMPACT TOPICS INCLUDED IN THIS DOCUMENT**

The list of potential resource effects to be considered for this project is taken from DO 12, Handbook 12 (NPS 2001), and from the project assessment completed by NPS personnel prior to initiation of the EA.

### ***Cave Resources and Groundwater Quality***

Both alternatives described in this document have the potential to affect water quality in the project area, and any contaminants that are generated at the surface and enter the groundwater will reach Carlsbad Cavern or other cave systems (known or unknown) and, eventually, the water table. For this reason, cave resources and groundwater quality are linked as a single Impact Topic within this EA. The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act (CWA) of 1977, is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters, to enhance the quality of water resources, and to prevent, control, and abate water pollution. The 2006 NPS Management Policies provide direction for the preservation, use, and quality of water originating, flowing through, or adjacent to park boundaries. The NPS seeks to restore, maintain, and enhance the quality of all surface water and groundwater within the national parks, consistent with the 1972 Federal Water Pollution Control Act, as amended, and other applicable federal, state, and local laws and regulations.

### ***Special Status Species***

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§1531–1544) requires an examination of impacts on all federally listed threatened or endangered species. NPS policy also requires examining the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species and local species of special concern identified by the Park. Because ground-disturbing activities and loud noises could cause impacts to local species of concern, special status species are discussed as an impact topic.

### ***Visitor Experience***

Providing for visitor enjoyment is one of the basic purposes of the NPS, according to the Organic Act. The Final General Management Plan/Environmental Impact Statement for Carlsbad Caverns National Park (NPS 1996) and other Park management documents reaffirm the importance and significance of recreational values and established provisions for recreational uses by providing quality facilities for a meaningful visitor experience. Both the no action alternative and the preferred alternative have the potential to variously affect the visitor experience at the Park. Therefore, visitor experience is addressed as an impact topic in this EA.

## ***Park Operations***

Park operations associated with maintaining the wastewater treatment system and cave resources could be affected by either of the alternatives described in this document. Therefore, Park operations is addressed as an impact topic in this EA.

## ***Historic Structures***

Historic structures, including historic buildings and other engineered features, are protected by the NHPA of 1966 (16 U.S.C. §470, as amended), NEPA (42 U.S.C. §§4321 et seq.), and the Archeological Resources Protection Act of 1979 (16 U.S.C. §§470aa–470mm). NPS policy regarding cultural resources includes DO 12 (NPS 2001), DO 28—Cultural Resource Management (NPS 1998a), and the 2006 NPS Management Policies (NPS 2006c).

The Bat Cave Draw parking area is part of and located within the Caverns Historic District. The Bat Cave Draw parking area would be affected by the proposed project, and the impact topic of historic structures is therefore analyzed further in this EA.

## **IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS**

Other resource categories were considered but were not carried through full analysis. These categories and the reasons for their exclusion are discussed in this section.

### ***Wildlife***

Loss of wildlife would be proportional to the amount of habitat lost. The temporary disturbance or loss of habitat would be minor compared to available wildlife habitat. Overall, populations of affected species might be slightly and temporarily displaced from the project area during construction, but no permanent negative effects on wildlife are anticipated. Because the adverse and beneficial impacts would be negligible, wildlife was dismissed as an impact topic.

### ***Vegetation***

Vegetation associations form the basis for the existence of both terrestrial and aquatic wildlife species. The principal vegetation regimes at the Park range from Chihuahuan Desert Scrub and Mixed Arroyo Shrubland to Pinchot Juniper Shrubland, grading in and out of Curlyleaf Muhly Grassland. Impacts to vegetation are related to a project's direct impacts from construction activities. For this project, these impacts would be localized along the proposed utility corridor if those areas are not currently disturbed. Since all construction areas would be reclaimed and replanted with native species, impacts to vegetation would be negligible under both alternatives. Therefore, vegetation was dismissed as an impact topic.

### ***Geohazards***

In accordance with the 2006 NPS Management Policies (NPS 2006c), the NPS is charged with preserving unimpaired some naturally occurring geologic processes that have the potential to be hazardous to humans and park infrastructure. These processes include earthquakes, volcanic eruptions, mudflows, landslides, floods, shoreline processes, tsunamis, and avalanches. The NPS tries to avoid placing new visitor and other facilities in geologically hazardous areas. This project

would take place in an area that is not subject to geological hazards. Therefore, this impact topic was not further analyzed.

### ***Geologic Resources***

Construction of the sewer forcemain and outfall pipelines would be under areas that are currently paved, under areas of unconsolidated alluvium (at the base of the escarpment), and over exposed bedrock where the pipeline is on the steep escarpment face. The area with steep slopes and exposed bedrock would be elevated aboveground to avoid construction in the (near) surface bedrock. Impacts from this construction would be adverse and long term but negligible. Therefore, the topic of geologic resources was dismissed from further consideration.

### ***Soils***

The soils of the Park are predominantly limestone rock land soils, often the residuum from weathered limestone. They are very shallow, stony, and rocky, and occur on mesa tops, on side slopes, and as older, deeper deposits on bajadas and within canyon bottoms. Vegetation is sparse due to the shallow depth and rocky nature of the soil. If vegetation is removed, these soils are very erodible.

Both the no action alternative and the preferred alternative would result in temporary disturbance of soils, with required erosion control measures including reclamation and replanting with native vegetation. The no action alternative would leave the wastewater treatment system in its present condition and location. Although there would be no new construction activity under this alternative, occasional removal of vegetation would occur whenever repairs to the belowground pipes are required. The preferred alternative would result in temporary disturbance to soils followed by reclamation. Erosion or loss of soils within the reclaimed acreage would be prevented by revegetation with native species. Because impacts to soils would be short-term, localized, and negligible under both alternatives, this impact topic was dismissed from further consideration.

### ***Air Quality***

The 1963 Clean Air Act, as amended (42 U.S.C. §§7401 et seq.), requires land managers to protect air quality. Section 118 of the Clean Air Act requires national parks to meet all federal, state, and local air pollution standards. The Clean Air Act also states that the federal land manager has an affirmative responsibility to protect the park's air-quality-related values (including visibility, plants, animals, soils, water quality, cultural and historic resources and objects, and visitor health) from adverse air pollution impacts. Carlsbad Caverns National Park is classified as a Class I air quality area under the Clean Air Act, as amended, and the NPS Management Policies (2006c) address the need to analyze potential impacts to air quality during Park planning.

Should the preferred alternative be selected, local air quality would be temporarily affected by dust and vehicle emissions. Hauling material and operating equipment during the construction period would result in increased vehicle exhaust and emissions. Hydrocarbons, nitrogen dioxide and sulfur dioxide emissions would be rapidly dissipated by air drainage, since air stagnation is rare at the project site.

Fugitive dust plumes from construction equipment would intermittently increase airborne particulates in the area near the project site, but loading rates are not expected to be appreciable. To partially mitigate these effects, such activity would be coupled with water sprinkling to reduce dust.

There would be temporary increases in localized air pollution during construction of the project, primarily from operation of the construction equipment. To reduce construction equipment emissions, the Park would apply appropriate mitigating measures limiting idling of construction vehicles.

Overall, there would be a negligible, adverse, and short-term (temporary) degradation of local air quality due to dust generated by construction activities and emissions from construction equipment. These effects would last only as long as the duration of construction, and the Park's Class I air quality would not experience any long-term adverse effects from the proposed project. Therefore, air quality was dismissed as an impact topic in this document.

### ***Soundscapes***

In accordance with the 2006 NPS Management Policies (NPS 2006c) and DO 47—Sound Preservation and Noise Management (NPS 2000), an important part of the NPS mission is to preserve natural soundscapes associated with national park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound that are considered acceptable vary among NPS units, as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas. Hauling material, operating equipment, and other construction activities could result in dissonant human-caused sounds.

Any impacts to the Park's soundscape would be temporary and would occur only during construction periods. Because any dissonant construction-related sounds would constitute short-term and negligible impacts on visitor enjoyment of the Park, soundscape management was dismissed as an impact topic.

### ***Surface Water Resources***

There are no perennial streams or marine or estuarine resources within the construction limits of the preferred alternative. The forcemain would be constructed across Bat Cave Draw, and the sewer outfall line crosses four intermittent drainages at the base of the escarpment. Any work conducted within the drainages would require compliance with Section 404 of the CWA and a State of New Mexico water quality certification under Section 401 of the CWA.

Under both the no action alternative and the preferred alternative, proposed changes to the current sewage treatment system would not alter erosion or percolation sufficiently to affect these resources. Implementation of best management practices (BMPs) under a Stormwater Pollution Prevention Plan would mitigate any impacts to surface water during construction. Impacts to surface water resources would be adverse, negligible, and temporary. Therefore,

impacts to stream flow and other surface-water resources have been dismissed as an impact topic.

### ***Wetlands and Floodplains***

Executive Order 11990, Protection of Wetlands (Federal Register [FR] 1977a), and DO 77-1 (NPS 2002b) provide protection for wetlands. Floodplains are covered under Executive Order 11988 (Floodplain Management [FR 1977b]). Guidelines governing proposed actions in park floodplains are found in the 2006 NPS Management Policies (NPS 2006c); DO 2—Planning Guidelines (NPS 1998b); DO 12—Conservation Planning, Environmental Impact Analysis, and Decision-Making (NPS 2001); and DO 77-2—Floodplain Management (NPS 2003). There are no wetlands or 100-year floodplain areas within the proposed project area of Carlsbad Caverns National Park. Therefore, wetlands and floodplains has been dismissed as an impact topic.

### ***Rare or Unusual Vegetation Habitats***

Under the preferred alternative, construction of a new sewer outfall pipeline would temporarily impact some habitat, but none of this habitat is rare or unusual. Therefore, rare or unusual vegetation habitats was dismissed as an impact topic. Habitat for special status plants is considered as an impact topic under the discussion of special status species.

### ***Unique or Important Terrestrial Wildlife or Wildlife Habitat***

Carlsbad Caverns National Park exhibits a diversity of vegetation and habitat types, which in turn support a diversity of wildlife and a species composition peculiar to those habitats, including habitats found in the project area. There are no designated critical wildlife habitat areas within the construction limits of the proposed project. Therefore, unique or important terrestrial wildlife or wildlife habitat has been dismissed as an impact topic. Habitat for special status wildlife is considered as an impact topic under the discussion of special status species.

### ***Socioeconomics***

The preferred alternative would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementing the preferred alternative could provide a negligible, short-term, beneficial impact to the economy of Eddy County (e.g., minimal increases in employment opportunities for the construction workforce and in revenues for local businesses and government, generated by construction activities and workers). Any increase, however, would be temporary and negligible, lasting only as long as the duration of construction. Therefore, socioeconomics was dismissed as an impact topic.

### ***Environmental Justice***

Presidential Executive Order 12898, “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (FR 1994), requires all federal agencies to incorporate environmental justice concerns into their missions by identifying and addressing disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The preferred alternative would not have health or environmental effects on minorities or low-income

populations or communities as defined in the Environmental Protection Agency's Environmental Justice Implementation Plan (Environmental Protection Agency 1996). Therefore, environmental justice was dismissed as an impact topic.

### ***Wilderness Values***

The Wilderness Act of 1964 (16 U.S.C. §§1131–1136) “established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as ‘wilderness areas,’ [to] be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” Wilderness has been designated in about 71 percent (33,125 acres) of the Park's 47,000 acres. All proposed construction and rehabilitation activities would occur within or near the high public use and maintenance areas of the Park and would not directly impact any of the designated wilderness areas. There could be impacts to users of the wilderness areas nearest the construction noise and from construction activities visible from high points. These impacts would be temporary and negligible, and wilderness values has therefore been dismissed as an impact topic.

### ***Visual Resources***

Under the preferred alternative, there would be some impact to visual resources during the construction period as the sewer outfall pipeline is built down the escarpment. A short-term minor impact to the views of the escarpment from U.S. Highway 62/180 and from Rattlesnake Spring would occur during construction. There would also be a negligible impact to the view from the south edge of the lower Visitor Center parking lot from the exposed pipeline on the escarpment face. Impacts to visual resources would be limited to the small area of construction near the Visitor Center and would be both short term and long term, localized, and negligible. Therefore, visual resources has been dismissed as an impact topic.

### ***Indian Trust Assets***

Secretarial Order 3175 (U.S. Department of the Interior 1993) requires that any anticipated impacts to Indian Trust resources from a proposed project or action by a Department of the Interior agency be explicitly addressed in environmental documents. The federal Indian Trust responsibility is a legally enforceable obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to Native American and Alaska Native tribes. No Indian Trust resources are involved in the rehabilitation and resurfacing activities proposed in this EA; that is, none of the lands comprising the Park are held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, Indian Trust assets was dismissed as an impact topic.

### ***Archeology***

Significant archeological sites are found throughout Carlsbad Caverns National Park. The area of potential effect (APE) was surveyed for archeological resources November 3–4, 2004 (Carlson 2004). No new sites were discovered during the survey; one isolated occurrence was recorded. Two previously recorded sites in the APE were revisited and re-recorded and their NRHP eligibility was reaffirmed. These two sites would be fenced and avoided for protection during the construction period, and no impacts to archeological resources would be anticipated.



If significant archeological resources should be discovered during construction, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and, if necessary, an appropriate mitigation strategy developed in consultation with the New Mexico SHPO and any affiliated tribes. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony should be discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001) of 1990 would be followed. Therefore, archeological resources were dismissed as an impact topic.

### ***Ethnographic Resources***

Ethnographic resources are defined by the NPS as any “site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it” (DO 28; NPS 1998a). There are no known ethnographic resources in the project area or its general vicinity. The Park contacted 14 Native American groups traditionally associated with Park lands, pursuant to Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (FR 2000). The tribes were apprised of the proposed action, by letter, on May 24, 2005. None of the tribes has expressed concerns regarding the proposed project. In March 2006, Mescalero Apache Elders visited the Park and identified several locales of significance to them. However, the Project would not adversely impact any of the identified ethnographic resources, and ethnographic resources was therefore dismissed as an impact topic.

Each of the park’s associated tribal groups will be notified of the EA’s availability for review and comment. If any of the tribes subsequently identify ethnographic resources within the proposed project area, appropriate mitigation measures would be undertaken in consultation with the tribes. The location of such ethnographic sites would not be made public. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, all items would be left in situ, and provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (43 CFR 10) would be followed.

### ***Museum Collections***

Neither the no action alternative nor the preferred alternative would affect the museum collections of the Park. Therefore, museum collections was dismissed as an impact topic.

### ***Cultural Landscapes***

According to the NPS Cultural Resource Management Guidelines (DO-28; NPS 1998a), a cultural landscape is

a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Implementation of the preferred alternative would minimally impact the Caverns Historic District's landscape. Once the sewer line is installed and the trench is backfilled, the disturbed ground in the historic district would be restored to its pre-construction contour and condition. In addition, installation of the sewer line would have no effect on the scale and visual relationships among landscape features in the historic district. Also, the spatial arrangement, circulation features, and land use patterns of the historic district would remain unaltered, and revegetation of the construction corridor with native species where appropriate would help ensure that the integrity of the district is not diminished.

The sewer line that would descend aboveground from the steep escarpment to the desert flats would not be visible to visitors in the historic district. In addition, the flat-colored, nonreflective wrap of insulation and rock shield applied to protect the pipeline would help the pipeline to blend with the surrounding craggy rock environment, lessening any visual impact. The aboveground sewer line that descends the escarpment would have no effect upon the landscape of the Caverns Historic District.

Construction activities associated with rehabilitation of the wastewater system would temporarily introduce nonhistoric visual, audible, and atmospheric elements into the setting of the historic district. However, such intrusions would be short term, lasting only as long as construction, and of negligible intensity.

Because potential impacts to the cultural landscape of the Caverns Historic District would be of negligible intensity, and potential impacts to specific buildings and structures are addressed under the historic structures impact topic, cultural landscapes was dismissed as an impact topic.

# **ALTERNATIVES**

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## **INTRODUCTION**

Alternatives were developed during the December 2000 Value Analysis (VA), which evaluated eight options (seven action options and one no-action option) for addressing the wastewater system needs at Carlsbad Caverns National Park. The VA identified Option 4 as the preferred option, which is the preferred alternative (Alternative B) in this document. Alternative A in this document is the no action alternative. The six options that were dismissed are briefly described at the end of this section.

## **THE NO ACTION ALTERNATIVE (ALTERNATIVE A)**

The no action alternative would continue the present management operation and condition. It does not imply or direct discontinuation of the present action or removal of existing uses, developments, or facilities. The no action alternative provides a basis of comparison for the management direction and environmental consequences of the preferred alternative. Should the no action alternative be selected, the NPS would respond to future needs and conditions associated with the wastewater system without major actions or changes in the present course.

The sewer system begins at the Park housing and maintenance buildings and crosses Bat Cave Draw, where it joins the outfall line running east from the Visitor Center. That line then runs south-southeast to the sewage storage ponds. About 2,200 feet of the sewer line are located directly above Carlsbad Cavern. The no action alternative would leave in place the deteriorating sewer system, and sewer system pipes would still be repaired on an emergency basis.

The existing sewer system would continue to experience periodic plugs and leaks and pose the continued risk of further releases of effluent over the cavern system. The entire system lies in the groundwater infiltration zone that leads to the underground caverns. The existing sewer lines have deteriorated and become damaged due to settling and abrasion of loose rock fill against the underground galvanized metal pipes. The current system of sewage waste collection pipes, pump station, main sewer line, and treatment storage ponds has been identified as a primary source of contamination of groundwater that poses a contamination risk for the Main Corridor, Left-hand Tunnel, and Quintessential Right in Carlsbad Cavern (NPS 1996). The lines are currently leaking and have become plugged, backed up, and overflowed an average of four times per year since 2003. Maintenance and repair are very difficult due to the below-grade placement of the pipes and the rugged terrain.

## **THE PREFERRED ALTERNATIVE (ALTERNATIVE B)**

The preferred alternative presents the NPS proposed action and defines the rationale for the action in terms of resource protection and management, visitor and operational use, costs, and other applicable factors.

The preferred alternative subscribes to and supports the practice of sustainable planning, design, and use of the sewer wastewater facilities.

The preferred alternative would replace the existing 4–6-inch forcemain line and 6–8-inch outfall lines of galvanized pipe with 8-inch (outside diameter) double-walled HDPE pipe, and would also replace the sewage lagoon liner (CAVE 2002). The construction elements of the preferred alternative are summarized in Table 2.

**Table 2.** Construction Elements for the Preferred Alternative, Carlsbad Sewage Treatment System Rehabilitation

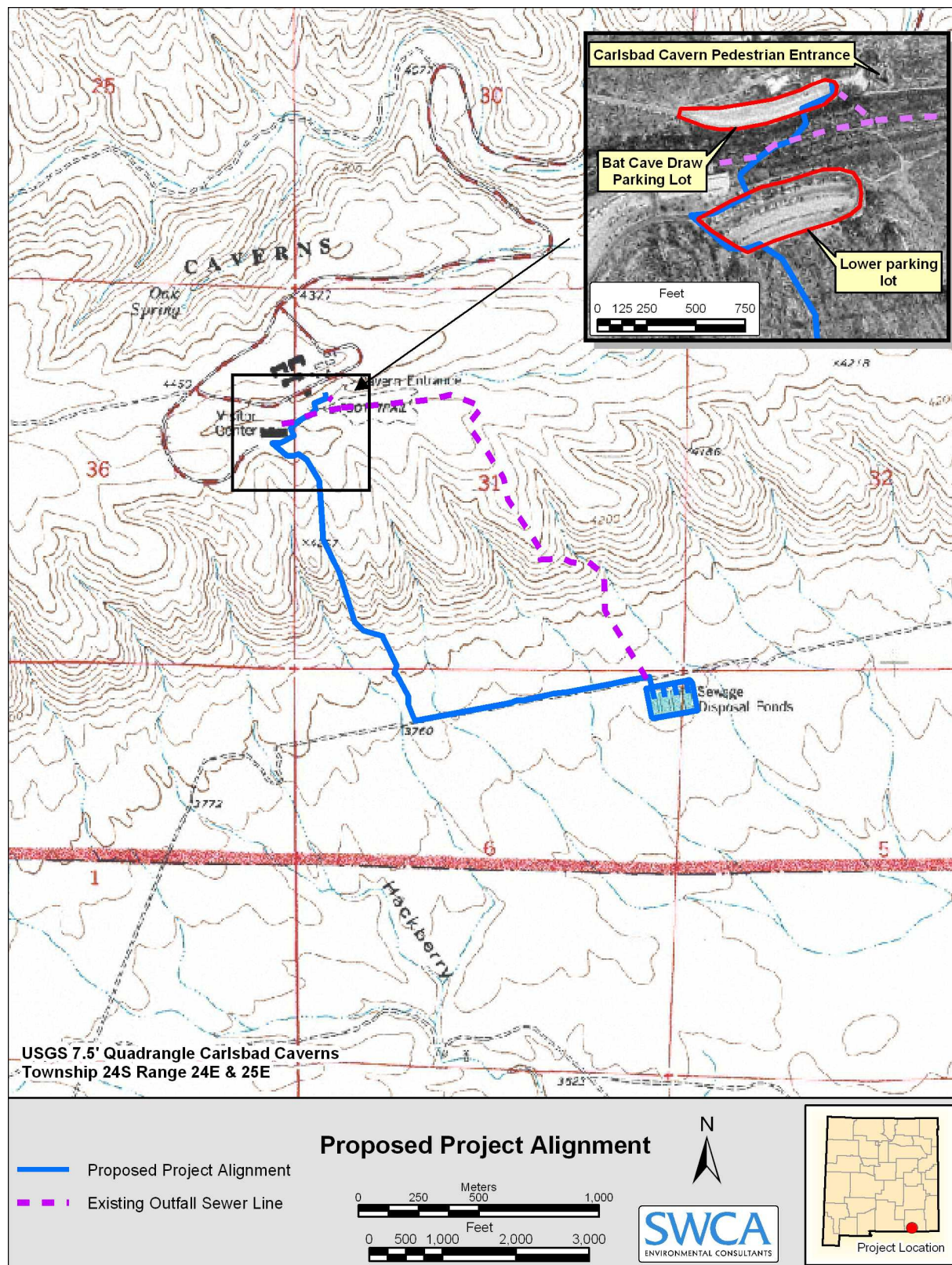
Construction Element	Location	Construction Length (feet)	Construction Easement Width (feet)	Total Construction Acreage	Previously Disturbed Acreage	New Disturbance Acreage
Forcemain Pipeline	under Bat Cave Draw parking area	340	30	0.23	0.23	None
Forcemain Pipeline	across Bat Cave Draw	60	30	0.04	None	0.04
Forcemain Pipeline	under existing pedestrian path	540	10	0.12	0.07	0.05
Gravity Outfall Pipeline	under lower Visitor Center parking area	760	30	0.52	0.52	None
Gravity Outfall Pipeline	connection to existing sanitary sewer behind Visitor Center, under existing sidewalk	85	30	0.06	0.06	None
Gravity Outfall Pipeline	above ground, down escarpment	3,065	30	2.11	None	2.11
Gravity Outfall Pipeline	below ground behind existing potable water infrastructure	335	30	0.23	None	0.23
Gravity Outfall Pipeline	below ground in shoulder of existing graded road	4,070	30	2.80	1.68	1.12
Repair embankments; replace valves and liner at the sewage disposal ponds	In sewage disposal ponds	630	420	6.07	6.07	None
<b>Total Acres</b>				<b>12.18</b>	<b>8.63</b>	<b>3.55</b>
Total Pipeline Length (forcemain and gravity flow)		9,255 feet				

Under the preferred alternative (Figure 3), the forcemain from the comfort station adjacent to the Bat Cave Draw parking lot would be about 940 feet in length. The forcemain would be buried under the Bat Cave Draw parking lot (scheduled for rehabilitation under a different project), trenched and buried under Bat Cave Draw, and buried under the existing sidewalk that connects the Visitor Center with the pedestrian entrance to Carlsbad Cavern. During the short time that the path to the natural cavern entrance is under construction, visitors would access the natural entrance using the paved Nature Trail – a slightly longer walk. The forcemain would connect to the new gravity outfall east of the Visitor Center under the lower Visitor Center parking area.

The new gravity sewer outfall would be constructed west of the existing sewer outfall, through the Visitor Center parking area (a distance of about 760 linear feet). There would be a short (85-foot) connection to the existing Visitor Center sanitary sewer behind the west end of the building. From the south edge of the edge of the parking lot, at the top of the escarpment, the outfall would continue to the south-southeast, down the steep escarpment, a distance of about 3,065 feet to a point near the Park's existing potable water facilities at the base of the escarpment. The section of outfall built on the steep escarpment slope would be constructed aboveground on pylons, to avoid the need to trench into the hard rock substrate and to avoid rock movement against the pipe, which can cause damage. About 335 feet of the new gravity sewer outfall would be buried in trenches behind the water tank and pumping station building, at which point it would intersect the existing road. The new gravity flow pipeline would be installed in the shoulder along the south side of the road, to the existing sewage disposal ponds. This would result in negligible to minor impacts to vegetation. The eroded embankments of the ponds would be repaired, and inlet/outlet valves would be replaced. The lining of two existing, empty, dry sewage disposal ponds would be replaced with new HDPE liners. The existing pipelines would be abandoned in place.

A 30-foot-wide construction corridor overlying the existing pipeline would be used during installation of the replacement pipeline, except for the pedestrian path between the Visitor Center and the pedestrian entrance to Carlsbad Cavern, where the construction corridor width is restricted to 12 feet and the pipeline would be placed under the existing path. About 2 to 4 feet of the construction disturbance along this path would impact existing undisturbed vegetation. All construction procedures—primarily clearing, trenching, pipe preparation and assembly, and backfilling—would be confined to the linear construction corridor. Construction vehicles and equipment, as necessary, would also be confined to the construction corridor and existing roads; vehicle and equipment movement over the area would be minimized to reduce soil compaction and damage to vegetation. Temporary access roads would not be built.

Trenching operations would utilize appropriate equipment to excavate a trench approximately 36 inches wide and 42 inches deep. After trenching is complete, bedding would be placed and compacted in the bottom of the trench and the replacement pipe installed in the bedding. Backfilling and compaction would begin immediately after the pipe is placed into the trench, and the trench surface would be returned to preconstruction contours. Revegetation would only occur in the construction corridor between the visitor center and Bat Cave Draw where the disturbance falls outside the paved path.



**Figure 3.** Proposed project alignment

Any excavated material would be windrowed in the construction zone. Although soil windrowed during construction would be susceptible to some erosion, such erosion would be minimized, as excavated soil would be windrowed for only as long as it would take to dig the trench and install the replacement water line. Once construction is complete and disturbed surfaces have been recontoured, erosion mats or other erosion control measures would be used to protect bare, exposed soils from erosion until revegetation could take place, as appropriate.

Any fill material needed beyond that produced from construction activities would be obtained from Park-approved sources outside the Park. Any excess material generated from construction activities would be stockpiled in Park storage areas for future use in approved projects or disposed of at approved sites outside the Park.

Before construction begins, construction limits would be surveyed and staked, and as necessary marked with construction fencing, tape, flagging, snow fencing, or some similar material. The construction limits identify and limit the area of construction activity. The Contractor would be responsible for ensuring that all work and all contract employees stay inside the construction limits. All protection measures would be clearly stated in the construction specifications, and workers would be instructed to avoid conducting activities beyond the construction limits. All construction personnel would also be required at all times to avoid all caves, archeological sites, and similar Park resources outside of the construction limits. Temporary structures such as erosion control fencing may be placed outside the APE only after an NPS archeologist has surveyed the area for archeological resources. No materials would be moved off site or out of the Park during this project.

All contractor-related staging for construction supplies and equipment would occur in previously disturbed areas negotiated and approved by the Contractor, the Park, and other affected parties. Large staging areas would be located outside the Park. Smaller staging areas in the park would be in the tennis courts on top of the escarpment or by the wastewater lagoons at the base of the escarpment within the construction limits. Construction-related offices or laboratories would be located outside Park boundaries. Fueling and daily maintenance of all machinery and vehicles would be conducted outside Park boundaries in White City or other approved areas. The construction contractor will be required to have an approved hazardous spill plan. Any spill of hazardous materials, fuel, etc., would be cleaned up immediately. Hazardous materials clean-up kits would be available at the staging area and on any fuel and oil trucks. Equipment would be checked daily to identify and repair any leaks.

No nighttime, holiday, or weekend work (Saturday and Sunday) would be permitted. The trail from the Visitor Center to the pedestrian entrance to Carlsbad Cavern would be made passable and safe during non-construction hours.

## **THE ENVIRONMENTALLY PREFERRED ALTERNATIVE**

In accordance with DO 12 (NPS 2001), the NPS is required to identify the “environmentally preferred alternative” in all environmental documents, including EAs. According to CEQ guidelines for NEPA implementation (40 CFR §§1500–1508), the environmentally preferred



alternative is the alternative that would best promote national environmental policy criteria as set forth in Section 101 of NEPA (42 U.S.C. §§4321 et seq.):

1. Fulfilling the responsibilities of each generation as trustee of the environment for succeeding generations
2. Assuring for all generations safe, healthful, productive, and aesthetically and culturally pleasing surroundings
3. Attaining the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences
4. Preserving important historic, cultural, and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice
5. Achieving a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities
6. Enhancing the quality of renewable resources and approaching the maximum attainable recycling of depletable resources

Generally, these criteria mean that the environmentally preferred alternative is the alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural, and natural resources. In this case, the preferred alternative (Alternative B) is also the environmentally preferred alternative.

For NEPA criteria 2, 4, 5, and 6, there is not a discernible difference between the alternatives.

Alternative A is not the environmentally preferred alternative because it does not:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations (NEPA criterion 1)
- Attain the widest range of beneficial uses of the environment without degradation (NEPA criterion 3)

The existing sewer system that serves the visitor and administrative areas above Carlsbad Cavern is failing due to the age of the component structures. Raw sewage contamination from leaks in the system is infiltrating the cavern system and its associated groundwater. Continuing under present policy would not address these deficiencies.

Alternative B is the environmentally preferred alternative because it:

- Fulfills the responsibilities of each generation as trustee of the environment for succeeding generations (NEPA criterion 1) by protecting Carlsbad Cavern from impacts
- Attains the widest range of beneficial uses of the environment without degradation (NEPA criterion 3) in that it allows continued use of the resource while limiting destructive contamination



Thus, not only does Alternative B best meet the purpose and need of this project, it also best fulfills the criteria established by the CEQ. In addition, Alternative B would promote and support environmentally sound management of the Park's resources, as outlined in existing NPS Resource Management Plans.

## **VALUE ANALYSIS**

Value Analysis is a process of arriving at an optimal solution to a complex issue through a structured and reasoned analysis of the factors and functions related to the issue. On December 12 and 13, 2000, a Choosing by Advantages (CBA)/Value Analysis (VA) was conducted at the Park to identify the NPS preferred alternative for the outfall sewer and the treatment/disposal system. These subsystems of the overall wastewater treatment system were evaluated together because the design of each greatly influences the design of the other.

## **STAGING AREAS**

All contractor-related staging for construction supplies and equipment would occur in previously disturbed areas negotiated and approved by the Contractor, the Park, and other affected parties. Large staging areas would be located outside the Park. Smaller staging areas in the park would be in the tennis courts on top of the escarpment or by the wastewater lagoons at the base of the escarpment within the construction limits. Batch plants, where asphalt and concrete would be prepared for use in construction, would be located outside the Park.

## **MITIGATION MEASURES FOR THE PREFERRED ALTERNATIVE**

The mitigation measures described in Table 3 have been developed as part of the preferred alternative in response to adverse impacts identified for specific impact topics, in order to lessen the overall impact of the preferred alternative on Park resources. In addition to decreasing adverse effects on impact topics, the mitigation measures may also provide benefits to other resources. Mitigation measures would be incorporated into the contractual documents and construction specifications.

## **GENERAL CONSTRUCTION SCHEDULE**

Rehabilitation work for the Park wastewater system is currently scheduled for the summer of 2007. Specifics of the project schedule have not been developed, but construction is expected to take less than one year.

**Table 3.** Mitigation Measures Included with the Preferred Alternative

Resource Area	Impact Topics Addressed	Mitigation Measures
<b>General Considerations</b>	<p>Impact Topics: Cave Resources and Groundwater Quality, Special Status Species, Historic Structures</p> <p>Other resources protected by measure: Wildlife, Vegetation, Geologic Resources, Soils, Rare or Unusual Vegetation Habitats, Unique or Important Terrestrial Wildlife or Wildlife Habitat, Archeology</p>	<p>Before construction begins, construction limits would be surveyed and staked, and as necessary marked with construction fencing, tape, flagging, snow fencing, or some similar material. The construction limits identify and limit the area of construction activity. The Contractor would be responsible for ensuring that all work and all contract employees stay inside the construction limits. All protection measures would be clearly stated in the construction specifications, and workers would be instructed to avoid conducting activities beyond the construction limits. All construction personnel would also be required at all times to avoid all caves, archeological sites, and similar Park resources outside of the construction limits. Temporary structures such as erosion control fencing may be placed outside the area of potential effect (the 30-foot-wide construction area) only after an NPS archeologist has surveyed the area for archeological resources. No materials would be moved off site or out of the Park during this project. In addition, the NPS would ensure that all contractors and subcontractors are informed that damage to resources outside the scope of work is subject to prosecution, fine, restitution costs, and other penalties.</p>
		<p>A 30-foot-wide construction corridor overlying the existing pipeline would be rough-graded and developed during installation of the replacement pipeline, except for the pedestrian path between the Visitor Center and the pedestrian entrance to Carlsbad Cavern, where the construction corridor width would be restricted to 12 feet and the pipeline would be placed under the existing path. All construction procedures—primarily clearing, trenching, pipe preparation and assembly, and backfilling—would be confined to the linear construction corridor. Construction vehicles and equipment, as necessary, would also be confined to the construction corridor and existing roads; vehicle and equipment movement over the area would be minimized to reduce soil compaction and damage to vegetation. Temporary access roads would not be built.</p>
		<p>The NPS project engineer would ensure that the project is confined within the parameters established in the compliance documents and that mitigation measures are properly implemented.</p>
		<p>All contractor-related staging for construction supplies and equipment would occur in previously disturbed areas negotiated and approved by the Contractor, the Park, and other affected parties. Large staging areas would be located outside the Park. Smaller staging areas in the park would be in the tennis courts on top of the escarpment or by the wastewater lagoons at the base of the escarpment within the construction limits. Construction-related offices or laboratories would be located outside Park boundaries. Fueling would occur only in White City. Daily maintenance of all machinery and vehicles would be conducted only in equipment staging or other approved areas. The construction contractor will be required to have an approved hazardous spill plan. Any spill of hazardous materials, fuel, etc., would be cleaned up immediately. Hazardous materials clean-up kits would be available at the staging area and on any fuel and oil trucks. Equipment would be checked daily to identify and repair any leaks.</p>

**Table 3.** Mitigation Measures Included with the Preferred Alternative (continued)

Resource Area	Impact Topics Addressed	Mitigation Measures
<b>General Considerations</b> (continued)	Impact Topics: Special Status Species  Other resources protected by measure: Wildlife	<p>To minimize open trenches, trenching and back-filling crews would work as closely together as construction and topography allow.</p> <p>All trenching would have at least one end sloped to prevent trapping of wildlife. The Contractor would inspect trenches before refilling to ensure that no wildlife would be buried.</p> <p>If any wildlife (lizards, rodents, snakes, etc.) or insects are found, the Contractor would contact a Park biologist and ask for guidance or assistance in removing the wildlife.</p> <p>If the wind is blowing significant amounts of dust into the Bat Cave entrance, construction would be stopped until the wind either subsides or changes direction. This only pertains to work in Bat Cave Draw.</p> <p>The Contractor would be required to maintain strict trash control so that no wildlife is attracted to the project area. No food scraps would be discarded or fed to wildlife.</p>
	Impact Topics: Visitor Experience, Park Operations  Other resources protected by measure: Visual Resources	All demolition debris, including visible concrete and metal pieces, would be immediately hauled from the Park to an appropriate disposal location. All tools, equipment, barricades, signs, surplus materials, and rubbish would be removed from the project work limits upon project completion. Any asphalt surfaces or concrete surfaces damaged due to work on the project would be repaired.
	Impact Topics: Cave Resources and Groundwater Quality, Special Status Species  Other resources protected by measure: Wildlife, Vegetation, Soils, Surface Water Resources, Wetlands and Floodplains, Rare or Unusual Vegetation Habitats, Unique or Important Terrestrial Wildlife or Wildlife Habitat	BMPs for drainage and sediment control would be implemented to prevent or reduce non-point-source pollution and minimize soil loss and sedimentation in drainage areas.

**Table 3.** Mitigation Measures Included with the Preferred Alternative (continued)

Resource Area	Impact Topics Addressed	Mitigation Measures
<b>Special Status Species</b>	Impact Topics: Special Status Species	To avoid direct impacts to special status and other migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. §§703–712), clearing of vegetation would be scheduled between September 1 and April 1, outside of the normal nesting season for most avian species. If it is not possible to avoid vegetation removal during the migratory bird breeding season, pre-construction bird surveys would be conducted by Park biologists to assure that no breeding birds would be affected. Any positive pre-construction survey results or observation of affected species during construction would be discussed with the USFWS to coordinate nesting area avoidance.
		Before ground-disturbing activities begin, construction workers would be educated about sensitive animals and plants that may be found in the project area so that harm to such species is avoided.
		A Park biologist would survey for the presence of special status plants that might be disturbed during construction. As a contract specification, sensitive resource areas would be mapped and flagged or fenced, as appropriate, for avoidance during construction. The flagging would not identify the resource and would be in place only for the duration of the construction. Construction workers would be made aware of any sensitive resource areas so that they could be avoided. The Park superintendent would be notified in advance of any flagged areas that could not be avoided during construction. Newly identified construction areas would be surveyed for special status plants, and any that are identified would be flagged by a Park biologist prior to any construction.
		Contractor-selected noncommercial areas outside of the project limits (including but not limited to material sources, disposal sites, waste areas, haul roads, and staging areas) would not encroach upon any species protected under the ESA of 1973. The written proof shall be satisfactory to the NPS and shall include: (1) a current USFWS list of all threatened or endangered species in the area and (2) a “no effect” determination by a biological specialist, according to Section 7 of the ESA.
		To avoid disturbance of bats and other nocturnal wildlife, nighttime activities would not be permitted. Demolition and construction would take place in the Bat Cave Draw and lower Visitor Center parking lots only between September 1 and April 1 to avoid disturbance of bats during maternity.

**Table 3.** Mitigation Measures Included with the Preferred Alternative (continued)

Resource Area	Impact Topics Addressed	Mitigation Measures
Visitor Experience	Impact Topics: Visitor Experience, Park Operations	No nighttime, holiday, or weekend work (Saturday and Sunday) would be permitted. The trail from the Visitor Center to the pedestrian entrance to Carlsbad Cavern would be made passable and safe during non-construction hours.
		Although the replacement line going up the escarpment would be aboveground, it would be distant from most visitor use areas, and the pipe itself would be covered in a non-intrusive material in a flat, non-reflective color that would blend with the escarpment itself. Additionally, regrowth of plants would further mask the pipeline by concealing portions of the pipe itself.
Cultural Resources	Impact Topics: Historic Structures	The Bat Cave Draw parking lot retaining wall and other structures in the Caverns Historic District have been recorded in detail (NPS 1986). Mitigation of impacts to the wall would include dismantling, recovery, and reconstruction of the wall in accordance with Department of the Interior Standards for treatment of historic properties and cultural landscapes, Standard 5, for rehabilitation: "distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property would be preserved." Any damage to the stone or mortar during construction would be repaired or replaced with the original stone when possible, or with similar material that matches the color and texture of the existing wall, from a source approved by the Park.
	Other resources protected by measure: Archeology	Construction workers would be educated regarding the possibility and recognition of previously unidentified archeological resources.  An archeological survey conducted in 2004 (Carlson 2004) identified all known archeological resources in the project area, and all such resources would be avoided during construction activities. If during construction previously undiscovered archeological resources should be uncovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed in consultation with the SHPO and, if necessary, associated American Indian tribes.

**Table 3.** Mitigation Measures Included with the Preferred Alternative (continued)

Resource Area	Impact Topics Addressed	Mitigation Measures
Vegetation	Impact Topics: Cave Resources and Groundwater Quality, Special Status Species, Visitor Experience  Other resources protected by measure: Wildlife, Vegetation, Soils, Surface Water Resources, Visual Resources	Adverse impacts to rare plants would be mitigated by flagging individuals or groups of specimens for avoidance during construction.
		The Contractor would implement the previously approved revegetation plan.
		Ground-surface treatment would include grading to natural contours, topsoil replacement, seeding, and planting. This work would occur as soon after the completion of construction as possible.
		In an effort to avoid introducing non-native/noxious plant species, no imported hay bales would be used. On a case-by-case basis, other materials may be used for erosion control dams, as approved by the Park. Examples of such materials include certified weed-free rice straw, cereal grain straw that has been fumigated to kill weed seed, and wood-fiber products.
	Other resources protected by measure: Wildlife, Vegetation	<p>To prevent the introduction of and minimize the spread of non-native vegetation, especially noxious weeds, the following measures would be implemented during construction:</p> <ul style="list-style-type: none"> <li>• Minimizing soil disturbance.</li> <li>• Pressure washing and/or steam cleaning all construction equipment before entering the Park to ensure that all equipment, machinery, rocks, gravel, or other materials brought into the Park are clean and weed free.</li> <li>• Covering all haul trucks bringing fill materials from outside the Park to prevent seed transport.</li> <li>• Limiting vehicle and equipment parking to the area within construction limits, existing roadways, and parking lots.</li> <li>• Limiting disturbance to the designated construction limits; limiting movement of machinery and equipment to areas within the construction limits.</li> <li>• Obtaining all fill, rock, or additional topsoil from the project area if possible, otherwise obtaining weed-free fill, rock, or additional topsoil from sources outside the Park. The weed-free condition of the material from sources outside the Park would have to be approved by the Park. If material from an outside source is not weed free, then the Park may either reject use of material from that source or approve use if appropriate measures are taken to treat the material.</li> <li>• Monitoring disturbed areas for up to 2 years following construction, under a contract provided by the NPS, to identify growth of noxious weeds or other non-native vegetation. Treatment of non-native vegetation would be completed in accordance with NPS-13, Integrated Pest Management Guidelines.</li> </ul>

**Table 3.** Mitigation Measures Included with the Preferred Alternative (continued)

Resource Area	Impact Topics Addressed	Mitigation Measures
<b>Soils</b>	Impact Topics: Cave Resources and Groundwater Quality	During periods of heavy rainfall, the NPS project engineer would issue a temporary stop order and work would be halted. During these work stoppage periods, project personnel would continue to check the silt fences and check dams, maintain the silt fences in effective condition, and remove accumulated sediment, as necessary, to ensure that stabilization is maintained.
	Other resources protected by measure: Soils, Surface Water Resources	Erosion control and sediment control would be required, consistent with BMPs for compliance with the CWA and with approval of the NPS project engineer.
<b>Air Quality</b>	Other resources protected by measure: Air Quality	Fugitive dust would be controlled by periodic water sprinkling and other BMPs as appropriate.
		The Contractor would be responsible for assuring that construction vehicle engines are not allowed to idle when the equipment is not actively being used. Visitors stopped due to construction delays would be encouraged to turn off their engines.

## **ALTERNATIVES CONSIDERED BUT DISMISSED**

Six alternatives were considered but dismissed from further consideration during the VA Study (Denver Service Center [DSC] 2000). These alternatives are summarized here as described in the VA report, with the DO-12 criteria under which they were dismissed from consideration:

- (a) technical or economic infeasibility
- (b) inability to meet project objectives or resolve need
- (c) duplication with other, less environmentally damaging or less expensive alternatives
- (d) conflict with an up-to-date and valid park plan, statement of purpose and significance, or other policy (see section 7-3 of this handbook), such that a major change in the plan or policy would be needed to be implemented
- (e) too great an environmental impact

### **OPTION 01**

#### ***Rehabilitate Current Line – Outfall System***

##### ***Reason for Dismissal***

Sewage outflow would still flow over significant portions of the cave, and future leaks could threaten cave resources. Vehicle access to the sewage line to effect repairs would cause more surface disturbance than the proposed action. Option 01 would not meet the project objectives and would have too great an environmental impact and was therefore dismissed under DO-12 criteria (b) and (e).

### **OPTION 02**

#### ***Replace Current Line – Outfall System***

Extensive excavations, removal and replacement of existing pipes.

##### ***Reason for Dismissal***

Sewage outflow would still flow over significant portions of the cave and future leaks could threaten cave resources. Vehicle access to the sewage line to effect repairs would cause more surface disturbance than the proposed action. Option 02 would not meet the project objectives and would have too great an environmental impact and was therefore dismissed under DO-12 criteria (b) and (e).

### **OPTION 03**

#### ***Reroute Sewage Line #1 – Outfall System***

Construct new sewage disposal ponds and obliterate the existing sewage disposal ponds.



### ***Reason for Dismissal***

This option would involve increased surface impact outside of the developed area compared to the preferred alternative, and at a higher cost. Option 03 would have too great an environmental impact at a greater cost than other alternatives and was therefore dismissed under DO-12 criteria (e) and (a).

## **OPTION 05**

### ***Alternative Technology #1 – Outfall System***

A Living Machine biological treatment system would be installed adjacent to the Visitor Center to reduce transport of raw sewage. About 40 percent of the treated and reclaimed water would be recycled to flush toilets and urinals; the remainder would be discharged for groundwater or surface recharge or for other beneficial use. The recently abandoned 4-inch waterline would be used as the treated water discharge line. A valve and pipe connection from the treated outfall water line to the existing water evaporation pond would be constructed to provide backup in case of treatment plant upset. The existing sewage disposal ponds would be obliterated.

### ***Reason for Dismissal***

This option would involve additional plumbing costs and higher maintenance needs. Option 05 would introduce relatively new technology that would result in long-term increased maintenance needs and costs and would cost more to implement than other alternatives. It was therefore dismissed under DO-12 criteria (a) and (c).

## **OPTION 06**

### ***Alternative Technology #2 – Outfall System***

A Living Machine biological treatment system would be installed adjacent to the new water evaporation pond at the base of the escarpment. A new outfall would be built from the Visitor Center to the water evaporation pond. A valve and pipe connection from the treated outfall water line to the existing water evaporation pond would be constructed to provide backup in case of treatment plant upset. Existing sewage disposal ponds would be obliterated. One of the existing ponds would be relined and used for sewage sludge composting.

### ***Reason for Dismissal***

This option would involve higher maintenance needs and cost. Option 06 would introduce relatively new technology that would result in long-term increased maintenance needs and costs and would cost more to implement than other alternatives. It was therefore dismissed under DO-12 criteria (a) and (c).

## **OPTION 07**

### ***Alternative Technology #3 – Outfall System***

Three of the four existing sewage disposal ponds would be replaced by a Living Machine biological treatment system. The fourth existing pond would be used for sludge composting. A

valve and pipe connection from the Living Machine to the existing sewage disposal pond would be constructed to provide backup in case of treatment plant upset. All existing outfall pipes would be sliplined. The concrete support would be rehabilitated.

### ***Reason for Dismissal***

This option would involve higher maintenance cost and sewage flow above cave resources. Option 07 would not meet the project objectives, would introduce relatively new technology that would result in long-term increased maintenance needs and costs, and would cost more to implement than other alternatives. It was therefore dismissed under DO-12 criteria (b), (a), and (c).

## **ALTERNATIVES COMPARISON TABLE**

**Table 4.** Comparative Summary of Alternatives and Extent to which Each Alternative Meets the Project Purpose and Need

<b>Alternative A: No Action Alternative</b>	<b>Alternative B: Preferred Alternative— Rehabilitate Sewage System</b>
<p>Action: The no action alternative would leave the sewer system in place. It is a deteriorating system that experiences periodic plugs and leaks and poses the continued risk of further releases of effluent over the cavern system. Smells from the leaks are known to annoy visitors, and the leaks could be a public health risk. Pipes would still be repaired, but no action could risk continued contamination of the cave system and large spills of sewage before leaks were found.</p> <p>The no action alternative would not meet the purpose and need of the project because it would not stop the continuing intermittent contamination of Carlsbad Cavern and the associated groundwater from sewage leakage.</p>	<p>Action: The preferred alternative would re-locate and replace the existing forcemain and gravity outflow sewer lines with new, longer-lasting HDPE pipe and would replace the sewage pond liners and piping. Less of the new pipeline would be located directly over Cavern than is currently the case.</p> <p>The preferred alternative would meet the project purpose and need by removing the intermittent contamination of Carlsbad Cavern and its associated groundwater caused by a leaking sewage system.</p>

## SUMMARY AND COMPARISON OF ENVIRONMENTAL IMPACTS

**Table 5.** Summary and Comparison of Environmental Impacts of the No Action Alternative and the Preferred Alternative.

Impact Topic	Alternative A: No Action Alternative	Alternative B: Preferred Alternative — Sewage System Rehabilitation
Cave Resources and Groundwater Quality	<p>Under the no action alternative, there would be continued groundwater contamination from intermittent sewage plugs and leakage. Impacts would be moderate, adverse, and long term. Cumulative impacts under the no action alternative would yield short-term minor adverse impacts but would reduce the long-term impacts by removing one source of the groundwater contamination—road and parking lot runoff—that is to be addressed by a planned entrance road and parking lot rehabilitation project. No impairment of Park resources or values related to cave resources or groundwater quality would occur under this alternative.</p>	<p>Under the preferred alternative, groundwater contamination from sewage would be eliminated by replacing the old and leaking pipe with new pipe and replacing the sewage lagoon liners. Impacts to cave resources would be short term, negligible, and adverse. Cumulatively, the road rehabilitation and sewer line replacement would reduce the contaminants entering Carlsbad Cavern. Cumulative impacts would be long term, moderate, and beneficial. No impairment of Park resources or values related to cave resources or groundwater quality would occur under this alternative.</p>
Special Status Species	<p>Under the no action alternative, there would be no discernible short- or long-term impacts to special status animals. Impacts to special status plants are expected from repeated emergency repairs to the belowground sewage pipes, resulting in some inadvertent loss of special status plants known to occur in the area. These multiple, unmitigated disturbances are expected to result in minor and long-term adverse impacts to special status plants. The no action alternative would not contribute to cumulative impacts to special status species. No impairment of Park resources or values related to special status species would occur under this alternative.</p>	<p>In order to limit impacts during the period of bat maternity, ground-disturbing work on top of the escarpment in the vicinity of Bat Cave Draw and the Visitor Center lower parking lot would not occur between April 1 and September 1. However, ground disturbance and construction activities may occur in areas off the escarpment at any time provided the specified mitigation is implemented. To avoid impacts to special status birds and migratory birds, vegetation clearing and construction would be scheduled between April 1 and September 1. If construction cannot be avoided during the nesting season, the Park biologist would conduct active nest surveys and active nests would be avoided. The locations of any special status plants within 3 feet of the utility corridor would be flagged by the Park biologist and avoided to the extent possible during construction. If special status plants cannot be avoided, the impacts would be adverse, minor, and long term, since these plants do not readily re-establish in disturbed soils.</p> <p>Cumulative impacts from this and other Park projects would be long term, localized, and minor for special status plants. There would be negligible to minor impairment of Park resources or values related to threatened, endangered, or other special status species in the Park under the preferred alternative.</p>

**Table 5.** Summary and Comparison of Environmental Impacts of the No Action Alternative and the Preferred Alternative (continued).

Impact Topic	Alternative A: No Action Alternative	Alternative B: Preferred Alternative — Sewage System Rehabilitation
Visitor Experience	The current condition of the sewage system results in odor that has been anecdotally reported by visitors and is a long term, minor, adverse impact to the visitor experience. Cumulative impacts to visitor experience from other projects in the Park would be short term and negligible, with the no action alternative increasing the cumulative impacts to long term, minor, and adverse.	The preferred alternative would have short-term, localized, moderate adverse effects lasting for the duration of construction activities. Over the long term, the effects would be beneficial. Cumulative impacts would create additional short-term, localized, minor adverse effects by lengthening time of construction or increasing visitors' exposure to construction projects. However, the long-term cumulative effects would be beneficial to visitor experience.
Park Operations	The current condition of the sewer system results in increased maintenance needs and long-term, moderate, adverse impacts to Park operations. Cumulative impacts to Park operations from other projects in the Park and the no action alternative could create a long-term, moderate, adverse impact.	The preferred alternative would have short-term, localized, moderate, adverse effects lasting for the duration of construction activities. Over the long term, the effects would be beneficial. Cumulative impacts would create additional short-term, localized, moderate adverse effects by lengthening time of construction or increasing Park staff duties to mitigate construction impacts. However, the long-term cumulative effects would be beneficial to Park operations.
Historic Structures	Construction would not occur and there would be no impacts to historic structures.	There would be negligible to minor, long-term adverse impacts to the historic structures of the Caverns Historic District. There would be no impairment of Park resources or values.

## **AFFECTED ENVIRONMENT**

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Detailed information on resources in Carlsbad Caverns National Park may be found in the Carlsbad Cavern Resource Protection Plan: Implementation Plan and Environmental Assessment (NPS 2002a); the Final General Management Plan/Environmental Impact Statement for Carlsbad Caverns National Park (NPS 1996); the Caverns Historic District Cultural Landscape Inventory (NPS 2006a); the Caverns Historic District National Register Nomination (NPS 1986); Two Cultural Landscapes at Carlsbad Caverns National Park: Rattlesnake Springs and Caverns Historic District (Colby 1993); and the Fire Management Plan Environmental Assessment (NPS 2005). A summary of the resources associated with this project follows.

### **CAVE RESOURCES AND GROUNDWATER QUALITY**

Under natural conditions, most precipitation at the Park percolates into the soil, where it is taken up by plants or evaporates. Any water not evaporated or used by plants becomes a part of the groundwater system. During intense thunderstorms, surface water flows into Bat Cave Draw (NPS 2002a).

The water moves downward, primarily through fractures in the limestone underlying Bat Cave Draw and the developed areas. This water eventually appears in Carlsbad Cavern as seeps or drips, which are responsible for the pools and cave formations found throughout the cave system. Over time, the water continues downward through fractures in the cave passages to the water table, approximately 200 feet below the deepest known point in the cave.

Park development has disrupted the natural drainage and infiltration patterns above Carlsbad Cavern. Paved areas and buildings are impervious to water and thus focus drainage into culverts and drains, from which the water eventually enters Bat Cave Draw. Any contaminants generated at the surface are carried by groundwater into the cave and eventually into the water table. The contaminated water poses a threat to cave ecosystems (NPS 2002a).

The Park does not conduct regular water quality sampling, but has baseline chemistry data from multiple studies. These past samples will be used to compare with future chemistry work to determine changes in water chemistry after mitigation measures have been implemented.

The absence of a continuous soil zone at the Park and the presence of highly permeable fracture zones and of well-developed karst contribute to a relatively high level of vulnerability of the caves. A major concern is that most Park facilities are located directly above Carlsbad Cavern. There are no indications that any massive contamination is occurring, but incidences have been detected, primarily related to chronic, low-level releases from sewer line leakage and parking lot runoff (van der Heijde et al. 1997). Van der Heijde et al. (1997) also noted that “it is very conceivable that in the future, a major contamination incident may take place if no preventative measures are taken.”

Some endemic invertebrates such as flatworms and crickets have been found in Carlsbad Cavern, but no federal- or state-listed threatened or endangered species have been identified in the Park's caves. Several species of bacteria have been found in Lechuguilla and Spider Caves that rely on cave environments similar to that of Carlsbad Cavern, suggesting that these types of bacteria may be present here also (NPS 2002a).

## **SPECIAL STATUS SPECIES CONFIRMED IN THE GENERAL PROJECT AREA**

Protection of outstanding natural resource values is one of the missions of the NPS. The Park contains one of the few protected portions of the northern Chihuahuan Desert ecosystem, with high diversity and an abundance of wildlife and plants. This EA considers those special status species that have been identified as present in the Park and that may be found in the project area (NPS 2006b).

The agencies that have primary responsibility for the conservation of plant and animal species in New Mexico are the USFWS, under authority of the ESA (16 U.S.C. §§1531–1544); the New Mexico Department of Game and Fish (NMDGF), under authority of the New Mexico Wildlife Conservation Act of 1978 (New Mexico Statutes Annotated [NMSA] 1978a); and the New Mexico Energy, Minerals and Natural Resources Department (EMNRD), under authority of the New Mexico Endangered Plant Species Act of 1978 (NMSA 1978b). These agencies maintain lists of plant and animal species that have been classified, or are potential candidates for classification, as threatened or endangered. In addition, the Park identifies and takes measures to protect species of local concern. These sources were used to identify all potential special status species known to occur in Eddy County, and then screened for their potential for occurring in the project area, as shown in Appendix A.

Species that have been confirmed as occurring or are likely to occur in the project area and that have been identified by the USFWS, the State of New Mexico, and the NPS as special status species include those listed by the USFWS as threatened or endangered under the ESA, as amended. Other species have been identified as species of concern by the NPS for planning and conservation as part of the natural heritage of the Park. The project area was surveyed in 2004 for rare and sensitive plants (Tonne 2004).

Thirty special status species were identified as present or likely to occur in or near the project area. Although no federally listed endangered species are known to occur in the project area, five species that may be present in or near the project area are indicated as species of concern by the USFWS. The State of New Mexico lists three species also listed by the USFWS, and an additional 16 plants and animals that are confirmed or likely to occur in the project area. One of these species, the gray-banded kingsnake, is listed as endangered by NMDGF; four species are threatened, and 14 species are listed as sensitive and likely to occur. The NPS lists all 21 of these federal- and state-listed species as species of concern that are likely to be found in the project area, as well as an additional seven animals and two plants that are not listed by the USFWS or the NMDGF.

## INVERTEBRATES

### ***Guadalupe Mountains Tiger Beetle (Cicindela politula petrophila)***

This beetle is a species of concern for the USFWS and the Park. This subspecies is known only from above 1,670 m in the Guadalupe Mountains of Texas and New Mexico, where it is endemic. The most common habitat for the Guadalupe Mountains tiger beetle is limestone or calcareous clay, in particular dirt roads, bare areas, and trails near this type of substrate. The Park does contain areas of this beetle's preferred habitat. All populations of the species are tightly associated with limestone outcroppings. Adults are found on gravel, rocks, and large flat surface boulders of limestone. They may occur in open and low vegetation or in forested sites from 1,500 m to more than 2,500 m elevation, but not near water (most tiger beetles are associated with damp soils). Rainfall is critical for adult activity because of their requirement for extremely dry habitat; the various subspecies become active with the initiation of the summer rains, July through October, but each local population is active for only three to eight weeks during their respective wet periods. These beetles run quickly among boulders and rocks and fly on rare occasions.

## REPTILES

Reptiles may be diurnal or nocturnal, are most active during the warmer months, and as ectotherms, bask on warm rocks or pavement surfaces. Four of the eight special status reptile species in Eddy County are found in the project area (see Appendix Table A). These species are described below.

### ***Rock Rattlesnake (mottled) (Crotalus lepidus lepidus)***

The rare mottled rock rattlesnake is state-listed as threatened and is found only in New Mexico, Texas, and Chihuahua, Mexico. In New Mexico, the rattlesnake is limited to the southern Guadalupe Mountains. Its key habitat exists within all canyons of the Park, and it is in fact the most frequently encountered rattlesnake in the Park. This snake favors the Park's rocky canyons, where it feeds on lizards, snakes, and small mammals. In spite of its rare occurrence throughout its limited range, it has been documented multiple times within the Park (Degenhardt et al. 1996).

### ***Gray-banded Kingsnake (Lampropeltis alterna)***

The gray-banded kingsnake is protected by the NMDGF as a state endangered species. The gray-banded kingsnake is extremely rare in New Mexico, but is possible in the project area. Rocky areas with Chihuahuan Desert vegetation are primary habitat for this animal, which feeds primarily on lizards (Degenhardt et al. 1996).

### ***Desert Kingsnake (Lampropeltis getula splendida)***

The Park considers the desert kingsnake a species of concern. In New Mexico, the desert kingsnake occurs throughout the state, most frequently along the middle and lower Rio Grande and the Pecos River, and in the southwestern corner of the state. The desert kingsnake prefers riparian and grassland habitats in New Mexico but is also found in piñon-juniper and low desert areas (Degenhardt et al. 1996).

### ***Texas Horned Lizard (Phrynosoma cornutum)***

The Texas horned lizard is considered a species of concern by the Park and a sensitive species by other federal agencies due to declines over its range in Oklahoma and Texas and other factors. The Texas horned lizard is most commonly found on sandy to gravelly soils in grasslands and open deserts throughout eastern and southwestern New Mexico (Degenhardt et al. 1996).

## **BIRDS**

Of the bird species confirmed in the Park, six have some form of agency listing or special status (see Appendix Table A). In addition to the legal protection for birds listed under the ESA, all birds considered native to North America are protected under the Migratory Bird Treaty Act ([MBTA]; 16 U.S.C. §§703–712). The diverse Park avifauna, among them all of the birds identified as occurring or with the potential to occur in the project area, includes migratory birds, making the nesting season a particularly crucial time for their protection within the Park. Immature birds and eggs are highly vulnerable to human-caused mortality. Bird nests are likely to be present in woody vegetation, or even in rocky cliffs, grass, or bare ground, from April 1 to September 1.

### ***Western Burrowing Owl (Athene cunicularia hypugea)***

The western burrowing owl is a species of concern for the USFWS. New Mexico is part of both the historic and current breeding range of these birds, and they also winter in approximately half of the state, including the Park. Burrowing owls are closely associated with prairie dog colonies, where they utilize existing tunnels and burrows. These owls require a mammal burrow or natural cavity surrounded by sparse vegetation. They forage in a variety of habitats, including cropland, pasture, prairie dog colonies, fallow fields, and sparsely vegetated areas; vegetation over 1 m in height may be too tall for burrowing owls to locate or catch prey. Natural predators of burrowing owls include mammals such as the badger, skunk, and coyote, and raptor species such as hawks, falcons, and great horned owls. Habitat loss and fragmentation, particularly in their breeding territories, pose a major threat to the success of this species.

### ***Yellow-billed Cuckoo (Coccyzus americanus)***

The yellow-billed cuckoo is a species of concern for both the USFWS and the Park. It occurs locally along waterways in lowland deciduous woods and thickets throughout New Mexico (NMDGF 2006a). Yellow-billed cuckoos breed along major river valleys in southern and western New Mexico (the Rio Grande and the San Juan, Pecos, Canadian, San Francisco, and Gila Rivers; Howe 1986). This species does occasionally use dry canyons for nesting, and in the summer of 2003 it was found nesting in three park canyons, including the project area (West 2003). Yellow-billed cuckoos prefer open woodlands with clearings and low, dense, scrubby vegetation often associated with watercourses. Little information is available about threats to the yellow-billed cuckoo. However, it is known that predation may account for failure to fledge young from 80 percent of nests in some regions, while raptors may be an important cause of mortality in adults on migration routes or upon arrival in wintering grounds following migration (Hughes 1999).



### ***Gray Catbird (Dumetella carolinensis ruficrissa)***

The gray catbird is a Park species of concern that breeds in low numbers throughout most of New Mexico (NMDGF 2006a). This secretive bird is primarily associated with dense thickets along streams and marshes, though it is occasionally found in drier environments. Suitable habitat for this bird exists along riparian areas and woodlands. The gray catbird forages in a variety of locations ranging from ground to treetops and consumes a variety of insects, mainly ants, and numerous small fruits. This catbird is one of only about a dozen species known to recognize cowbird (*Molothrus* spp.) eggs and eject them from its nest—an ability that is learned, not innate. An Ohio study found that predation accounted for 40 percent of egg losses and that the brown thrasher occasionally appropriates gray catbird nests shortly after construction (Cimprich and Moore 1995).

### ***Loggerhead Shrike (Lanius ludovicianus)***

The loggerhead shrike is listed as a Park species of concern. It has an extensive, but shrinking, range throughout the North American continent. Though these birds are migratory, a few sedentary populations generally remain on breeding territories throughout the winter. Loggerhead shrikes are rare and local in the Southwest, but are fairly common year-round residents throughout Eddy County (NMDGF 2006a). Like other shrikes, this bird utilizes a variety of habitats, including desert scrub and open grasslands, though it prefers to nest in trees of medium to tall height. The loggerhead shrike feeds on a variety of invertebrate and vertebrate prey, and preferred nesting sites are in low bushes along road corridors. As a result of their presence near roads, loggerhead shrikes experience primary threats from predation and vehicle collisions (Yosef 1996).

### ***Varied Bunting (Passerina versicolor)***

The varied bunting is listed as threatened by the State of New Mexico. Though it breeds primarily in shrublands of Mexico, it does cross into lower parts of the United States. In New Mexico (particularly Carlsbad Caverns National Park and the Guadalupe Mountains), the bunting prefers nesting in mesquite bushes found in Chihuahuan Desert scrub. The first state sighting of a varied bunting was in the Park in the project area. Varied buntings nest very near the project area, and a 2003 study in selected Park areas found “much larger numbers than expected” (West 2003). Loss of habitat, in particular the loss of dense shrubby riparian habitat required by this species, is a principal threat in New Mexico. Cowbird parasitism may also threaten New Mexico’s small breeding populations (NMDGF 2006b).

### ***Cave Swallow (Petrochelidon fulva)***

A Park species of concern, the cave swallow is a permanent resident of Mexico that is currently experiencing an expansion in its range northward into the United States. The primary nesting sites chosen by the birds are caves; however, they sometimes occupy bridges and similar structures. Cave swallows arrive in the Park in early February to nest by April and remain until late October or early November. They nest just inside the cavern entrance. Unlike the cliff swallow’s nest, the cave swallow’s is not fully enclosed but is shaped like a small half-cup. It is constructed of mud and plant fibers, and lined with feathers. The colonies of cave swallows at the Park are probably among the northernmost of the species in the United States (Steve West, personal communication 2006). The main threat to the Park’s cave swallows is predation by

great horned owls, and it is known that cold and rainy weather limits access to food, of greatest importance when feeding nestlings (West 1995).

### ***Bell's Vireo (Vireo bellii )***

Bell's vireos were listed as threatened by the NMDGF in 1975. This small, insectivorous migratory bird breeds in the central and southwestern United States and northern Mexico. Within New Mexico, it occurs in the southernmost portion of the state, where small numbers summer primarily in the Gila Valley, Guadalupe Canyon, and the lower Rio Grande and Pecos River valleys and associated drainages. The species prefers dense, typically low, shrubby vegetation (e.g., hackberry, mesquite, saltcedar) in riparian areas. There is a significant population in the vicinity of Rattlesnake Springs that numbers about 20 pairs annually; cowbird parasitism there typically exceeds 60 percent of vireo nests. Beyond the reduced productivity resulting from cowbird parasitism, the principal threat to Bell's vireo is loss or fragmentation of their dense shrubby/woody riparian habitats (NMDGF 2006).

### ***Gray Vireo (Vireo vicinior)***

The gray vireo is a New Mexico threatened species that is found in the desert Southwest from Utah and Colorado south through New Mexico and Arizona and west to southern Nevada and California. In New Mexico, this bird is found sporadically throughout the state, where it is considered uncommon (NMDGF 2006a). Gray vireos inhabit grassy, open juniper woodlands in arid foothills, on mesas, and in rocky canyon bottoms. The migratory gray vireo nests in the summer in low scrub in the juniper woodlands, including within the Park in canyon bottoms. A 2003 study in selected Park areas found "much larger numbers than expected" (West 2003). The gray vireo's diet consists almost exclusively of insects. Threats to this species include destruction of habitat and activities that increase the density of the cowbirds that parasitize vireo nests (NMDGF 2006b).

## **MAMMALS**

The diversity of habitat types in Carlsbad Caverns National Park supports terrestrial mammal species as well as the only true flying mammals—bats. All bat species in the Park (described below) are susceptible to the same basic threats. Primarily nocturnal, bats can be negatively impacted by human activities such as habitat destruction or disturbance of hibernacula and maternity colonies. Baby bats may be dropped to their deaths or abandoned by panicked parents if disturbance occurs during the maternity season (Harvey et al. 1999). Thirteen special status terrestrial mammals are listed in Eddy County; six of them are found within the proposed project area of the Park. The Park also provides habitat for eight of the ten special status bats listed for Eddy County (see Appendix Table A).

### ***Ringtail (Bassariscus astutus)***

The ringtail is a state sensitive species in New Mexico that, although seldom seen, is fairly common throughout most of New Mexico, particularly in the southern half of the state (Findley 1987). These nocturnal, raccoon-like carnivores inhabit a variety of rocky, broken, and shrubby terrains at low to mid elevations throughout the state. Ringtails are common in the Park and are

most often found in the rocky areas of the higher-elevation reef (Geluso and Geluso 2004). This secretive species may utilize denning and foraging sites within the proposed project area.

### ***Nelson's Pocket Mouse (Chaetodipus nelsoni canescens)***

A state sensitive species in New Mexico, the Nelson's pocket mouse has a limited distribution that extends from southeastern New Mexico into western Texas and north-central Mexico. The southeastern corner of New Mexico is its northernmost limit, and the only records of this pocket mouse's presence in New Mexico (thus far) are in Carlsbad Caverns National Park (Geluso and Geluso 2004). The pocket mouse occurs in small burrows on steep rocky slopes (to about 30%), but also on sandy flats in and around rock piles and in desert shrub vegetation along riparian corridors in the Chihuahuan Desert ecosystem. Its home range is less than 0.5 ha, with multiple overlapping territories in an area. Within its range, it is usually the most common mouse. Its burrows are usually found at the base of desert shrubs, and it forages nocturnally for seeds and small insects.

### ***Common hog-nosed skunk (Conepatus leuconotus mearnsi)***

The common (white-backed) hog-nosed skunk is a state sensitive species in New Mexico. They are most common in the southern portion of the state in deserts, grasslands, and woodlands (Geluso and Geluso 2004). Hog-nosed skunks are distinguished from striped skunks primarily by the pelage, with a characteristic broad white marking beginning at the top of the head and extending down the back and tail. The hog-nosed skunk lives primarily in rocky areas in foothills and in grasslands. They are active most of the year and are mostly nocturnal. They actively root out insects, grubs, snails, and earthworms from the ground with a distinctive nose pad. During cold weather they are less active and remain in underground dens (Findley et al. 1975).

### ***Pale Townsend's Big-eared Bat (Corynorhinus townsendii pallescens)***

The pale Townsend's big-eared bat is a federal species of concern and a state sensitive species in New Mexico. A year-round resident of the state and the Park, it occurs in habitats ranging from desert scrub to montane forests. The species' distribution is correlated with cave availability for roosts and hibernacula, but for foraging the bats prefer semi-desert shrublands, piñon-juniper woodlands, and open montane forests (Harvey et al. 1999). In the Park, Townsend's big-eared bats use caves for shelter in the warm months and as hibernacula during cold months (Geluso and Geluso 2004). The pale Townsend's big-eared bat is extremely sensitive to human disturbance and has a low reproductive rate, making it particularly susceptible to population decline.

### ***Mountain Lion (Felis concolor)***

The mountain lion is a Park species of concern. Mountain lions or cougars are in the cat family, Felidae. They are large, unspotted cats—hence the name *Felis concolor*, or cat of one color—with a long, heavy tail. With the exception of the eastern plains, they appear throughout New Mexico, especially in mountainous areas. The Guadalupe Mountains appear to be one of the state's strongholds for this species and sightings have become somewhat regular in the Park in the past decade (Geluso and Geluso 2004). In the Chihuahuan Desert, adult males average 125 to 160 pounds and adult females 90 to 110 pounds (Burgess et al. 1997).

### ***Eastern Red Bat (Lasiurus borealis)***

The eastern red bat is a state sensitive species and a Park species of concern. These bats are common throughout their range, with their southwestern extent occurring in southeastern New Mexico (Harvey et al. 1999). In New Mexico, it is only known from three locales, one of which is the Park. Except for individuals reported in Park caves, all state captures were in areas of large deciduous trees (Geluso and Geluso 2004). This species spends daylight hours hanging in foliage of trees. Although these bats seldom enter caves for any distance, they often swarm about cave entrances in the fall. In colder parts of their range, they may migrate south in the winter or hibernate in hollow trees or leaf litter. Eastern red bats consume moths, crickets, flies, mosquitoes, beetles, cicadas, and other insects. This species mates in flight during August and September; sperm is stored over the winter, and females give birth to one to four babies during late spring or early summer.

### ***Western Small-footed Myotis Bat (Myotis ciliolabrum melanorhinus)***

The western small-footed myotis is listed by the State of New Mexico as a sensitive species. More common at higher elevations, its center of distribution appears to be ponderosa pine forests. In New Mexico, this small bat is commonly associated with caves and mines, and prefers to use rock crevices, caves, and other isolated and protected areas for day roosts, maternity colonies, and hibernacula. Numerous skulls of unknown age discovered in Lechugilla Cave suggest that the western small-footed myotis may have been more abundant in the Park in past years. All recent captures at the Park were during July and August (Geluso and Geluso 2004).

### ***Fringed Myotis Bat (Myotis thysanodes thysanodes)***

The fringed myotis is state-listed by New Mexico as a sensitive species. Its distribution includes southwestern Canada and the western United States. In New Mexico, this species is most commonly associated with mid-elevation evergreen woodlands throughout the state. The fringed myotis is found at both low and high elevations. They occupy a variety of cave, mine, and structural habitats within a large range of habitats including deserts, grasslands, woodlands, and forests (Geluso and Geluso 2004). The fringed myotis is known to migrate, but little is known about its movements (Harvey et al. 1999). A small colony of about 100 fringed myotis bats lives in Carlsbad Cavern over a mile from the nearest entrance. This colony is rare and the subject of scientific investigations into these bats' behavior (Burgess et al. 1997).

### ***Cave Myotis Bat (Myotis velifer)***

The cave myotis is a state sensitive species in New Mexico. A common inhabitant of New Mexico deserts and grasslands, the cave myotis is especially prevalent in areas containing open bodies of water (Geluso and Geluso 2004). This bat occupies caves and other isolated and protected areas for day roosts, maternity colonies, and hibernacula (Harvey et al. 1999). A Park resident, cave myotis number from 100–1,000 and have a maternity colony in Carlsbad Cavern. They are also reported to occupy buildings at both the Park and other areas. All records from the Park occur between early March and late October, and it is suspected that some cave myotis hibernate east of the Park in gypsum caves (Geluso and Geluso 2004).

### ***Long-legged Myotis Bat (Myotis volans interior)***

The long-legged myotis bat is a state-listed New Mexico sensitive species. Based on greater than 700 specimens collected in New Mexico, it is typically found in ponderosa pine or higher montane habitats. This bat emerges in the twilight of early evening and is a rapid, direct flyer that pursues its prey over relatively long distances through, around, and over the forest canopy (Harvey et al. 1999). The long-legged myotis bat has been documented very rarely in the Park. Though this bat is a hibernating species, nothing is known of its wintering habits in New Mexico. The only two captures of long-legged myotis in the Park were from June and August (Geluso and Geluso 2004).

### ***Eastern White-throated Wood Rat (Neotoma albigula melas)***

The white-throated wood rat is a Park species of concern. It is found in the southern United States in Texas, New Mexico, Arizona, and California. In New Mexico, the white-throated wood rat lives in a variety of habitats ranging from desert lowlands to mixed conifer forests. There are three species of woodrat found at the Park, but the white-throated has the widest distribution (Geluso and Geluso 2004). This large rat is often called a packrat because of the large nest of sticks and other material that it incorporates into nests. These animals live in a wide range of habitats, but especially below rocky ledges or brushy areas in the desert grasslands, with dense stands of cacti such as cholla and prickly pear cactus. This nocturnal rat feeds on a wide variety of plants.

### ***Big Free-tailed Bat (Nyctinomops macrotis)***

The big free-tailed bat is regarded as sensitive by the NMDGF. This species is uncommon throughout most of its range (Harvey et al. 1999). Most captures are in Texas, but two occurred in the Guadalupe Mountains of New Mexico within Carlsbad Caverns National Park (Geluso and Geluso 2004). It inhabits rocky country, where it roosts in crevices high up on cliff faces, but it has been known to roost in buildings. This bat leaves its roost late, when it is quite dark. Diet consists primarily of large moths, but may include crickets, flying ants, stinkbugs, and leafhoppers. Maternal colonies are formed by females, who give birth to one baby in June or July.

### ***Western Spotted Skunk (Spilogale gracilis)***

The western spotted skunk is a state sensitive species in New Mexico, where it is most commonly found in the western portion of the state. It occurs in many habitat types, including lower montane, mixed shrub, sagebrush, piñon-juniper, wetland, and riparian areas. This skunk is most often associated with rocky and brushy areas, especially in deserts, grasslands, and woodlands (Geluso and Geluso 2004). This species generally uses rocky areas for denning sites, but has also been reported to den in hollow logs (NMDGF 2006).

### ***Brazilian (Mexican) Free-tailed Bat (Tadarida brasiliensis mexicana)***

The Brazilian free-tailed bat is a species of concern for the Park. It has a distribution in the southern United States and southward through Mexico and Central America into northern South America and the Caribbean (Harvey et al. 1999). In New Mexico, Brazilian free-tailed bats are most common in lowland habitats of deserts, grasslands, and piñon-juniper woodland and occur

statewide. The population that occurs at the Park is the best known, and perhaps most studied, of this species (Geluso and Geluso 2004). The subspecies inhabiting the Park is referred to as the Mexican free-tailed bat and were involved in the discovery of Carlsbad Cavern. They are present in very large numbers at the Park and have become a major visitor attraction (Geluso and Geluso 2004). The population inhabiting the Park is migratory, The Brazilian free-tailed bat travels long distances into Mexico to winter, and the Park, therefore, provides an important migratory stopover, in addition to it being a maternity roost/resident colony in the summer. They are a colonial species that feeds entirely on insects. This species usually feeds on small moths and beetles (Burgess et al. 1997).

## **PLANTS**

### ***Cliff Nama* (*Nama xylopodum*)**

A Park species of concern, the Cliff nama is a rare plant being tracked in surveys in the Park (Tonne 2004). It has a limited distribution between the Guadalupe Mountains of New Mexico and the Franklin Mountains in Texas. However, it is abundant within the Park, where Tonne (2004) observed six occurrences with a total of 339 plants within the project area.

### ***Chihuahuan Fishhook Cactus* (*Sclerocactus uncinatus ssp. wrightii*)**

The Chihuahuan fishhook cactus is a Park species of concern and is deemed by the New Mexico Natural Heritage Program as critically-imperiled-rare. It occurs in southeastern New Mexico and is also scattered throughout Trans-Pecos Texas and northern Mexico, generally in small numbers (Tonne 2004). However, the species was relatively abundant in the Park during the 2004 survey, during which Tonne identified 17 plants at 15 locations in the project area. It grows as single plants and in extended clusters of plants. This species is quite cryptic, often obscured by overlying shrubs (Tonne 2004).

### ***Few-flowered (Guadalupe) Jewelflower* (*Streptanthus sparsiflorus*)**

The few-flowered (Guadalupe) jewelflower is a species of concern for both the USFWS and the Park. Endemic to the Guadalupe Mountains, it can be locally abundant, but little is known of its distribution and habitat requirements. However, most known habitats for this plant are very rugged and remote, occurring in limestone canyon bottoms and montane scrub at 5,000–7,000 feet (1,525–2,150 m) (New Mexico Rare Plant Technical Council [NMRPTC] 1999). The few-flowered Guadalupe jewelflower was recorded at only one location with 32 plants within the project area (Tonne 2004).

## **VISITOR EXPERIENCE**

Carlsbad Caverns National Park receives approximately 500,000 visitors annually, with highest visitation occurring on weekends and holidays and in June, July, and August. Visitation from 1991 to 2004 ranged from a high of 688,742 (1992) to a low of 416,815 (2004). Carlsbad Cavern, which is the main and most accessible cave, attracts visitors from throughout the world. Most visitors walk the popular self-guided tour. Others venture on guided tours to off-trail areas of Carlsbad Cavern, Slaughter Canyon Cave, and Spider Cave. Seventy-one percent of the Park

is wilderness, providing visitors not only with the clean air found throughout the Park but with spectacular vistas, natural sound, and solitude. Many people visit the Park to experience the dusk exodus of Brazilian (Mexican) free-tailed bats and their pre-dawn return.

Visitors use the lower parking area, the Visitor Center, and the sidewalks in front and to the rear of the Visitor Center. In particular, the path from the Visitor Center to the Carlsbad Cavern opening sees heavy use from visitors who wish to use the natural entrance or view the bat flights.

## **PARK OPERATIONS**

Park operations in the vicinity of the Visitor Center, the Carlsbad Cavern entrance, and parking areas include general maintenance of the inside and outside of facilities and greeting, assisting, and guiding visitors. A gift shop and restaurant are located in the Visitor Center. Clearing blockages and addressing leaking pipes are among the maintenance activities involving the existing sewer system.

## **HISTORIC STRUCTURES**

The Caverns Historic District was listed on the National Register of Historic Places in 1986. The historic district encompasses 13 rustic stone and adobe buildings associated with the development of the Park from 1926 to 1942. The earliest buildings, which are representative of the Pueblo Revival style of architecture, and the nearby terracing are built of local bedrock limestone. Later construction was of adobe, in the New Mexico Territorial Revival style. Eight of the buildings remain largely unaltered, and several of the buildings are used by the Park as maintenance, residential, utility, cave research, and administrative facilities.

In addition to the stone and adobe buildings, other important architectural and landscape features of the historic district include:

- Dry-laid stone retaining walls around parking terraces that are harmonious with both the buildings and the natural setting of the historic district in their use of similar materials (stone), color, and texture, and the lack of straight lines in their configuration. Limestone steps are also incorporated in curving trails between residences and administrative buildings, and footpath surfaces include gravel, flagstone, and bedrock.
- Ashlar masonry curbs along the road. The masonry curbs extend approximately 1 foot above the road surface and are approximately 1 foot thick. The white/buff stone of the curbs contrasts sharply with the dark asphalt of the roadway. The stone curbing of the road contributes to the cohesiveness of the historic district.





# ENVIRONMENTAL CONSEQUENCES

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## INTRODUCTION

This section examines the environmental consequences or impacts of the no action alternative and the preferred alternative for Carlsbad Caverns National Park. The organization of the chapter follows NPS EA organization and terminology, as provided in DO-12 (NPS 2001). The Methodology section defines NPS terminology as it is generally applied. The Impacts section addresses the impact topics described in the Affected Environment section of this document. Under each impact topic, potential impacts are described and assessed in terms of the defined terminology and in relation to the no action alternative and the preferred alternative.

## METHODOLOGY

### ANALYSIS TERMINOLOGY AND DEFINITIONS

This EA determines the environmental consequences of the no action alternative and the preferred alternative pursuant to NEPA requirements. The impact analyses and conclusions that follow are based on a review of existing literature, Carlsbad Caverns National Park studies, information provided by experts at the Park and at other agencies, professional judgments and Park staff insights, public input, and surveys conducted by SWCA. Impact analysis was based on *context*, *intensity*, *type*, and *duration* of an impact, *cumulative impacts*, and the potential for *impairment of Park resources or values* by an impact.

**Context** is the area an impact would affect and the scale of the effect: local, park-wide, regional, national, global.

**Intensity** of an impact is defined as negligible, minor, moderate, major, or impairment. The measure of intensity varies by topic (cave resources and groundwater quality, special status species, etc.) and is thus defined separately for each impact topic.

**Type** of impact is the nature of the effect that the project has on a resource, that is, whether it is beneficial or adverse, and provides a relative measure of these effects on biological or physical systems, cultural resources, or the social environment. For example, adverse impacts on ecosystems might degrade the size, integrity, or connectivity of a specific habitat. Conversely, beneficial impacts might enhance ecosystem processes or increase native species richness. The formal definitions of the impact types are:

- **Beneficial** — a positive change in the condition or appearance of a resource or a change that moves the resource toward a desired condition
- **Adverse** — a change that detracts from the condition or appearance of a resource or that moves the resource away from a desired condition

**Duration** is the length of time that an impact will last. Duration can be short term, for example during construction or for a single growing season; long term, spanning a number of years; or permanent, in which the impact or effect will never end.

**Cumulative effects** are the effects on the environment that result from incremental impacts of the action and other possible actions. The CEQ regulations, which implement NEPA, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impact is 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 can result from individually minor, but collectively major, actions taking place over a period of time.

### ***Projects that Make Up the Cumulative Impact Scenario***

To determine potential cumulative impacts, projects in the area surrounding Carlsbad Caverns National Park, including Eddy County, were identified. Projects were identified through phone calls to the Eddy County and City of Carlsbad governments and to the New Mexico Department of Transportation (NMDOT). Potential projects identified as cumulative actions included any planning or development activity that was currently being implemented or that would be implemented in the reasonably foreseeable future.

These cumulative actions are evaluated in the cumulative impact analysis in conjunction with the impacts of each alternative to determine if they would have any additive effects on a particular natural resource or on visitor use, historic structures, or Park operations. Because some of these cumulative actions are in the early planning stages, the evaluation of cumulative effects was based on a general description of the project.

### ***Past Actions***

The following past actions could contribute to cumulative effects:

- Historic trends of groundwater contamination by visitors and staff. The underground concession in Carlsbad Cavern has changed the products they sell to reduce contamination. The Bat Cave Draw parking area is currently used only for handicapped access to the entrance to Carlsbad Cavern and for tour-group loading and unloading.
- The Park completed a waterline replacement project in 2000. The buried waterline that had served since the 1930s was replaced by a new waterline to Rattlesnake Springs.

### ***Current and Future Actions***

Current actions and those projected for the future also could contribute to cumulative effects:

- The Park’s Fire Management Plan guides the detection and control of wildfires and the management of prescribed fires (NPS 2005).
- Proposed Visitor Center rehabilitation, scheduled to begin around April or May 2007.
- Proposed rehabilitation of the Park’s entrance road and visitor parking lots, scheduled for fiscal year 2008. This project will reconfigure/reconstruct the parking areas at the Visitor

Center and at Bat Cave Draw and add water-treatment devices (oil and grit separators) to remove hydrocarbon-carrying sediment and free oil from the parking area runoff. Road rehabilitation would resurface approximately 7.5 miles of Walnut Canyon Road and its associated paved pullouts and parking areas. The visitor parking lots are located above parts of Carlsbad Cavern, and runoff from these areas contributes to contamination of cave resources and associated groundwater (van der Heijde et al. 1997).

- NMDOT construction projects:
  - During the next four years, U.S. Highway 62/180 between Carlsbad and the Texas state line will be rehabilitated and widened to four lanes. The project is divided into seven construction sections.
  - A section of U.S. Highway 62/180 east of Carlsbad will undergo maintenance in the next two years.
  - NM 18 is scheduled for a rebuild, including realignment of some sections from the junction with NM 31 (just east of Carlsbad) to the Texas state line.

## **IMPAIRMENT OF PARK RESOURCES OR VALUES**

In addition to determining the environmental consequences of the no action alternative and the preferred alternative, the 2006 NPS Management Policies and DO 12 require that analysis of potential effects must also determine whether preferred alternatives would impair Park resources and values.

The fundamental purpose of the National Park System, as established by the National Park Service Organic Act (16 U.S.C. §§1–4) and reaffirmed by the General Authorities Act (NPS 1970), as amended, is a mandate to conserve Park resources and values. NPS managers must always seek ways to avoid or minimize to the greatest degree practicable adverse impacts to park and monument resources and values. However, the laws do give NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, “as long as the impact does not constitute impairment of the affected resources and values.” Thus, although Congress has given NPS management some latitude in allowing certain impacts within parks, that latitude is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. However, an impact would be more likely to result in resource impairment when the conservation of the resource value is:

- necessary to fulfill specific purposes identified in establishing legislation or proclamation of the park, or
- 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 Park’s Master Plan or General Management Plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing a park, from visitor activities, or from activities undertaken by concessionaires, contractors, and others operating within a park. In this Environmental Consequences section, each impact topic for the no action alternative and the preferred alternative includes, in the conclusion, a determination on impairment. Relevant studies and the professional judgment of Park staff and environmental consultants are the basis for these determinations. The NPS does not analyze recreational values/visitor experience (unless impacts are resource-based), socioeconomic values, or Park operations for impairment.

## CAVE RESOURCES AND GROUNDWATER QUALITY

### METHODOLOGY

Cave resources and groundwater quality are functionally linked at Carlsbad Cavern. Information for determining the impacts of the no action alternative and the preferred alternative was gathered by reviewing the Carlsbad Caverns Final General Management Plan (NPS 1996) and the Carlsbad Cavern Resource Protection Plan (NPS 2002a).

#### *Impact Intensity, Type, and Duration*

For this impact topic, levels of impact intensity are defined as follows:

Impact Intensity	Description
Negligible	Groundwater quality or quantity could be modified, but the impact would be so small that it would not have any measurable or perceivable consequences.
Minor	Groundwater quality or quantity could be modified to the extent that impacts might be visible, but would be slight and localized with few measurable consequences.
Moderate	A proposed action would result in evident impacts both to groundwater quality or quantity and to the cave ecosystems. Consequences may be perceived over a large area, but could be successfully mitigated to ensure short-term impacts.
Major	A proposed action would result in substantial impacts to groundwater resources and the unique cave ecosystems throughout Carlsbad Cavern and other known or unknown cave systems; extensive mitigation measures would be required, and their success could not be guaranteed.

The types of impacts that might occur are assessed under each action alternative. Temporary contamination of groundwater during and for a period of one year following construction, with no effect on cave ecosystems, is considered here to be a short-term impact. Long-term impacts would include contamination of the groundwater that lasts for more than one year or that results in impacts to cave ecosystems.

## NO ACTION ALTERNATIVE

### *Impact Analysis*

Under the no action alternative, there would be no new impacts. The existing sewer system would be left in place. The system is in a deteriorating condition and experiences periodic plugs and leaks and poses the continued risk of further releases of effluent over the cavern system. Raw sewage would continue to occasionally contaminate Carlsbad Cavern. The sewer line would remain in its current location, with about 2,200 feet of sewer line located directly over Carlsbad Cavern. Once contaminants infiltrate into the subsurface, they have a long-term adverse impact on a considerably larger area, including the unique caverns that the Park is charged to protect.

Continued deterioration of the sewer outfall, especially that portion located directly above Carlsbad Cavern, could lead to catastrophic breakage that would have the potential to elevate any impacts to a higher level. The impact of the no action alternative on cave resources and associated groundwater would be moderate, adverse, and long term.

### **Cumulative Impacts**

Most development related to Park operations, employee housing, and visitor services is located directly above Carlsbad Cavern. Historically, trends in staff and visitor activities around these developed areas have produced on-going contamination of cave resources and related impacts to groundwater. A 1996 infiltration study found contamination of Carlsbad Cavern pools from sewer leakage and parking lot runoff, with the potential for catastrophic contamination (van der Heijde et al. 1997). About 2,200 feet of the sewer outfall is over Carlsbad Cavern, and this line has a history of blockage and leaks (DSC 2000). The parking lots not only alter natural infiltration patterns, they collect and concentrate hazardous materials generated by automobiles, maintenance operations, and residential activities that accumulate on the pavement surface. In combination, these activities create a moderate, long-term, adverse impact to cave resources and associated groundwater.

The goal of the proposed sewer system rehabilitation and parking lot reconstruction projects, both of which would occur in the developed area above Carlsbad Cavern, is to reduce contamination of cave resources and related impacts to groundwater. These projects, along with the waterline project completed in 2000 and the proposed Visitor Center rehabilitation, would have possible short-term minor adverse impacts during construction and long-term moderate beneficial impacts.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. Because they are located away from the Park's groundwater and cave systems, they are not expected to have any cumulative impacts to those resources.

The no action alternative represents a future of continuing, long-term adverse moderate impacts on the Park's cave resources and associated groundwater, with a high potential for a major contamination incident.

## ***Conclusion***

Under the no action alternative, there would be no new impacts. There would be continued use of a deteriorating system and occasional contamination of cave resources and associated groundwater from leaks in the sewer outfall line. Impacts would be moderate, adverse, and long term. Cumulative impacts under the no action alternative would yield short-term minor adverse impacts but would reduce the long-term impacts by removing one source of the groundwater contamination—parking lot runoff—which is to be addressed by a planned parking lot reconstruction project. No impairment of Park resources or values related to cave resources or groundwater quality would occur under this alternative.

## **PREFERRED ALTERNATIVE**

### ***Impact Analysis***

Under the preferred alternative, new sewer line (forcemain and outfall) would be constructed to replace the compromised and leaking existing sewer line. The new sewer line would be located to the west of the existing line so that the length of sewer line located directly above Carlsbad Cavern would be reduced from about 2,200 feet to about 750 feet. The incidences of sewer leakage should be reduced with a new sewer line, and the opportunities for catastrophic contamination of Carlsbad Cavern would be reduced because of the new location of the sewer outfall.

In the short term, implementing measures for controlling stormwater pollution would mitigate construction impacts to water quality. Short-term impacts would be negligible and adverse. Long-term impacts would be moderate and beneficial.

### ***Cumulative Impacts***

Most development related to Park operations, employee housing, and visitor services is located directly above Carlsbad Cavern. Historically, trends in staff and visitor activities around these developed areas have produced on-going contamination of cave resources and related impacts to groundwater. A 1996 infiltration study found contamination of Carlsbad Cavern pools from sewer leakage and parking lot runoff with the potential for catastrophic contamination (van der Heijde et al. 1997). About 2,200 feet of the sewer outfall is over Carlsbad Cavern, and this line has a history of blockage and leaks (DSC 2000). The parking lots not only alter natural infiltration patterns, they collect and concentrate hazardous materials generated by automobiles, maintenance operations, and residential activities that accumulate on the pavement surface. In combination, these activities create a moderate, long-term adverse impact on cave resources and associated groundwater.

The goal of the proposed sewer system rehabilitation and parking lot reconstruction projects, both of which would occur in the developed area above Carlsbad Cavern, is to reduce contamination of cave resources and related impacts to groundwater. These projects, along with the waterline project completed in 2000 and the proposed Visitor Center rehabilitation, would have possible short-term minor adverse impacts during construction and long-term moderate beneficial impacts.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. Because they are located away from the Park's groundwater and cave systems, they are not expected to have any cumulative impacts to those resources.

In combination with the preferred alternative, these projects would be mitigated to produce short-term negligible adverse impacts during construction. Long-term impacts would be moderate and beneficial.

### ***Conclusion***

Under the preferred alternative, groundwater contamination from sewer system leakage would be reduced by replacing the existing sewer outfall. The risk of catastrophic failure would be reduced by replacing the old pipe and moving about 1,450 feet of sewer outfall from its current location above Carlsbad Cavern. Cumulatively, the sewer system rehabilitation, Walnut Canyon Road rehabilitation, and Visitor Center rehabilitation would reduce the level of contaminants entering Carlsbad Cavern. No impairment of Park resources or values related to cave resources or groundwater quality would occur under this alternative.

## **SPECIAL STATUS SPECIES**

### **METHODOLOGY**

Information was collected regarding habitat use and potential threats to 30 special status species of wildlife confirmed or likely to occur in or near the project area by reviewing Park surveys and literature, USFWS species lists (USFWS 2005), NMDGF species accounts (NMDGF 2006), and original literature. Information on three special status plant species in the Park was obtained from Park surveys (Tonne 2004) and from species accounts obtained from the New Mexico EMNRD.

### ***Impact Intensity, Type, and Duration***

The levels of intensity for this impact topic are defined as follows:

<b>Impact Intensity</b>	<b>Description</b>
Negligible	The action could affect individuals of a species, but the effect would be so small that it would not create any measurable or perceptible change in populations of sensitive species.
Minor	The action could change a population but would be small and localized to a small area of the Park, with few measurable consequences.
Moderate	Evident modifications to a sensitive species population would occur, with a decrease or increase of the species within the Park. However, the change would be localized and not considered to have a long-term impact on the species' survivability.
Major	A substantial decrease in a population or in species diversity would occur that could be considered a threat to the long-term survivability of, and/or eliminate, an endemic or keystone species within the Park; or species diversity or the long-term survival of sensitive populations within the Park would be increased.

The type of impact is assessed for each action alternative. Impacts would be considered short term if affected species could recover in less than one year. Impacts would be considered long

term if recovery would require more than one year. Impacts would be considered permanent if any special status population was extirpated from the Park, thereby causing impairment of the resource.

## **NO ACTION ALTERNATIVE**

### ***Impact Analysis***

The no action alternative would not change the existing condition of the deteriorating sewer lines, leakage into groundwater, and the impact of frequent but localized repairs of belowground pipes in steep terrain or in and around the Park facilities. Impacts to special status species would be highly localized and occasional due to unscheduled ground disturbance, noise, routine hazards from mechanized digging equipment, foot traffic, and hand digging to repair leaks or breakage of the below-grade pipes for the foreseeable future. Trampling of special status plants and occasional disturbance of nesting birds in nearby vegetation would be negligible. No additional disturbance of special status species would occur with the no action alternative because no construction, ground or vegetation removal, or construction noise and activity would occur. The no action alternative would have negligible, long-term impacts to special status species.

### ***Cumulative Impacts***

Past, present, and reasonably foreseeable future actions that could have an effect on special status species within the Park include the waterline project completed in 2000, the proposed Visitor Center rehabilitation, and the proposed reconstruction of Visitor Center parking areas and roads. The effects of these projects could result in minor, long-term, localized, adverse cumulative impacts if not properly mitigated. Similarly, the roads projects planned by NMDOT could result in minor adverse impacts if not mitigated. However, environmental protection measures and procedures are in place for this project and other projects in the area to mitigate impacts to special status species during these projects. The no action alternative for the Waste System Rehabilitation project would not contribute to these cumulative adverse impacts.

### ***Conclusion***

Under the no action alternative, there would be negligible and long-term impacts to special status species. The no action alternative would have a negligible adverse contribution to cumulative impacts to special status species, which would be minor, long-term, localized, and adverse. No impairment of Park resources or values related to special status species would occur under this alternative.

## **PREFERRED ALTERNATIVE**

### ***Impact Analysis***

Under the preferred alternative, potential short-term impacts to special status species of wildlife would be due to increased human presence, generation of construction noise, and new disturbance in 3.55 acres of habitat (Table 2). Suitable habitats for special status species occur in the project area, mostly Chihuahuan Desert grassland and rock outcrop areas with exposed rock, grasslands, and woody vegetation. The proposed action would temporarily disturb quality habitats along the utility corridor during construction.



**Table 6.** Relative Impacts of the NPS Preferred Alternative to Special Status Species Known to Occur in the Project Area

<b>Scientific Name</b> Common Name	<b>Potential Project Impacts</b>	<b>Impact Intensity</b>	<b>Impact Duration</b>
<b>INVERTEBRATES</b>			
<b><i>Cicindela politula petrophila</i></b> Guadalupe Mountains tiger beetle	Entrapment in trenches or other direct impacts during warm season construction	Negligible	Short term
<b>REPTILES</b>			
<b><i>Crotalus lepidus lepidus</i></b> Mottled rock rattlesnake	Entrapment in trenches or other direct impacts during warm season construction	Negligible	Short term
<b><i>Lampropeltis alterna</i></b> Gray-banded kingsnake	Entrapment in trenches or other direct impacts during warm season construction	Negligible	Short term
<b><i>Lampropeltis getula splendida</i></b> Desert kingsnake	Entrapment in trenches or other direct impacts during warm season construction	Negligible	Short term
<b><i>Phrynosoma cornutum</i></b> Texas horned lizard	Entrapment in trenches or other direct impacts during warm season construction	Negligible	Short term
<b>BIRDS</b>			
<b><i>Athene cunicularia hypugea</i></b> Western burrowing owl	Disturbance of nesting activity due to noise or ground disturbing activity during warm season construction	Negligible	Short term
<b><i>Coccyzus americanus occidentalis</i></b> Yellow-billed cuckoo	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Dumetella carolinensis ruficrissa</i></b> Gray catbird	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Lanius ludovicianus</i></b> Loggerhead shrike	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Passerina versicolor</i></b> Varied bunting	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Petrochelidon fulva</i></b> Cave swallow	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Vireo bellii</i></b> Bell's vireo	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term
<b><i>Vireo vicinior</i></b> Gray vireo	Disturbance of nesting activity due to noise or vegetation clearing during warm season construction	Negligible	Short term

**Table 6.** Relative Impacts of the NPS Preferred Alternative to Special Status Species Known to Occur in the Project Area (continued)

<b>Scientific Name</b> Common Name	<b>Potential Project Impacts</b>	<b>Impact Intensity</b>	<b>Impact Duration</b>
<b>MAMMALS</b>			
<b><i>Bassariscus astutus</i></b> Ringtail	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Chaetodipus nelsoni canescens</i></b> Nelson's pocket mouse	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Conepatus leuconotus</i></b> Common (white-backed) hog-nosed skunk	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Felis concolor</i></b> Mountain lion	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Lasiurus borealis</i></b> Eastern red bat	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Myotis ciliolabrum melanorhinus</i></b> Western small-footed myotis (bat)	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Myotis thysanodes thysanodes</i></b> Fringed myotis (bat)	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Myotis velifer</i></b> Cave myotis (bat)	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Myotis volans interior</i></b> Long-legged myotis (bat)	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Neotoma leucodon melas</i></b> Eastern white-throated woodrat	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Nyctinomops macrotis</i></b> Big free-tailed bat	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Corynorhinus townsendii pallescens</i></b> Pale Townsend's big-eared bat	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term
<b><i>Spilogale gracilis</i></b> Western spotted skunk	Disturbance of mating or foraging activity due to noise during warm season construction	Negligible	Short term
<b><i>Tadarida brasiliensis mexicana</i></b> Brazilian (Mexican) free-tailed bat	Disturbance of mating or roosting activity due to noise during warm season construction	Negligible	Short term

**Table 6.** Relative Impacts of the NPS Preferred Alternative to Special Status Species Known to Occur in the Project Area (continued)

<b>Scientific Name</b> Common Name	<b>Potential Project Impacts</b>	<b>Impact Intensity</b>	<b>Impact Duration</b>
<b>PLANTS</b>			
<b><i>Nama xylopodum</i></b> Cliff nama	Direct loss or injury of individual plants in construction areas regardless of season	Negligible	Long term
<b><i>Sclerocactus uncinatus ssp. Wrightii</i></b> Chihuahuan fishhook cactus	Direct loss or injury of individual plants in construction areas regardless of season	Negligible	Long term
<b><i>Streptanthus sparsiflorus</i></b> Few-flowered (Guadalupe) jewelflower	Direct loss or injury of individual plants in construction areas regardless of season	Negligible	Long term

As ectotherms, special status reptiles that may occur in the project area are usually found basking on warm rocks or pavement surfaces during the warm seasons of the year, and are not found in the winter. Reptile nests could be found in the project area. Reptiles and their nests are susceptible to injury or mortality through direct construction impacts from the movement of heavy equipment for trenching, vegetation removal, and ground surface treatments. Reptiles may become entrapped in open trenches or injured during deposition of fill materials.

Vegetation along the utility corridor includes quality desert grassland, desert riparian, and Chihuahuan Desert scrub vegetation types that provide breeding habitat for several of the special status bird species and many of the 300 species of migratory birds known to occur in the Park. Migratory birds are granted protection under the MBTA (16 U.S.C. §§703–712) and its amendments, which prohibits interference of any kind with migratory birds or their eggs or nests. Migratory birds are active in the Park from April 1 through September 1. As highly mobile species, adult birds are able to avoid direct construction impacts but may be disrupted during breeding by human-caused noise or clearing of vegetation. Immature birds and eggs are highly vulnerable to human-caused mortality. Vegetation damage can also result in the death of smaller prey species required to feed nestlings. Avoidance of construction on top of the escarpment including the area near Bat Cave Draw and the Visitor Center parking areas during the nesting season from April 1 to September 1 will afford migratory birds and special status birds protection during the crucial breeding season. In other areas off the escarpment where construction will occur during the nesting season, breeding bird surveys would be conducted by a Park biologist, and all active nests would be flagged for avoidance. If mechanized construction cannot be avoided during the nesting season, breeding bird surveys would be conducted by a Park biologist, and all active nests would be flagged for avoidance.

Primarily nocturnal, bats can be negatively impacted by human activities such as habitat destruction or disturbance of hibernacula and maternity colonies. Baby bats may be dropped to their deaths or abandoned by panicked parents if disturbance occurs during the maternity season (Harvey et al. 1999). Most bats breed in the autumn and give birth in May or June. To avoid impacts to bats and other nocturnal wildlife, nighttime activities would not be permitted.

Demolition and construction in Bat Cave Draw and the lower visitor parking lots would only be permitted between September 1 and April 1 to avoid impacts to bat maternity. Avoidance of construction during this time will ensure protection of the Park's flying mammal population in the vicinity of the project.

Most of the Park's terrestrial mammals are able to vacate areas when noise from heavy equipment alerts them to potential risk. Grading activities and fill materials may bury or damage mammal nests or den and burrow entrances, and some species may be susceptible to entrapment in trenches. Removal of vegetation (either temporary or permanent) can reduce both available forage and seclusion from predators.

During the cold season from late October through late February, most of the special status terrestrial animals will either not be present in the project area or will be hibernating. Those that may still be present are mobile and would be able to avoid construction activities that would result in injury or mortality. During warm season construction, entrapment of the Guadalupe Mountains tiger beetle and the four species of reptiles is possible in temporary construction trenches. Because ground-disturbing activities are planned to occur in areas off the escarpment during the summer, and mitigation including trench monitoring for trapped reptiles and insects would be implemented, only negligible impacts are anticipated to the beetles and reptiles identified in this area. Since the existing main pipe that leads down the escarpment to the waste treatment ponds will be abandoned in place, and there will be no trenching in this area, only negligible impacts to any active special status mammals would occur in this area. All of the animal species of special concern to the Park would experience only negligible and short-term effects from this alternative.

Areas within the utility corridor would be cleared of existing vegetation. These proposed new disturbances would destroy habitat that would otherwise provide protective cover, food base, and breeding habitat for one or more of the special status animal species confirmed in the project area. Impacts to special status plants would be from direct removal or inadvertent crushing of individual plants during construction. The three special status plants would be unlikely to re-establish in areas where the soil has been disturbed during construction, or if they do, it is unclear how long successful recolonization would take (Tonne 2004).

Rocky outcrops and the steep terrain of the Guadalupe Escarpment provide important microhabitats for the three special status plant species—Chihuahuan fishhook cactus, cliff nama, and few-flowered (Guadalupe) jewelflower. Specific mitigation measures would be required to avoid adverse impacts to these plants. The Park biologist would flag and fence individual special status plants in the utility corridor so that they could be avoided during construction of the pipeline. However, some impacts to individual plants may be unavoidable. Since these plants are found in many of the specific areas where construction would occur and are slow to re-establish compared to other species, the action would impact individuals but not the population. Impacts would be localized to a very small area in the Park, and with mitigation would be very small in comparison with the plant populations in the Park. Therefore, adoption of the preferred alternative would likely have negligible long-term impacts to a few plants that could not be avoided during construction of the new aboveground pipeline down the escarpment.

## *Cumulative Impacts*

Special status species may be affected by other projects in the past, the present, and the reasonably foreseeable future. A waterline project was completed in 2000, and planned future projects include roadway and parking lot rehabilitation and reconfiguration.

If these future projects are constructed in conjunction with or in close proximity to the Waste System Rehabilitation project, sheet flow across the construction areas may increase, causing erosion and adversely affecting rare plants and wildlife habitat. Incorporating storm-water flow controls as a mitigation measure would reduce these impacts. Other construction impacts, such as noise, may increase cumulatively, adversely impacting nesting migratory birds and the more secretive special status species in the area, such as varied bunting, gray vireo, and mountain lion. Thus, cumulative impacts to special status animals and plants would be short term to long term, localized, and negligible if mitigation measures are in place to protect special status species.

## *Conclusion*

Impacts to special status species would be mitigated. Recommended mitigation measures include:

- Specifying avoidance of special status plants by having the Park biologist flag and fence individual plants within the utility corridor and relocating some of the plants that cannot be avoided during construction.
- Conducting construction activities only during daytime to avoid impacts to bats caused by nighttime noise and construction lights.
- Conducting as much vegetation clearing, trenching, and ground-disturbing construction activities as possible between September 1 and April 1 to avoid impacts to nesting birds, bats, special status invertebrates, and special status reptiles.
- If construction is scheduled after April 1 and before September 1, the following additional mitigation measures would be required with the presence and assistance of a Park biologist:
  - Conducting pre-construction nest surveys and flagging and avoiding all active nests.
  - Providing low-grade exits on all open trenches.
  - Monitoring trenches and removing any trapped beetles and reptiles or other wildlife from trenches before working in them or filling them.
- Park biologist will flag special habitats for special status species, including any riparian areas and any stands of dense woody vegetation. These areas will be fenced and avoided during construction to mitigate impacts to many of the special status species by providing areas of refuge during construction.

Over the long term, all resources outside the outfall pipe footprint would be restored to natural conditions, and impacts would be negligible or minor. Cumulative impacts to special status species would be long term, localized, minor, and adverse if these mitigation measures are implemented. There would be no impairment of Park resources or values related to threatened, endangered, or other special status species in the Park under the preferred alternative.

## VISITOR EXPERIENCE

### METHODOLOGY

Information about visitor experience was gathered from Park staff.

#### *Impact Intensity, Type, and Duration*

Levels of intensity for this impact topic are defined as follows:

Impact Intensity	Description
Negligible	Visitors would not be affected, or modifications in visitor experience would be at or below any or perceivable consequences.
Minor	There may be detectable modifications in visitor experience, but they would be slight and localized, with few perceivable consequences.
Moderate	Modifications to visitor experience would be readily apparent to visitors to the extent that visitors may voice an opinion about the modifications.
Major	Modifications to visitor experience could be substantial and either adverse or beneficial. Visitors would be aware of the effects and would likely express strong opinions about the changes.

The type of impact is discussed under each of the alternatives. Visitor experience impacts would be considered short term if the effects last only during construction. If effects last longer than the project's duration, impacts would be considered long term.

### NO ACTION ALTERNATIVE

#### *Impact Analysis*

Under the no action alternative, there would be no new impacts to visitor experience. Existing impacts from the deteriorating sewer main would continue, and the existing line would continue to degrade. Visitor experiences could be adversely impacted by odors from leaking sewage and inconveniences during sewer blockage. This general degradation of the sewage system would have a long-term, minor, adverse impact on the visitor experience at the Park.

#### *Cumulative Impacts*

Past, present, and future projects to improve the infrastructure of the Park would impact visitor experience in the short term but would be beneficial in the long term. The no action alternative would have a long-term, localized, minor, adverse impact from potential deterioration of the

sewage system. Cumulative impacts from other projects would be short term, adverse, and negligible. The no action alternative would increase the minor, adverse, long-term impacts.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. These projects would result in short-term minor adverse impacts for any visitors traveling those routes to Carlsbad Caverns National Park during construction and long-term moderate beneficial impacts once the roads are improved.

### ***Conclusion***

The current condition of the sewage system constitutes long-term, minor, adverse impacts to the visitor experience. Cumulative impacts to visitor experience from other projects in the Park would be short term and negligible.

## **PREFERRED ALTERNATIVE**

### ***Impact Analysis***

The preferred alternative would entail construction activities around the heavily used Visitor Center, the lower parking area, and the path to the entrance to Carlsbad Cavern. These activities would lead to temporary closure and rerouting of some traffic flow patterns and of pedestrian walkways. Visitors could possibly be required to use longer pathways from the Visitor Center to the Carlsbad Cavern entrance and amphitheater during construction of the portion of the forcemain that would be located under the path. In the short term, construction will be visible to visitors traveling on U.S. Highway 62/180 and visitors at Rattlesnake Springs and in the long term the pipeline will be visible to visitors at these same locations. Construction noise, dust, fumes, and equipment would also detract from the overall visitor experience during the construction period.

Over the long term, the preferred alternative would reduce odors from sewage leaks and reduce the potential for inconveniences associated with sewer blockages. The construction activities related to the preferred alternative would have short-term moderate, adverse impacts to the visitor experience. The benefits of the preferred alternative would yield long-term minor beneficial impacts to the visitor experience.

### ***Cumulative Impacts***

Past, present, and future projects to improve the infrastructure of the Park would impact visitor experience in the short term, but would be beneficial in the long term. The preferred alternative would have a long-term, localized, minor adverse impact from potential deterioration of the sewage system. Cumulative impacts from other projects would be short term, adverse, and negligible. The preferred alternative would increase the minor, adverse, long-term impacts.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. These projects would result in short-term minor adverse impacts for any visitors traveling those routes to Carlsbad Caverns National Park during construction and long-term moderate beneficial impacts once the roads are improved.

## ***Conclusion***

The preferred alternative would have short-term, localized, minor, adverse effects lasting for the duration of construction activities. Over the long term, the effects would be beneficial. Cumulative impacts would create additional short-term, localized, minor adverse effects by lengthening time of construction and the associated inconvenience to visitors. However, the long-term effects would be beneficial to the visitor experience.

## **PARK OPERATIONS**

### **METHODOLOGY**

Information about Park operations was gathered from Park staff.

### ***Impact Intensity, Type, and Duration***

Levels of intensity for this impact topic are defined as follows:

<b>Impact Intensity</b>	<b>Description</b>
Negligible	Park operations would not be affected, or modifications in Park operations would be at or below any perceivable consequences.
Minor	There may be detectable modifications in Park operations, but they would be slight and localized with few perceivable consequences.
Moderate	Modifications to Park operations would be readily apparent, to the extent that visitors may voice an opinion about the modifications.
Major	Modifications to Park operations could be substantial and either adverse or beneficial. Visitors and staff would be aware of the effects and would likely express strong opinions about the changes.

The type of impact is discussed under each of the alternatives. Park operations impacts would be considered short term if the effects last only during construction. If effects last longer than the project's duration, impacts would be considered long term.

### **NO ACTION ALTERNATIVE**

### ***Impact Analysis***

There would be no changes in Park operations related to the wastewater system. Continued system deterioration would increase the need for maintenance and repairs. Failure to take action could eventually result in extended repairs or wastewater system failure that would disrupt Park operations. This general decay of the wastewater system would have a long-term, moderate, adverse impact on the operations of the Park.



### ***Cumulative Impacts***

Past, present, and future projects to improve the infrastructure of the Park would impact Park operations in the short term but would be beneficial in the long term. The no action alternative would have a long-term, localized, moderate, adverse impact from potential deterioration of the wastewater system. Cumulative impacts from other projects would be short term, adverse, and negligible. The no action alternative would increase the moderate, adverse, long-term impacts.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. These projects would not contribute impacts to Park operations.

### ***Conclusion***

The current condition of the wastewater system constitutes long-term, moderate, adverse impacts to Park operations. Cumulative impacts to Park operations from other projects in the Park would be short term and negligible, but the no action alternative could create a long-term, moderate, adverse impact.

## **PREFERRED ALTERNATIVE**

### ***Impact Analysis***

Over the short term, Park operations would be adversely affected by affecting traffic patterns in the lower parking lot and pedestrian access to the Visitor Center, Carlsbad Cavern entrance, and amphitheater. Park staff would have the added burden of addressing visitor concerns during construction to make the visitor experience as enjoyable as possible. These activities would result in a short-term, minor, adverse impact to Park operations. The rehabilitated wastewater system would reduce the need for unscheduled maintenance activities. These changes would result in a long-term, moderate beneficial impact.

### ***Cumulative Impacts***

Impacts associated with past, present, and future projects would prolong the period of construction, increasing noise, dust, and fumes, adding construction vehicle traffic, construction fences, traffic delays, and congestion, and decreasing parking. The impacts would be short term, localized, minor, and adverse. These effects could be mitigated by timing construction to off-season and off-peak hours. All projects, past, present, or future, were designed with the ultimate goal of improving and protecting the visitor experience. Therefore, long-term cumulative impacts should be moderate and beneficial.

The roads projects planned by NMDOT have the goal of increasing the safety, comfort, and capacity of the area highways. These projects would not contribute impacts to Park operations.

### ***Conclusion***

The preferred alternative would have short-term, localized, minor, adverse impacts to Park operations lasting for the duration of construction activities. Over the long term, the effects would be beneficial. Cumulative impacts would create additional short-term, localized, minor

adverse effects by lengthening the time of construction or increasing Park staff duties to mitigate construction impacts. However, the long-term effects would be beneficial to Park operations.

## **HISTORIC STRUCTURES**

### **METHODOLOGY**

In this EA, analysis of impacts to historic structures is intended to comply with the requirements of both NEPA and Section 106 of the NHPA (16 U.S.C. §470). Thus, in addition to analysis in terms of context, intensity, type, and duration of impact and cumulative impacts, and in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 (36 CFR 800, Protection of Historic Properties), impacts to historic structures were also identified and evaluated by (1) determining the areas of potential effect, (2) identifying historic structures present in the areas of potential effect that are either listed on or eligible to be listed on the NRHP, (3) applying the criteria of adverse effect to affected NRHP-listed or eligible historic structures, and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations, a determination of either adverse effect or no adverse effect must be made for affected NRHP-listed or eligible historic structures. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion on the NRHP, for example, diminishing the integrity of its location, design, setting, materials, workmanship, feeling, or association (that is, the extent to which a resource retains its original historic condition). Adverse effects also include reasonably foreseeable effects of the alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, Assessment of Adverse Effects). A determination of no adverse effect means there is an effect, but the effect would not diminish the characteristics of the cultural resource that qualify it for inclusion on the National Register.

CEQ regulations and the NPS's guidelines on Conservation Planning, Environmental Impact Analysis and Decision Making (DO 12; NPS 2001) also call for a discussion of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, for example, reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Historic structures are non-renewable resources, and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis section for the preferred alternative. The Section 106 summary is an assessment of the effect of the undertaking (implementation of the alternative) on NRHP-eligible or listed historic structures only, based on the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

### ***Impact Intensity, Type, and Duration***

Levels of intensity for historic structures are defined as follows:

<b>Impact Intensity</b>	<b>Description</b>
Negligible	Impact is at the lowest levels of detection, with neither adverse nor beneficial consequences. The determination of effect for §106 would be <i>no adverse effect</i> .
Minor	Alteration of a feature would not diminish the overall integrity of the resource. The determination of effect for §106 would be <i>no adverse effect</i> .
Moderate	Alteration of a feature would diminish the overall integrity of the resource. The determination of effect for §106 would be <i>adverse effect</i> . An MOA is executed between the NPS and applicable state or tribal historic preservation officers and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate.
Major	Alteration of a feature would diminish the overall integrity of the resource. The determination of effect for §106 would be <i>adverse effect</i> . Measures to minimize or mitigate adverse impacts cannot be agreed upon, and the NPS and applicable state or tribal historic preservation officers and/or Advisory Council are unable to negotiate and execute an MOA in accordance with 36 CFR 800.6(b).

### **NO ACTION ALTERNATIVE**

#### ***Impact Analysis***

The wastewater system would remain in its present condition and location. There would be continued routine maintenance, with no change in management planning or decisions. There would be no disturbance to historic structures because under the no action alternative no construction or associated ground disturbance would occur.

#### ***Cumulative Effects***

Future actions that could have an effect on historic structures within the Park include rehabilitation of the Visitor Center and proposed road and parking lot rehabilitation. These projects could create moderate adverse, long-term cumulative impacts to the Caverns Historic District that would be mitigated through appropriate measures in consultation with the SHPO. The no action alternative would not contribute to these cumulative impacts; therefore, the no action alternative would have no effect in the cumulative impacts scenario.

#### ***Conclusion***

Under the no action alternative, there would be no impacts to historic structures. Also, the no action alternative would not contribute to cumulative impacts to historic structures. Under the no action alternative, there would be no impairment of Park resources or values.

## PREFERRED ALTERNATIVE

### *Impact Analysis*

A new sewer line about 940 feet long would be installed from the comfort station adjacent to the Bat Cave to a gravity outfall east of the Visitor Center. The sewer line would be buried under the Bat Cave Draw parking area, trenched and buried under Bat Cave Draw, and buried under the existing sidewalk connecting the Visitor Center with the pedestrian entrance to Carlsbad Cavern. Potential impacts associated with the linear construction corridor, which would vary in width from approximately 12 feet to 30 feet, would have no effect on the 13 rustic stone and adobe buildings of the Caverns Historic District. Where installation of the sewer line would traverse the Bat Cave Draw parking area, a small section of the dry-laid stone retaining wall would be carefully dismantled to allow burial of the sewer line across Bat Cave Draw, and the masonry elements would be saved for reuse. After the line is placed across Bat Cave Draw, the retaining wall would be rebuilt using the dismantled stones, and the rebuilt wall would thus match the existing wall in composition, material, texture, and color. Because the character-defining materials and features of the retaining wall would not be obscured, damaged, or destroyed, any adverse impacts to the retaining wall would be minor and long term.

Once the sewer line is installed and the trench is backfilled, the disturbed ground would be restored to its pre-construction contour and condition. Installation of the sewer line would have no effect on the scale and visual relationships among landscape features in the historic district. In addition, the topography, spatial arrangement, circulation features, and land use patterns of the historic district would remain unaltered, and revegetation of the construction corridor with native species where appropriate would also help ensure that the integrity of the district is not diminished.

The sewer line that would descend the steep escarpment aboveground to the desert flats would not be visible to visitors in the Caverns Historic District, and there are no interpretive trails in the vicinity. However, the sewer line would be visible to visitors standing along the eastern edge of the eastern parking lot as it crosses an arroyo—a minor, adverse impact. In addition, the flat-colored, nonreflective wrap of insulation and rock shield applied to protect the pipeline would blend with the surrounding craggy rock environment, lessening any visual impact of the pipeline. The aboveground sewer line that descends the escarpment would have no effect on the Caverns Historic District.

At the base of the escarpment, the new sewer outfall would be buried in trenches for about 335 feet behind the water tank and pumping station building, at which point it would intersect the existing two-track service road. The new pipeline would be constructed under the existing road and extend about 4,070 feet to the existing sewage-disposal ponds. The eroded embankments of the ponds would be repaired and inlet/outlet valves would be replaced. The lining of two existing empty, dry sewage-disposal ponds would be replaced with new HDPE liners. Neither installation of the sewer line at the base of the escarpment nor repair and rehabilitation of the sewage disposal ponds would have any impacts on the Caverns Historic District.

Construction activities associated with rehabilitation of the wastewater system would temporarily introduce nonhistoric visual, audible, and atmospheric elements into the setting of the Caverns

Historic District. Such intrusions would be short term, lasting only as long as construction. In addition, such intrusions would largely be eclipsed by the daily activities currently associated with the Visitor Center, the administrative facilities, and related parking areas that dominate the historic district's setting. Any adverse impacts would be of negligible intensity and short term.

### ***Cumulative Effects***

Over the years historic structures in the Caverns Historic District have been adversely impacted by the wear and tear associated with Park use and visitor access and by natural processes such as weathering and erosion. In addition, five of the 13 buildings that comprise the historic district have been altered. Long-term adverse impacts to historic structures from these causes range from minor to moderate in intensity.

Reasonably foreseeable future actions occurring in the Park, such as the proposed rehabilitation of the Park's entrance road and parking areas, also have the potential to adversely effect the historic structures of the Caverns Historic District. However, careful design would ensure that the rehabilitation would result in few, in any, adverse effects, and any adverse effects would be anticipated to be negligible to minor and long term.

As described above, implementation of the preferred alternative could result in negligible to minor, long-term adverse impacts to the historic structures of the Caverns Historic District. The negligible to minor, long-term adverse impacts of the preferred alternative, in conjunction with the minor to moderate, long-term adverse impacts of other past, present, and reasonably foreseeable future actions, would result in a long-term, minor to moderate adverse cumulative impact. The preferred alternative, however, would contribute only minimally to the minor to moderate, adverse cumulative impact.

### ***Conclusion***

Rehabilitation of the Park's wastewater system could result in negligible to minor, long-term adverse impacts to the historic structures of the Caverns Historic District. Implementation of the preferred alternative would contribute only minimally to the minor to moderate, adverse cumulative impact. There would be no impairment of Park resources or values.

### ***Section 106 Summary***

After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the NPS concludes that implementation of the preferred alternative would have *no adverse effect* on the Caverns Historic District.



# CONSULTATION AND COORDINATION

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Agencies and organizations that were contacted for information or that assisted in identifying important issues or selecting alternatives were given an opportunity to review and comment on this EA. These agencies are:

## **Federal Agencies**

- U.S. Fish and Wildlife Service
- Federal Highway Administration

## **State and Local Agencies**

- New Mexico Department of Game and Fish
- New Mexico State Historic Preservation Officer

## **Native American Tribes**

The Park contacted 14 Native American groups traditionally associated with the Park's lands. They were apprised of the preferred alternative, by letter, on May 24, 2005; no comments have been received to date. The groups contacted are:

- Apache Tribe of Oklahoma
- Comanche Nation, Oklahoma
- Fort Sill Apache Tribe of Oklahoma
- Hopi Tribe of Arizona
- Jicarilla Apache Nation, New Mexico
- Kiowa Indian Tribe of Oklahoma
- Mescalero Apache Tribe of the Mescalero Reservation, New Mexico
- Pawnee Nation of Oklahoma
- Pueblo of Isleta, New Mexico
- Pueblo of Zia, New Mexico
- San Carlos Apache Tribe of the San Carlos Reservation, Arizona
- White Mountain Apache Tribe of the Fort Apache Reservation, Arizona
- Pueblo of Zuni, New Mexico
- Ysleta del Sur Pueblo of Texas

## SCOPING

Internal scoping has been completed for the proposed road and parking lot improvements. The scoping meetings included personnel from the Park, the NPS Denver Service Center (DSC), NPS Intermountain Support Office (ISO), Central Federal Lands Highway Division (CFLHD), and the NEPA Contractor (SWCA) and were held on the following dates:

Date	Meeting	Attendees
December 2000	CBA/VA	Park, DSC, CFLHD
December 12, 2002	Initial Project Scoping Trip and Signed Project Agreement	Park, DSC, CFLHD
March 19, 2003	Preliminary Site Review/Data Collection	Park, DSC, CFLHD
June 26, 2003	30% Design Review	Park, DSC, CFLHD
December 2, 2003	Intermittent Design Review	Park, DSC, CFLHD
October 26, 2004	Environmental Compliance Kick-Off Meeting and Site Visit	Park, DSC, ISO, SWCA

## LIST OF CONTRIBUTORS

The following personnel provided invaluable assistance in the planning, resource assessment, development, and technical review for this EA:

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## ACRONYMS AND SHORT FORMS

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BMPs	Best Management Practices
Cavern	Carlsbad Cavern
CBA	Choosing by Advantages
CEQ	Council on Environmental Quality
CFLHD	Central Federal Lands Highway Division
CFR	Code of Federal Regulations
CWA	Clean Water Act
District	Caverns Historic District
DO	Director's Order
DSC	NPS Denver Service Center
EA	Environmental Assessment
EMNRD	New Mexico Energy, Minerals and Natural Resources Department
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FR	Federal Register
ha	Hectare(s)
HDPE	High Density Polyethylene
ISO	NPS Intermountain Support Office
m	meter(s)
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMRPTC	New Mexico Rare Plant Technical Council
NMSA	New Mexico Statutes Annotated
NPS	National Park Service
NRHP	National Register of Historic Places
Park	Carlsbad Caverns National Park
SHPO	State Historic Preservation Officer
ssp.	indicates a subspecies within a species
SWCA	SWCA Environmental Consultants
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
VA	Value Analysis



# **Appendix A**

## **LIST OF SPECIAL STATUS SPECIES IN EDDY COUNTY, NEW MEXICO**

**REVISED NOVEMBER 2006**

Table A provides pre-project planning information on special status species identified by the U.S. Fish and Wildlife Service (USFWS), the State of New Mexico, and the National Park Service (NPS). Under the Endangered Species Act (ESA), as amended, it is the responsibility of the federal action agency or its designated representative to determine whether a proposed action "may affect" any listed or proposed species. Section 7 of the ESA requires federal agencies to consult with USFWS should it be determined that their actions (permitting, authorizing, or carrying out) may affect a listed threatened or endangered species. Candidate species and species of concern have no legal protection under the ESA and are included in this document for planning purposes only.

In addition, state agencies provide additional species that are of particular concern at the state level. The New Mexico Department of Game and Fish (NMDGF) focuses the listing status on state populations, including subspecies. The NMDGF may designate as endangered, threatened or sensitive any native (terrestrial or aquatic) vertebrate, mollusk, or crustacean, but only state-endangered species receive full protection under Title 19 (19 NMAC 33.2). The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) is responsible for determining state-listed endangered plants. These plants receive full protection under Title 19 (19 NMAC 21.2.8).

NPS policy also requires examination of potential impacts on all special status species described above. For additional planning purpose, the expertise of staff biologists at Carlsbad Caverns National Park allows inclusion of local species of special concern, regardless of their status by pertinent Listing agencies.

The special status species from other federal land management agencies are not included because recent data do not exist and therefore status cannot be verified.

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico

(Species that may be affected by project activities appear in boldface type.)

## INVERTEBRATES

Common Name (Scientific Name)	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<b><i>Cicindela politula petrophila</i></b> <b>Guadalupe Mountains tiger beetle</b>	SC	–	SC	<b>Limestone or calcareous clay; Endemic to the Guadalupe Mountains</b>	<b>Documented in Park; possible habitat in project area</b>
<i>Popenaias popeii</i> Texas hornshell (mussel)	C	E	–	Larger streams with variable substrates; in NM, restricted to Pecos River	Not found in Park; no suitable habitat in project area
<i>Pyrgulopsis pecosensis</i> Pecos pyrg (springsnail)	SC	T	–	Mud and pebble substrate in spring habitat, mainly along the edges of the water; endemic to Blue Spring (tributary of the Black River)	Not found in Park; no suitable habitat in project area
<i>Vertigo ovata</i> Ovate vertigo (snail)	SC	T	SC	Marshy spring-brook areas with damp soil	No suitable habitat in project area

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

AMPHIBIANS and REPTILES

Common Name (Scientific Name)	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Crotalus lepidus lepidus</i> Mottled rock rattlesnake	–	T	SC	Rocky canyons or hillsides; reef escarpment habitats	Suitable habitat exists and species is confirmed in project area
<i>Lampropeltis alterna</i> Gray-banded kingsnake	–	E	SC	Rocky, dry limestone hills and mountain slopes vegetated with succulents and shrubs	Suitable habitat exists and species is possible in area
<i>Lampropeltis getula splendida</i> Desert kingsnake	–	–	SC	In New Mexico, preferred habitat is riparian or grassland, some in piñon-juniper or low-elevation desert areas.	Suitable habitat exists and species is possible in area
<i>Nerodia erythrogaster transversa</i> Plainbelly water snake	–	E	SC	Requires permanent water	No suitable habitat in project area
<i>Phrynosoma cornutum</i> Texas horned lizard	–	–	SC	Open desert grasslands on sandy to gravelly soils and sand dunes; common around yucca and ephedra and associated with playas, bajadas, and mountain foothills	Suitable habitat exists and species is possible in area
<i>Pseudmys gorzugi</i> Western river cooter	–	T	SC	River systems with deep pools	No suitable habitat in project area
<i>Sceloporus arenicolus</i> Sand dune lizard	C	E	–	Sand dune habitat with shinnery oak, most abundant in Mescalero sand dunes	Not found in Park; no suitable habitat in project area
<i>Thamnophis proximus diabolicus</i> Western ribbon snake	–	T	SC	Found at edges of water bodies; prefers areas that are open and sandy, associated more with brush than forest	Possible in Park; no suitable habitat in project area

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

FISH

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Astyanax mexicanus</i> Mexican tetra	–	T	–	Prefer low-velocity pool habitats in small streams and spring systems	Not found in Park; no suitable habitat in project area
<i>Cycleptus elongates</i> Blue sucker	SC	E	–	Deep river channels, pools with moderate currents, and deep lakes; limited to the Pecos River drainage below Brantley Reservoir to the NM/TX state line	Not found in Park; no suitable habitat in project area
<i>Cyprinodon pecosensis</i> Pecos pupfish	SC	T	–	Saline springs and gypsum sinkholes to desert streams with highly fluctuating conditions; backwaters and side pools of the Pecos River	Not found in Park; no suitable habitat in project area
<i>Etheostoma lepidum</i> Greenthroat darter	SC	T	SC	Vegetated riffles, with gravel and cobble bottoms; swift-flowing streams and springs; clear ponded-water habitats, including sinkholes and littoral areas	Not found in Park; no suitable habitat in project area
<i>Gambusia nobilis</i> Pecos gambusia	E	E	–	Heads and runs of springs with aquatic vegetation	Not found in Park; no suitable habitat in project area
<i>Gila pandora</i> Rio Grande chub	–	S	–	Able to inhabit both riverine and lacustrine habitats and usually found in pools with overhanging banks and brush	Not found in Park; no suitable habitat in project area
<i>Ictalurus lupus</i> Headwater catfish	SC	S	–	Clear, temperate waters generally with a moderate gradient	Not found in Park; no suitable habitat in project area
<i>Moxostoma congestum</i> Gray redbhorse	SC	T	–	Clear to moderately turbid, warm, low-gradient streams in medium to large pools, with cobble, gravel, silt, or sand bottoms	Not found in Park; no suitable habitat in project area
<i>Notropis jemezianus</i> Rio Grande shiner	SC	S	–	Large, open rivers with laminar flows and a minimum of aquatic vegetation; larger streams with gravel, sand, or rubble bottoms, sometimes overlain with silt	Not found in Park; no suitable habitat in project area
<i>Notropis simus pecosensis</i> Pecos bluntnose shiner	T	E	–	Main channel areas, with low-velocity water, depths of 17–31 cm, and a sandy substrate	Not found in Park; no suitable habitat in project area
<i>Percina macrolepida</i> Bigscale logperch [native population]	–	T	–	Most commonly found in fast-flowing, non-turbulent, moderately-deep water with large cobble substrata	Not found in Park; no suitable habitat in project area

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

**BIRDS**

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Accipiter gentilis</i> Northern goshawk	SC	S	SC	Dense coniferous and mixed-woodland areas	Irregular to rare in late fall and winter; no suitable nesting habitat in project area
<i>Ammodramus bairdii</i> Baird's sparrow	SC	T	SC	Winters in short and mixed grass upland prairies	Possible spring and fall migrant visitor; no suitable nesting habitat in project area
<b><i>Athene cunicularia hypugea</i></b> Western burrowing owl	SC	–	SC	<b>Semi-arid grasslands and prairies, often associated with prairie dog towns</b>	<b>Possibly nests in flats below escarpment; species is possible in area</b>
<i>Buteo gallus anthracinus</i> Common black-hawk	–	T	SC	Requires mature, well-developed riparian forest stands located near permanent streams where principal prey of fish, amphibians, and reptiles is available	Increasing visitor to Park, but only at Rattlesnake Springs; not in project area
<i>Calothorax lucifer</i> Lucifer hummingbird	–	T	SC	Prefers rugged canyons and slopes in dry mountain ranges, especially rocky hillsides, talus slopes, and dry washes vegetated with desert scrub	Accidental to rare in Park; not in project area
<i>Camptostoma imberbe ridgwayi</i> Northern beardless tyrannulet	–	E	–	A low-elevation riparian species that prefers dense thickets of mesquite, acacia, hackberry, and similar vegetation, typically along stream courses	Accidental visitor; not in project area
<i>Charadrius melodus circumcinctus</i> Piping plover	–	T	–	A wetland obligate, this species substantially depends upon availability of mudflat and sandbar habitats	Not found in Park; no suitable habitat in project area
<i>Charadrius montanus</i> Mountain plover	–	S	–	This wading bird is found in semi-arid plains, grasslands, and plateaus	Not found in Park; no suitable habitat in project area
<i>Chlidonias niger surinamensis</i> Black tern	SC	–	SC	Vegetated marshes and prairie wetlands	Extremely rare visitor seen at sewage pond in past; no suitable nesting habitat in project area
<b><i>Coccyzus americanus occidentalis</i></b> Yellow-billed cuckoo	SC	S	SC	<b>Prefers riparian habitat with dense willow, cottonwood, salt cedar and/or mesquite</b>	<b>Species nests in Park and in project area</b>

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

BIRDS (continued)

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Columbina passerine pallescens</i> Common ground-dove	–	E	SC	Prefers low-elevation prefers brushy, well-watered valleys, frequenting riparian woodlands and shrublands, especially mesquite thickets along streams and canyon bottoms.	Very rare Park visitor (formerly regular); not in project area
<i>Cynanthus latirostris magicus</i> Broad-billed hummingbird	–	T	SC	Low- to middle-elevation riparian woodlands; nest in hackberry thickets and similar vegetation	Uncommon to rare vagrant; not likely in project area
<b><i>Dumetella carolinensis ruficrissa</i></b> <b>Gray catbird</b>	–	–	SC	<b>dense thickets along streams and marshes, occasionally found in drier environments and anywhere in native brush or trees during migration and occasionally in winter</b>	<b>Suitable habitat exists and species is possible in area</b>
<i>Empidonax traillii extimus</i> Southwestern willow flycatcher	–	E	SC	Thick streamside vegetation	Uncommon in spring and fall in Park; no suitable nesting habitat in project area
<i>Falco femoralis septentrionalis</i> Northern aplomado falcon	E	E	–	Grassy plains interspersed with mesquite, cactus, and yucca	Not found in Park; no suitable nesting habitat in project area
<i>Falco peregrinus anatum</i> American peregrine falcon	SC	T	SC	Montane species; prefers to perch in open areas, often near water	No suitable nesting habitat in project area
<i>F.p. tundrius</i> Arctic peregrine falcon; listed for “similar appearance”	SC	–	–	Montane species; prefers to perch in open areas, often near water	May visit as a migrant; not likely in project area
<i>Haliaeetus leucocephalus alascanus</i> Bald eagle	T	T	SC	Winters along shores of rivers and lakes	Accidental winter visitor; no suitable nesting habitat in project area
<b><i>Lanius ludovicianus</i></b> <b>Loggerhead shrike</b>	–	S	SC	<b>Semi-open areas in desert scrub and grasslands with lookout posts, wires, scrub; prefers trees of medium to tall height for nesting</b>	<b>Nests in Park; suitable habitat exists, and species occurs in project area</b>
<b><i>Passerina versicolor</i></b> <b>Varied bunting</b>	–	T	SC	<b>Summers in New Mexico; dense, shrubby vegetation in arid canyons</b>	<b>Suitable habitat exists and species nests in project area</b>



**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

BIRDS (continued)

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Pelecanus occidentalis carolinensis</i> Brown pelican	–	E	–	Most frequent during summer-fall at large lakes or along major rivers	Not found in Park
<i>Petrochelidon fulva</i> Cave swallow	–	–	SC	Primary colonial nesting sites are in limestone caves	Suitable habitat exists, and species is confirmed in project area
<i>Phalacrocorax brasilianus</i> Neotropic cormorant	–	T	–	Nesting cormorants require stands of trees or shrubs, in or near water, that are free from human disturbance	Not found in Park, possible accidental visitor
<i>Sterna antillarum athalassos</i> Interior least tern	E	E	–	Sand bars and sandy shorelines	No Park records; No suitable habitat in project area
<i>Strix occidentalis lucida</i> Mexican spotted owl	T	S	SC	Mature mixed-conifer and pine-oak forests	May nest in isolated canyons of Park; species is possible but unlikely in project area
<i>Tympanuchus pallidicinctus</i> Lesser prairie chicken	C	S	SC	Short-, mid-, and tall-grass prairies and shrubsteppes	Rare visitor in Park; no suitable habitat in project area; not likely in project area
<i>Tyrannus crassirostris</i> Thick-billed kingbird	–	E	SC	Requires native broadleaf riparian habitats characterized by mature cottonwoods and sycamores	Rare in Park; not likely in project area
<i>Vireo bellii</i> Bell's vireo	–	T	SC	Dense, low, shrubby vegetation in riparian areas	Nests in Park and suitable habitat exists in project area
<i>Vireo vicinior</i> Gray vireo	–	T	SC	Grassy arid juniper woodlands; oak and piñon pines	Nests in Park and suitable habitat exists in area

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

**MAMMALS**

Common Name (Scientific Name)	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Bassariscus astutus</i> Ringtail	–	S	SC	Rocky areas of cliffs, outcroppings, and rock piles; rarely found in lowlands	Suitable habitat exists and species is possible in project area
<i>Chaetodipus nelsoni canescens</i> Nelson's pocket mouse	–	S	SC	Inhabits slopes with many boulders and large slabs of flat rock with moderate grass densities	Suitable habitat exists and species is possible in project area
<i>Conepatus leuconotus</i> Common (white-backed) hog-nosed skunk	–	S	SC	Deserts, grasslands, and woodlands; has occurred along the base of the escarpment in the Park	Suitable habitat exists and species is possible in project area
<i>Cryptotis parva</i> Least shrew	–	T	–	In New Mexico, primary habitat is mesic areas with dense grass cover	Not found in Park
<i>Cynomys ludovicianus ludovicianus</i> Black-tailed prairie dog	SC	S	–	Short-grass prairies	No suitable habitat in project area; not found in Park
<i>Lasiurus blossevillei</i> Western red bat	SC	S	–	Sycamore, cottonwood, and rabbitbrush riparian habitat	Not found in Park
<i>Lasiurus borealis</i> Eastern red bat	–	S	SC	Sycamore, cottonwood, and rabbitbrush riparian habitat; prefer areas with large deciduous trees	Suitable habitat exists and species is possible in area
<i>Mustela nigripes</i> Black-footed ferret	E	S	–	Prairies; associated with prairie dogs	Not found in Park; no suitable habitat in project area
<i>Myotis ciliolabrum melanorhinus</i> Western small-footed myotis (bat)	–	S	SC	Prefers conifer forests at higher elevations	Suitable habitat exists and species is possible in project area
<i>Myotis thysanodes thysanodes</i> Fringed myotis (bat)	–	S	SC	Lives in desert, grassland, woodland, and forests and found throughout the Park; roosts in buildings and caves	Suitable habitat exists and species is confirmed in project area
<i>Myotis velifer</i> Cave myotis (bat)	–	S	SC	Common in desert and grasslands of New Mexico, particularly near open bodies of water; may use caves for raising of young and roosting	Suitable habitat exists and species is confirmed in project area
<i>Myotis volans interior</i> Long-legged myotis (bat)	–	S	SC	Ponderosa pine forests at higher elevations, though a few are found in grassland habitats	Suitable habitat exists, and species is possible in area

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

MAMMALS (continued)

Common Name (Scientific Name)	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Myotis yumanensis yumanensis</i> Yuma myotis (bat)	–	S	SC	Primarily an inhabitant of desert regions most commonly encountered in lowland habitats near open water, where it prefers to forage. It roosts in caves, abandoned mine tunnels, and buildings	Known only from skeletal material in Park; species is possible in area
<i>Neotoma leucodon melas</i> Eastern White-throated woodrat	–	–	SC	Lives in a variety of habitats from desert lowlands to mixed coniferous forests; alluvial fans, rocky arroyos, and boulder-strewn ground	Suitable habitat exists and species is possible in project area
<i>Nyctinomops macrotis</i> Big free-tailed bat	–	S	SC	Typically inhabits rugged canyons with rocky outcrops and tall cliffs	Suitable habitat exists and species is possible in project area
<i>Ondatra zibethicus ripensis</i> Pecos River muskrat	SC	S	–	Riparian areas in Chihuahuan Desert scrub and piñon-juniper woodlands	Not found in Park; no suitable habitat in project area
<i>Plecotus townsendii pallescens</i> Pale Townsend's big-eared bat	SC	S	SC	Caves and rocky outcroppings in scrub deserts and piñon-juniper woodlands	Suitable habitat exists and species is possible in project area
<i>Puma concolor</i> Mountain lion	–	–	SC	Range occurs throughout New Mexico (except of eastern plains); prefer mountainous areas	Suitable habitat exists and species is possible in project area
<i>Spilogale gracilis</i> Western spotted skunk	–	S	SC	Most often associated with rocky and brushy areas, especially in desert, grassland, and woodland areas	Suitable habitat exists and species is possible in project area
<i>Tadarida brasiliensis mexicana</i> Brazilian (Mexican) free-tailed bat	–	–	SC	Lowland habitats of desert, grassland, and pinyon-juniper woodland	Suitable habitat exists and species is confirmed in project area
<i>Thomomys bottae guadalupensis</i> Guadalupe pocket gopher	SC	S	–	Sycamore, cottonwood, and rabbitbrush in riparian areas; higher elevations of Guadalupe mountains	Not found in Park; no suitable habitat in project area
<i>Vulpes vulpes</i> Red fox	–	S	–	Favored habitat is mixed woodland uplands interspersed with farms and pastures	Not found in Park
<i>Vulpes velox velox</i> Swift fox	SC	S	SC	Short- to mid-grasslands and pastures	Not found in Park

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

PLANTS

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Amsonia tharpii</i> Tharp's blue-star	SC	E	SC	Limestone and gypsum hills in Chihuahuan Desert scrub	Species not found in project area during 2004 rare plant survey
<i>Chaetopappa Hershey</i> Mat lestdaisy	SC	S	SC	Steep limestone cliffs in piñon-juniper woodland and Rocky mountain montane coniferous forest	Species not found in project area during 2004 rare plant survey
<i>Chrysothamnus nauseosus</i> var. <i>texensis</i> Guadalupe rabbitbrush	SC	S	SC	Crevices on faces of limestone cliffs and huge boulders of canyon woodlands	Species not found in project area during 2004 rare plant survey
<i>Coryphantha scheeri</i> var. <i>scheeri</i> Scheer's pincushion cactus	–	E	SC	Favors nearly level areas in desert grassland and Chihuahuan Desert scrub, usually on gravelly or silty soils, occasionally on rocky benches or bajadas on limestone or gypsum	Species not found in project area during 2004 rare plant survey
<i>Coryphantha sneedii</i> var. <i>leei</i> ( <i>Escobaria sneedii</i> var. <i>leei</i> ) Lee's pincushion cactus	T	E	SC	Cracks in limestone in areas of broken terrain and steep slopes of Chihuahuan Desert scrub	Species not found in project area during 2004 rare plant survey
<i>Echinocereus fendleri</i> var. <i>kuenzleri</i> Kuenzler's hedgehog cactus	E	E	SC	Gentle, gravelly or rocky slopes and benches on limestone or limey sandstone in grassland, oak woodland, or piñon-juniper woodland	Species not found in project area during 2004 rare plant survey
<i>Eriogonum gypsophilum</i> Gypsum wild-buckwheat	T	E	SC	Sparsely vegetated pure gypsum	Suitable habitat does not exist, and species not found in project area during 2004 rare plant survey
<i>Hexalectris nitida</i> Shining coralroot	–	E	SC	Deep canyons in leaf litter under oaks	Species not found in project area during 2004 rare plant survey
<i>Justicia wrightii</i> Wright's water-willow (Wright's justicia)	SC	S	SC	Limestone benches in Chihuahuan Desert scrub	Species not found in project area during 2004 rare plant survey
<b><i>Nama xylopodum</i></b> <b>Cliff Nama</b>	–	–	SC	<b>Abundant on exposed rocks and boulders on cliff surfaces and arroyo bedrock</b>	<b>Suitable habitat exists and species is confirmed in the project area</b>
<i>Penstemon cardinalis</i> ssp. <i>Regalis</i> Guadalupe penstemon	–	S	SC	Limestone slopes and canyon bottoms in montane scrub, piñon-juniper woodland, and lower montane coniferous forest	Species not found in project area during 2004 rare plant survey

**Table A.** Threatened (T), Endangered (E), Candidate (C), Species of Concern (SC), and Sensitive (S) Wildlife and Plant Species Known to Occur in Eddy County, New Mexico (continued)

PLANTS (continued)

Common Name ( <i>Scientific Name</i> )	STATUS			General Habitat	Occurrence in Project Area
	FWS <sup>1</sup>	STATE <sup>2</sup>	NPS <sup>3</sup>		
<i>Perityle quinqueflora</i> Five-flowered rock daisy	–	S	SC	Crevices of limestone bluffs; cliffs in high canyons and caprock	Species not found in project area during 2004 rare plant survey
<i>Salvia summa</i> Supreme Sage	–	–	SC	Typically occurs on cliffs and at cliff bases, but may also appear in arroyo bottoms	Species not found in project area during 2004 rare plant survey
<b><i>Sclerocactus uncinatus</i> ssp. <i>Wrightii</i></b> Chihuahuan fishhook Cactus	–	–	SC	<b>Dry, gravelly desert slopes, often under bushes below 4,500 feet.</b>	<b>Suitable habitat exists and species is confirmed in the project area</b>
<i>Streptanthus sparsiflorus</i> Few-flowered (Guadalupe) jewelflower	SC	S	SC	Limestone canyon bottoms and montane scrub	<b>Suitable habitat exists and species is confirmed in the project area</b>

Information taken from <sup>1</sup>USFWS 2006; <sup>2</sup>State of New Mexico: BISON-M 2006; NMDGF 2006; and EMNRD 2006; <sup>3</sup>NPS: Tonne 2004 and Carlsbad Caverns personal communication with Renee West and Danielle Foster, 2006. NMRPTC 1999 consulted for plant county-of-occurrence.

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