National Park Service
U.S. Department of the Interior

Waco Mammoth Site

Special Resource Study/Environmental Assessment

July • 2008

This report has been prepared to provide Congress and the public with information about the resources in the study area and how they relate to criteria for inclusion within the national park system. Publication and transmittal of this report should not be considered an endorsement or a commitment by the National Park Service to seek or support either specific legislative authorization for the project or appropriation for its implementation. Authorization and funding for any new commitments by the National Park Service will have to be considered in light of competing priorities for existing units of the national park system and other programs.

Cover illustration by Joe Taylor.

Summary

PURPOSE AND NEED

This special resource study is investigating, for possible designation as a new unit of the national park system, the site within the city limits of Waco, Texas, where the remains of a Pleistocene Columbian Mammoth herd were discovered.

Special resource studies are initiated at the direction of Congress. On December 16, 2002, Public Law 107-341 was enacted, directing the secretary of the interior, in consultation with the state of Texas, the city of Waco, and other appropriate organizations, to conduct a special resource study. The study would determine the national significance, suitability, and feasibility of designating the Waco Mammoth Site as a unit of the national park system, and the need for direct management by the National Park Service.

RESOURCE DESCRIPTION

The Waco Mammoth Site is located 4.5 miles north of Waco's city center. The study area includes over 109 combined acres under the ownership of the city of Waco and Baylor University.

Both entities have formed a partnership for the purpose of providing preservation and interpretation of the site's paleontological resources. A number of collected specimens are currently housed in Baylor University's Mayborn Museum Complex, while *in situ* specimens remain at the discovery site owned by the city of Waco.

Currently, visitor access to the Waco Mammoth Site is restricted and would continue to be so until the current actions already underway by the Waco community to erect an excavation shelter and provide for visitor access are completed. This would be the first time that public access would be accommodated at the site and mark a very special milestone for members of the Waco community who have been actively involved in preservation efforts there for almost 30 years.

SPECIAL RESOURCE STUDY PROCESS

To receive a favorable recommendation from the National Park Service, a proposed addition to the national park system must meet four criteria:

(1) Possess nationally significant resources

(2) Be a suitable addition to the system

(3) Be a feasible addition to the system

(4) Require direct management by the National Park Service instead of protection by another public agency or the private sector

National Significance

The paleontological resources of the Waco Mammoth Site meet the National Park Service's established criteria for national significance. The combination of both *in situ* articulated skeletal remains and the excavated specimens from the site represents the nation's first and only recorded discovery of a nursery herd of Pleistocene mammoths. The resource possesses exceptional interpretive value and provides superlative opportunities for visitor enjoyment and scientific study. The

resource retains a high degree of integrity as many of the remains represent fully articulated specimens of varying age groups. Their location and position have been recorded; the stratigraphy of the site has been studied in detail; and collected specimens have been placed under the curatorial care of a single institution.

Suitability

The resources of the Waco Mammoth Site meet the National Park Service's established suitability criteria for consideration as a new unit of the national park system. Including this site would expand and enhance the diversity of paleontological resources already represented by other parks in the system.

Feasibility

The Waco Mammoth Site is considered a feasible candidate for consideration as a new unit of the national park system. There are opportunities for efficient administration by the National Park Service at a reasonable cost, especially if existing partnership support could be maintained and enhanced.

Need for Direct Management by the National Park Service

The fourth and final criterion in the special resource study process is the determination of the need for direct management by the National Park Service. With the resources of the Waco Mammoth Site having met the criteria for national significance, suitability, and feasibility, it was deemed appropriate to investigate the potential for inclusion of the site in the national park system and for the National Park Service to take on key roles in a partnership arrangement. Comments received during the initial public scoping phase of the study project supported expanding the existing partnership between Baylor University and the city of Waco to include the National Park Service. It was found that direct NPS management is not the only practicable means for meeting the goals of protecting resources and furthering public use; however, to meet these goals to the fullest extent, there are significant roles that the National Park Service could have in site operation and management.

MANAGEMENT OPTIONS

The methodology adopted to assist in the evaluation of the need for direct management by the National Park Service included developing a range of management options or alternatives, analyzing the environmental consequences of each, and providing a comparison of the attributes of each alternative.

Alternative A – Continuation of Current Management Trend

Alternative A is the no-action alternative, which represents the continuation of current management trends at the Waco Mammoth Site and serves as a base-line measurement for comparing three proposed alternative management strategies. The existing cooperative management arrangement between the city of Waco and Baylor University would continue. The local community would continue to play a key partnership role in supporting current preservation and public access initiatives. Additional staffing, new programs, activities, or site development beyond the efforts currently underway by the Waco community are not considered in this alternative.

Alternative B – Partnerships Led by the City of Waco

The existing cooperative management arrangement between the city of Waco and Baylor University would be expanded with additional partners, with the city taking a lead role. National natural landmark status would be actively pursued, allowing the city to seek technical assistance from the National Park Service for site resource preservation, interpretation, and educational research. Additional partnerships, such as local community initiatives, land trusts, foundations, federal, state, and local governments, and nongovernmental organizations, would also

be sought to assist with developing and managing the site. This alternative would protect, provide opportunities for research, and interpret core paleontological resources. It also would give the city freedom to pursue possible broader ideas such as providing environmental education and recreational opportunities. An option under this alternative could include pursuing designation as a "National Park Service affiliated area" to further strengthen National Park Service involvement.

Alternative C – Partnerships Led by the National Park Service

Waco Mammoth Site would be a new unit of the national park system, in partnership with the city of Waco, Baylor University, and others. The National Park Service would take lead responsibility for ensuring the protection, scientific study, and visitor enjoyment of paleontological resources, enlisting the help of partners for this mission. Partners would also take the lead for initiating additional recreational and educational opportunities within the lands surrounding the core paleontological resource.

Alternative D – Managed as a Focused Unit of the National Park System

Waco Mammoth Site would be a new unit of the national park system. Ownership of all paleontological resources (*in situ* fossils and the collection of fossils currently housed at Baylor University) and their associated documentation would be transferred to the federal government and management would be by the National Park Service. The National Park Service would focus on a core mission of protection, scientific study, and interpretation of paleontological resources. The National Park Service would not likely expand beyond this core focus to initiate other projects such as environmental education or other recreational opportunities. Partners would still play a role in educational outreach, interpretive programs, and site security to assist the National Park Service with achieving its core mission.

The matrix on the following page compares and contrasts the major components of each alternative.

Environmental Assessment

In order to comply with the National Environmental Policy Act, an environmental assessment accompanies this special resource study. The analysis of potential environmental consequences to the resources resulting from implementation of the alternatives found that there is no potential for significant environmental effects. For all action alternatives, it is anticipated that there would be moderate, long-term, beneficial impacts to the fundamental resources of the Waco Mammoth Site, the visitor experience, and the socioeconomic environment. Minor, long-term, adverse impacts are anticipated to the other resources of the site (soils and prime farmland; floodplains and wetlands; vegetation, wildlife, and wildlife habitat) to accommodate future development to enhance the visitor experience and to provide for management support at the site. The effect on special status species cannot be determined for any of the action alternatives until more definitive implementation plans are developed for the site. There would be moderate, long-term, beneficial to moderate, long-term, adverse impacts to the city of Waco, Baylor University, or the National Park Service, depending on the management alternative.

The environmental assessment contributed to the finding that direct management by the National Park Service is not the only practicable means for meeting the goals of protecting resources and furthering public use. However, to meet these goals to the fullest extent, there are significant roles that the National Park Service could have in guiding the preservation efforts of the paleontological collection, enhancing the interpretive and educational outreach programs, and enabling an expanded level of scientific research and study of this special resource.

Most Effective and Efficient Alternative

The 1998 Omnibus Parks Management Act (*Public Law 105-391 §303*) and NPS policy mandate that each special resource study identify the alternative or combination of alternatives which would, in the professional judgment of the director of the National Park Service, be most effective and efficient in protecting significant resources and providing opportunities for appropriate public enjoyment. For the purposes of this study, effectiveness and efficiency are defined as the capability to produce desired results with a minimum expenditure of energy, time, money, or materials.

A comparison of costs associated with each alternative indicates that alternative A, the no-action alternative, which continues current management trends, would require the least expenditure of energy, time, money, and materials. However, alternative A does not include increases in staffing or operational funding; consequently accommodating visitor access to the site is limited in this alternative to only monthly scheduled events. This is not a reasonable level of public enjoyment for such a nationally significant treasure, and as such, alternative A is the least effective of all the alternatives.

Of the three action alternatives, alternative D requires the least expenditures of energy, time, money, and materials, although the range of visitor opportunities is limited to just those associated with the core paleontological resources. Alternatives B and C provide a greater range of visitor enjoyment opportunities without compromising resource integrity. While the range of visitor opportunities are similar under alternatives B and C, alternative C provides a greater level of assurance for maintaining long-term resource protection. Alternative C assumes a full time, onsite commitment of NPS specialists with experience in the management and interpretation of paleontological resources. The day to day efforts of NPS resource managers and interpreters under this alternative has the potential to provide a more stable and consistent approach for protecting and enhancing the conditions of paleontological collection, enhancing interpretive and educational programs, and enabling an expanded level of scientific research and study related to the special resource in comparison to the periodic NPS technical assistance provided under alternative B. Assuming initial and continued funding is made available to support this level of resource stewardship, alternative C is the most effective and efficient management alternative.

The National Park Service's preferred alternative has not been identified in the study report; a recommendation will be prepared after considering public comments on the study.

After public review, comments will be collected, analyzed, and summarized. A final compliance document will be prepared to accompany the study.

Summary of Alternatives

	Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the city of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Overall Management Framework	The existing cooperative management arrangement between the city of Waco and Baylor University is continued.	The existing cooperative management arrangement between the city of Waco and Baylor University is expanded with additional partners, with the city assuming the lead responsibility for managing the site as a city park.	Waco Mammoth Site would be a new unit of the national park system, in partnership with the city of Waco, Baylor University, and others.	Waco Mammoth Site would be a new unit of the national park system, with the entire paleontological resource managed onsite by the National Park Service (*in situ* specimens and the paleontological collection currently housed at Baylor University).
Concept for Management	Managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, and providing for onsite visitor enjoyment and understanding.	Same as alternative A, plus… An expanded range of recreational and environmental educational opportunities could be provided by the city.		Same as alternative A.
Site Recognition	Potential National Natural Landmark Eligible for NPS Affiliated area status	The city pursues National Natural Landmark designation. National Park Service affiliated area status may be considered by Congress to further strengthen NPS involvement.	New unit of the national park system	
Initial Costs	(1)	Waco Community $8.1 million	Waco Community $8.1 million NPS $0.6 million	NPS $2.6 million
Annual Costs	(2)	City of Waco $300,000 Mayborn Museum $45,000 NPS (for 5 years) $25,000	City of Waco $300,000 Mayborn Museum (2) NPS $345,000	NPS $768,500

(1) It is assumed that the Waco community efforts to erect a protection shelter over the excavation area and to provide for controlled visitor access to the site are already underway. Funding for additional staffing, programs, or facilities is not included under the no-action alternative.

(2) Annual costs for managing the Waco Mammoth Site are difficult to quantify as staff support from the city of Waco and/or the Mayborn Museum Complex is an assigned collateral duty among a range of other responsibilities.

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CHAPTER OVERVIEW

Chapter one describes why and how the Waco Mammoth Site Special Resource Study was conducted. The chapter concludes with a brief discussion of study limitations, cost feasibility, and legislative processes.

PURPOSE AND NEED

New areas are typically added to the national park system by an act of Congress. However, before Congress decides to create a new park it needs to know whether the area's resources meet established criteria for designation. The National Park Service (NPS) is often tasked to evaluate potential new areas for compliance with these criteria and document its findings in a special resource study.

On December 16, 2002, Public Law 107-341 directed the secretary of the interior, in consultation with the state of Texas, the city of Waco, and other appropriate organizations, to conduct a special resource study to determine the national significance, suitability, and feasibility of designating the Waco Mammoth Site area located in the city of Waco, Texas, as a unit of the national park system. The legislation further requires that the study process follow Section 8(c) of Public Law 91-383 (16 U.S.C. 1a-5(c)).

The purpose of this special resource study is to provide Congress with information about the quality and condition of the Waco Mammoth Site and its relationship to criteria for parklands applied by the National Park Service.

This report summarizes NPS findings from its preliminary investigations and, in combination with additional analysis, provides a comprehensive assessment of the Waco Mammoth Site as a potential addition to the national park system.

BACKGROUND

The Waco Mammoth Site is located 4.5 miles north of Waco's city center. Situated in a partially excavated wooded ravine between two upland river terraces between the Bosque and Brazos Rivers, the study area includes over 109 combined acres under the ownership of the city of Waco and Baylor University. Both entities have formed a partnership for the purpose of providing preservation and interpretation of the paleontological resources discovered there. The site is being studied because it has yielded a nursery herd of Columbian mammoths ranging from 3 to 55 years of age, which appear to have died approximately 68,000 years ago. The Waco Mammoth Site is the largest concentration in North America of extinct proboscideans dying from the same event; as such it provides a unique opportunity to understand and interpret the behavior and ecology of an extinct species. The discoveries have received international attention, with archeologists, geologists, and paleontologists from United States, Sweden, and Great Britain visiting the site.

Baylor University has been actively investigating the site since its discovery in 1978 by Paul Barron and Eddie Bufkin. To date, the skeletons of 24 mammoths and 1camel have been discovered. Additional remains found at the site indicate the presence of an extinct saber tooth cat, dwarf antelope, and giant tortoise. Three quarters of the mammoth specimens have been removed and are currently being stored in Baylor University's Mayborn Museum Complex. The *in situ* remains, under a 40'×100' tent structure in the upper part of the site, include an almost complete skeleton of an adult bull mammoth, parts of a juvenile skeleton, the exposed skull of a female mammoth and its skeleton which has not been fully exposed, parts of other mammoth skeletons, and the camel skeleton.

Since 1978, local citizenry, Baylor University, and the city of Waco have been actively working together to protect the Waco Mammoth Site in a number of ways. Collectively they have acquired over 109 acres of land in and around the discovery site. Grants secured through the Cooper Foundation have supported a majority of the excavations and research since 1984. A fiberglass cast made from a series of latex molds of the *in situ* bull and juvenile has been incorporated into the Waco Mammoth Site Experience exhibit at the Baylor University's Mayborn Museum Complex.

STUDY METHODOLOGY

By law (Public Law 91-383 §8 as amended by §303 of the National Parks Omnibus Management Act (Public Law 105-391)) and NPS policy, potential new units of the national park system must 1) possess nationally significant resources, 2) be a suitable addition to the system, 3) be a feasible addition to the system, and 4) require direct NPS management or administration instead of alternative protection by other agencies or the private sector. A seven step study methodology was used to determine if the Waco Mammoth Site satisfied the required conditions.

Step 1: Evaluate National Significance, Suitability, and Feasibility

To be eligible for designation, potential new areas must be nationally significant, a suitable addition to the national park system, and feasible to manage and operate.

To be considered nationally significant, an area must satisfy all four of the following standards:

- The area must be an outstanding example of a particular resource type.
- The area must possess exceptional value or quality in illustrating or interpreting the natural or cultural themes of our nation's heritage.
- The area must offer superlative opportunities for recreation, public use and enjoyment, or scientific study.
- The area must retain a high degree of integrity as a true, accurate, and relatively unspoiled example of the resource.

To be suitable as a new unit, an area must represent a natural or cultural theme or type of recreational resource that is not already adequately represented in the national park system or is not comparably represented or protected for public enjoyment by another entity.

To be feasible as a new unit, an area's natural systems or historic settings must be of sufficient size and appropriate configuration to ensure long-term protection of the resources and to accommodate public use. It must have potential for efficient administration at reasonable cost. Important feasibility factors include landownership, acquisition costs, access, threats to the resource, and staff or development requirements.

A complete discussion of national significance, suitability, and feasibility is presented in chapter three of this document.

Step 2: Initiate an Evaluation of Need for Direct National Park Service Management

If the resources meet the criteria for national significance, suitability, and feasibility, the special resource study process continues with a series of steps to assist in the determination of need for direct National Park Service management instead of alternative protection by another group.

Step 3: Assess Public Opinion and Ideas about Managing the Site

During a process called "scoping," information was obtained about the broad range of potential ideas, goals, and objectives that future visitors, park neighbors, local and state government agencies, regional residents, and the general public would like to see achieved at the Waco Mammoth Site. Scoping occurred

continuously throughout the planning process. A summary of stakeholder ideas and concerns is presented in chapter four.

Step 4: Develop Management Alternatives

As might be expected, some of the desires, future visions, and development ideas expressed by stakeholders were mutually compatible and others were not. Working in conjunction with its many planning partners, the planning team drew upon the full range of stakeholder input to formulate a range of management alternatives, each reflecting a different combination of site development, interpretation, management responsibility, and cost variables. When considered together, the range of ideas is intended to express the broad diversity of public comments and suggestions received during scoping. A complete description of each management alternative is included in chapter four.

Step 5: Analyze Potential Environmental Consequences Associated with each Management Alternatives

An analysis of the consequences of each alternative on the fundamental resources of the Waco Mammoth Site, other resources, visitor experience, management operations, and socioeconomic environment was prepared. The impact analysis focused on those resources and values that would be affected by one or more of the alternatives. The analysis included a description of the context, duration, and intensity of impacts on all the major resources and values affected by one or more of the alternatives. Direct and indirect impacts were described, as well as consideration of the effects of connected, similar, and cumulative actions.

The environmental review contributed to the evaluation of the need for direct National Park Service management.

Step 6: Publish Study Report and Distribute for Public Review and Comment

As part of the overall effort to encourage public involvement in the decision-making process, solicitation of public comment on the special resource study will follow the requirements of the National Environmental Policy Act (NEPA). Comments are considered a critical aid in helping the National Park Service refine and reshape, if necessary, its recommendations so that they best represent existing and potential future conditions at the site. After public review, comments on the study will be collected, analyzed, summarized.

Step 7: Transmit Study Report to Congress

The study report and summary of public comments will be transmitted by the region to the Washington Office of the National Park Service, an agency within the Department of the Interior. The Department of the Interior will transmit the study and a recommendation to Congress.

STUDY LIMITATIONS

A special resource study serves as one of many reference sources for members of Congress, the National Park Service, and other persons interested in the potential designation of an area as a new unit of the national park system. The reader should be aware that the analysis and findings contained in this report **do not guarantee the future funding, support, or any subsequent action by Congress**, the Department of the Interior, or the National Park Service. Because a special resource study is not a decision-making document, it does not identify a preferred NPS course of action.

NEPA regulations and NPS policy require that the study identify an environmentally preferred alternative. This is determined by applying criteria set forth in NEPA, as guided by direction from the Council on Environmental Quality (CEQ). The CEQ has stated that the environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed in NEPA, Section 101 by accomplishing the following objectives:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Cost Feasibility and Cost Estimates

Many projects that are technically possible to accomplish may not be feasible in light of current budgetary constraints and other NPS priorities. This is especially likely where acquisition and development costs are high, the resource may lose its significant values before acquisition by the National Park Service, or other protection action is possible.

Preliminary cost estimates are provided for each management alternative for comparison purposes only. It is recommended that a more comprehensive cost estimate be prepared prior to initiating any of the proposed planning, design, or construction recommendations proposed in this study.

Congressional Legislation

During scoping, many stakeholders had a number of questions regarding the special resource study process once the report is submitted to Congress. They also requested that the special resource study include a synopsis of the legislative process typically used to create a new unit of the national park system.

Legislation to create new parks may be introduced in either the House of Representatives or the Senate.

Once introduced, a new bill is assigned to the Committee having jurisdiction over the area affected by the measure. If introduced in the House, national parks legislation is generally referred to the Natural Resources Committee, Subcommittee on National Parks, Forests, and Public Lands. Park legislation introduced in the Senate is referred to the Energy and Natural Resources Committee, Subcommittee on National Parks.

The most intense discussions about a proposed new park generally occur during committee action. Public hearings are sometimes conducted so committee members can hear witnesses representing various viewpoints on the measure. The secretary of the interior may be asked to present the position of the Department of the Interior or the National Park Service on the bill to the committee during public hearings.

After hearings are completed, members of the committee study the information and viewpoints presented in detail. Amendments may be offered and committee members vote to accept or reject these changes. At the conclusion of deliberations, a vote of the committee members is taken to determine what action to take. The committee can decide to report (which means endorse or recommend) the bill for consideration by the full House, with or without amendment, or table it (which means no further action will occur). Congressional committees may table a bill for a variety of reasons including, but certainly not limited to, the legislative priorities of committee members or because the bill is not supported by the administration. Generally, if the committee feels another agency or organization is better suited to manage the site, or alternative preservation actions can recognize and protect important resources outside of the national park system, the proposed bill is not supported. Likewise, the committee may not support a bill over concerns for higher priority government-wide

obligations or sensitivity to adding additional management responsibilities to the National Park Service at a time of limited funding or personnel shortages.

Consideration by the full House or Senate can be a simple or complex operation depending on how much discussion is necessary and the numbers of amendments members wish to consider.

When all debate is concluded, the full House or Senate is ready to vote on the final bill. After a bill has passed in one house it goes to the other house for consideration. A bill must pass both the Senate and House of Representatives in the same language before it can be presented to the president for signature.

If the Senate changes the language of the bill, it must be returned to the House for concurrence or additional changes. This back-and-forth negotiation may be conducted by a conference committee that includes both House and Senate members. The goal of a conference committee is to resolve any differences and report (resubmit) an identical measure back to both bodies for a vote.

After a bill has been passed in identical form by both the House and Senate, it is sent to the president who may sign the measure into law, veto it and return it to Congress, let it become law without a signature, or at the end of a session, pocket veto it. If the bill becomes law, a new unit of the national park system is authorized. The language in the new law is often referred to as the park's enabling legislation. Enabling legislation defines the purpose of the park and may specify any standards, limits, or actions that Congress wants taken related to planning, land acquisition, resource management, park operations, or funding.

Chapter Two: Resource Description

CHAPTER OVERVIEW

Chapter two describes the special resources of the Waco Mammoth Site. A summary description of Pleistocene mammoths (genus *Mammuthus*) is presented to provide context for the resource type, followed by a description of each of the four fundamental resource components that together constitute the special resources of the Waco Mammoth Site.

PLEISTOCENE MAMMOTHS (*MAMMUTHUS*)

Mammoths are members of the order *Proboscidea*, and are related to the modern elephant, especially the Asiatic elephant (*Elephas maximus*). Mammoths lived in North America during the Pleistocene Epoch, a time period about 2,000,000 years in length that ended roughly 10,000 years ago. Paleontologists theorize that representatives of the southern mammoth (*Mammuthus meridionalis*), which originated in Eurasia, migrated to North America from northeastern Siberia by way of the Bering Land Bridge during the early Pleistocene (at least 1.7 million years ago). In North America, the southern mammoth evolved into the imperial mammoth (*Mammuthus imperator*) during the middle Pleistocene. By the end of the middle Pleistocene, the Columbian mammoth (*Mammuthus columbi*) had evolved from the imperial mammoth. It became the largest of the three species, with a shoulder height reaching 12 to 14 feet. The Columbian mammoth preferred the more temperate to subtropical regions of the United States, Mexico, and Central America; fossils are found distributed across most of the North American continent. The Columbian mammoth is the species of mammoth found at the Waco Mammoth Site.

The woolly mammoth (*Mammuthus primigenius*) is smaller (10 feet at shoulder height) than the Columbian mammoth and is the most commonly recognized mammoth species by the general public. Similar to the Columbian mammoth, the woolly mammoth is a descendant of the southern mammoth, although the woolly mammoth evolved in Eurasia. Paleontologists theorize the woolly mammoth migrated to North America from Eurasia much later than the Columbian mammoth, approximately 35,000 and 18,000 years ago during the latter stages of the late Pleistocene.

Woolly mammoths typically inhabited the northern, colder regions of the continent, with a distribution mainly restricted to Alaska and Canada; however, remains have been discovered as far south as Kansas.

References can be found to yet another New World mammoth species, Jefferson's mammoth (*Mammuthus jeffersonii*), which has been found mostly around the Great Lakes region, although some paleontologists theorize this species to be synonymous with *Mammuthus columbi*.

The smallest of the New World mammoth species is the island dwelling pygmy mammoth (*Mammuthus exilis*). The remains of this creature have been found exclusively on San Miguel, Santa Rosa, and Santa Cruz Islands of Channel Islands National Park. Columbian mammoths originally inhabited the islands, but paleontologists theorize that over time and through a series of environmental stresses—such as shrinking habitat from rising sea levels during the end of the last Ice Age, overcrowding, and drought—natural selection favored smaller individuals, ultimately producing *Mammuthus exilis*. Evolving from Columbian mammoths, pygmy mammoths were considerably smaller (4 –8

feet at shoulder height) than their predecessors.

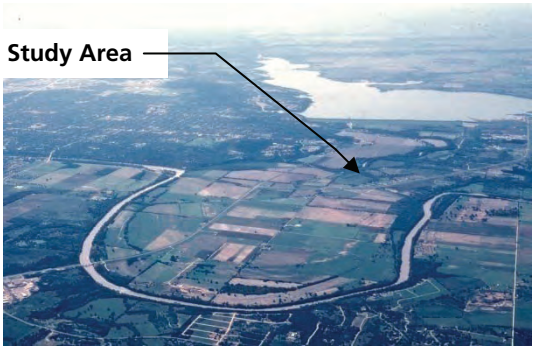
All New World mammoths became extinct about 11,000 years ago. There is much debate on the cause of the late Pleistocene mammalian extinction, theories range from disease or Paleo-Indian predation, to climatic or environmental change.

To date, 24 Columbian mammoths have been discovered at the Waco Mammoth Site. Eighteen specimens have been excavated and removed, four have been partially excavated and remain *in situ*, one was encountered while taking soil core samples for a geologic study, while another was recently found within the northwest wall of the excavation pit after a storm event eroded a portion of the wall. The resources of the Waco Mammoth Site include four fundamental resource components: the geologic context of the discovery site, the *in situ* specimens, the collected specimens, and the associated archival records.

GEOLOGIC CONTEXT OF THE DISCOVERY SITE

The current understanding of the site's geological context, as presented by Baylor University's Dr. Lee Nordt during the study team's initial site visit in July 2005, is summarized as follows:

The site is located on the second and third terrace level above the Bosque River within a partially excavated wooded ravine containing highly erodible silt/clay soils. It appears the paleosols are 4 –5 meters thick before encountering bedrock. The site is a freely drained environment, without a high water table. The site is unusual in that it is at the contact or border between two ecosystems represented on each side of the drainage. There are two terraces straddling the site that are composed of different sediments, derived from two different sources: The Bosque River and the Brazos River. The Bosque River only drains black land prairie soils, which are clay rich and contain mostly calcareous alluvium exclusively from a limestone source. In contrast, the Brazos River drains some black land prairie soils but mostly siliceous based sediments containing quartzite and chert. Documenting the sequence of terrace deposits may potentially reveal an earlier confluence position of the Brazos and Bosque Rivers.



Aerial view looking SW over the Waco Mammoth Site

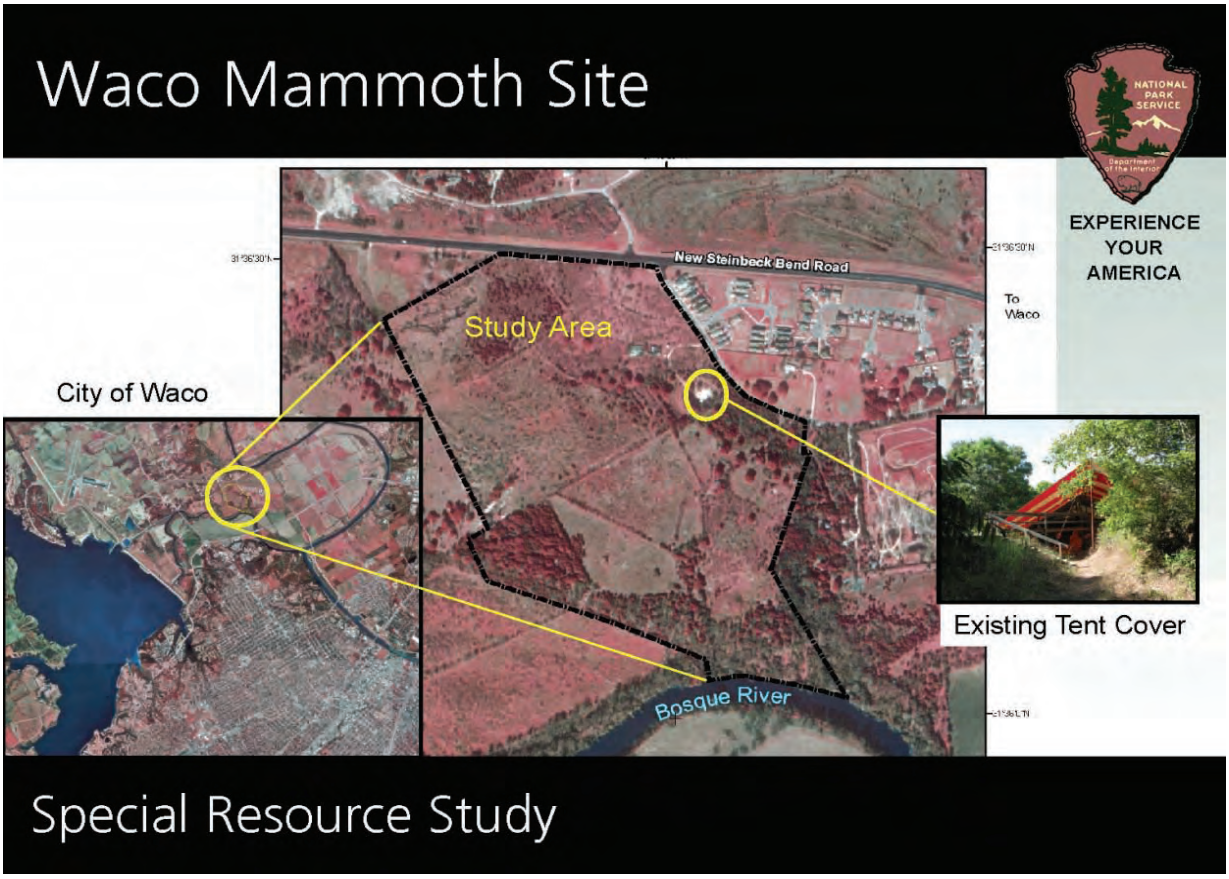
Initial dating efforts of the Waco Mammoth Site were attempted during the mid-1980s. Baylor University staff working with geochemist Dr. Herb Hass, Southern Methodist University, Texas, attempted radiocarbon dating on two samples; one sample was sent to Stafford Research Laboratories, Boulder, Colorado. The results of one sample came up inconclusive because it required the preservation of collagen, which unfortunately was not found. The second indicated a date of 28,000 years before present (BP); this then became the de facto date of the mammoth event. Pollen records for the area only go back 18,000 BP.

The estimated time of accumulation (28,000 BP) seemed too early based on the location of the mammoth herd within the terrace sequence. Another testing method was tried utilizing uranium series dating of the tooth enamel. The results of this test were not initially considered accurate because they were much older than the expected age of the site. Dr. Steve Foreman, University of Illinois, Chicago, was then contacted to attempt optically stimulated luminescence testing, a fairly new technique which dates the last time quartz deposits in the alluvial sediments were exposed to daylight. Samples were taken around, above, and below the mammoth bones. The technique indicated that it had

been 58,000 –73,000 years since the deposits had been exposed. This additional testing led to a change in the interpretation of the age of the site to approximately 68,000 BP rather than 28,000 BP. This older date is what is currently presented in the Waco Mammoth Site exhibit in the Mayborn Museum Complex.

In an effort to determine the extent of the resource still buried at the site, ground-penetrating radar was attempted but proved unsuccessful primarily due to the lack of contrast between the densities of the soil and the mammoth bones.

The recent research conducted by John Bongino as a part of his masters' thesis completed in August 2007 through Baylor University's Department of Geology has provided valuable additional information and interpretation of the soil stratigraphy and geologic context of the site. During the initial visit to the site by the study team, Mr. Bongino presented an overview of the research he was conducting to more accurately map the microstratigraphy of the site. He was attempting to provide a time line for the death of the mammoths, and confirm whether it was a single catastrophic event. His work has resulted in a refinement of the understanding of the circumstances surrounding the concentration of mammoths discovered there. His findings indicate that a herd of at least 19 adult female and juvenile mammoths succumbed in a single event, while also suggesting there were subsequent accumulations later in time.

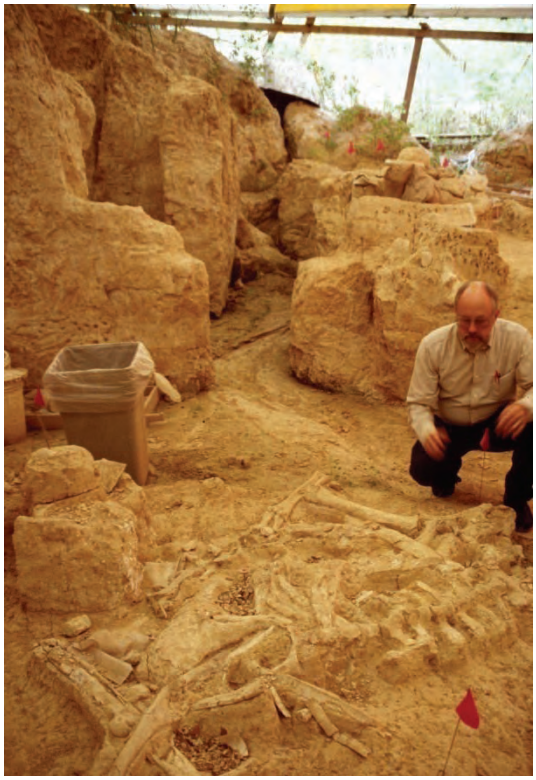


IN SITU SPECIMENS

Under a 40' ×100' tent structure that covers the upper part of the excavation area, the partially uncovered *in situ* material represents the remains of four Columbian mammoths (*Mammuthus columbi*): an almost complete skeleton of an adult bull, parts of a juvenile skeleton, the exposed skull of a female and its skeleton which has not been fully exposed, plus parts of other mammoth skeletons. In addition, there is a western camel (*Camelops hesternus*) skeleton, minus the skull, which was removed as a protective measure by Baylor University in 2005. Also, a deciduous canine tooth from a juvenile saber tooth cat (*cf. Smilodon*) was found in association with the remains of an unidentified animal whose bones are too small to be mammoth. Another mammoth was discovered 11 feet below the ground surface during subsurface coring 75 feet northeast of the covered, upper excavation area of the site, while another was recently found within the northwest wall of the upper excavation pit after a storm event eroded a portion of the wall.

Waco Mammoth Site upper excavation area, overlooking the in situ bull mammoth

The excavation pit retains a soil profile wall on three sides with a 9- to 10-foot depth to the pit floor on the upper end. On the open end, the pit connects with the initial discovery area or lower excavation area. Excavation efforts have been ongoing since 1978, when the bones were first discovered by Paul Barron and Eddie Bufkin who brought the find to the attention of David Lintz of Baylor University's Strecker Museum. The initial excavation efforts took an archeological approach to the work based on a potential association with Paleo-Indians. Soil pillars in the upper portion of the site were left in place to retain a reference sample of the soil stratigraphy. All sediments removed were screened as part of the excavation process. Evidence of human activity was not found, shaping the current theory of the site as a natural event and not a kill site. The site is now known to predate the entrance of humans into North America.



Upper excavation area, in situ prehistoric camel

Dr. Greg McDonald, paleontologist and NPS Senior Curator of Natural History providing guidance on in situ specimen preservation.

COLLECTED SPECIMENS

Collected specimens are currently being stored in Baylor University's recently opened (May 2004) Mayborn Museum Complex. A majority of the specimens are from the lower, southwest section of the excavation area where 16 mammoth skeletons were collected during a mass removal in the 1990s as the exposed specimens were being threatened by stormwater runoff.

Waco Mammoth Site lower excavation area

Parts of a juvenile skeleton (specimen #18 in figure #1) over the bull's tusk were removed as part of the casting effort during the mid 1990s. The lower female (specimen #21) from the upper concentration was removed later after erosion threatened its integrity. The collection includes 18 articulated or semi-articulated remains of Columbian mammoths, a Western camel skull, a molar from a dwarf antelope (*cf. Capromeryx*), and a giant tortoise shell (*Geochelone sp.*). A majority of the larger parts of the specimens are encased in 93 plaster field jackets and have not been prepared.

Collection storage in Mayborn Museum Complex

Preparation efforts remain to be completed that would include establishing protocols and documentation methods; removing specimens from field jackets; removing sediment from the bones; hardening the bones by impregnating with plastic if needed; reassembling broken pieces; re-associating separated material with original specimens; documenting, cataloging, and placing prepared specimens in cabinets or on shelving; and making them available for study or for casting for interpretive exhibits. There are also 137 boxes of collected material from the site, 11 of which contain soil samples. Approximately 30%–40% of the boxes contain mammoth bones that were washed from the exposed skeletons during storm events in 1978, 1981, 1984, and 1986. Staff from the Mayborn Museum Complex are currently sorting specimens and attempting to associate them with specific skeletons.

ARCHIVAL RECORDS

The archival records include slides and photographs of the excavation efforts, field notes, field maps, stratigraphic cross sections, research files, correspondence, grant proposals, and other records pertaining to the site.

A condition assessment of the collections and archives was conducted in February 2006 by Dr. Greg McDonald, NPS senior curator of natural history. A copy is included in appendix B.

Figure 1: Waco Mammoth Site Plan Map

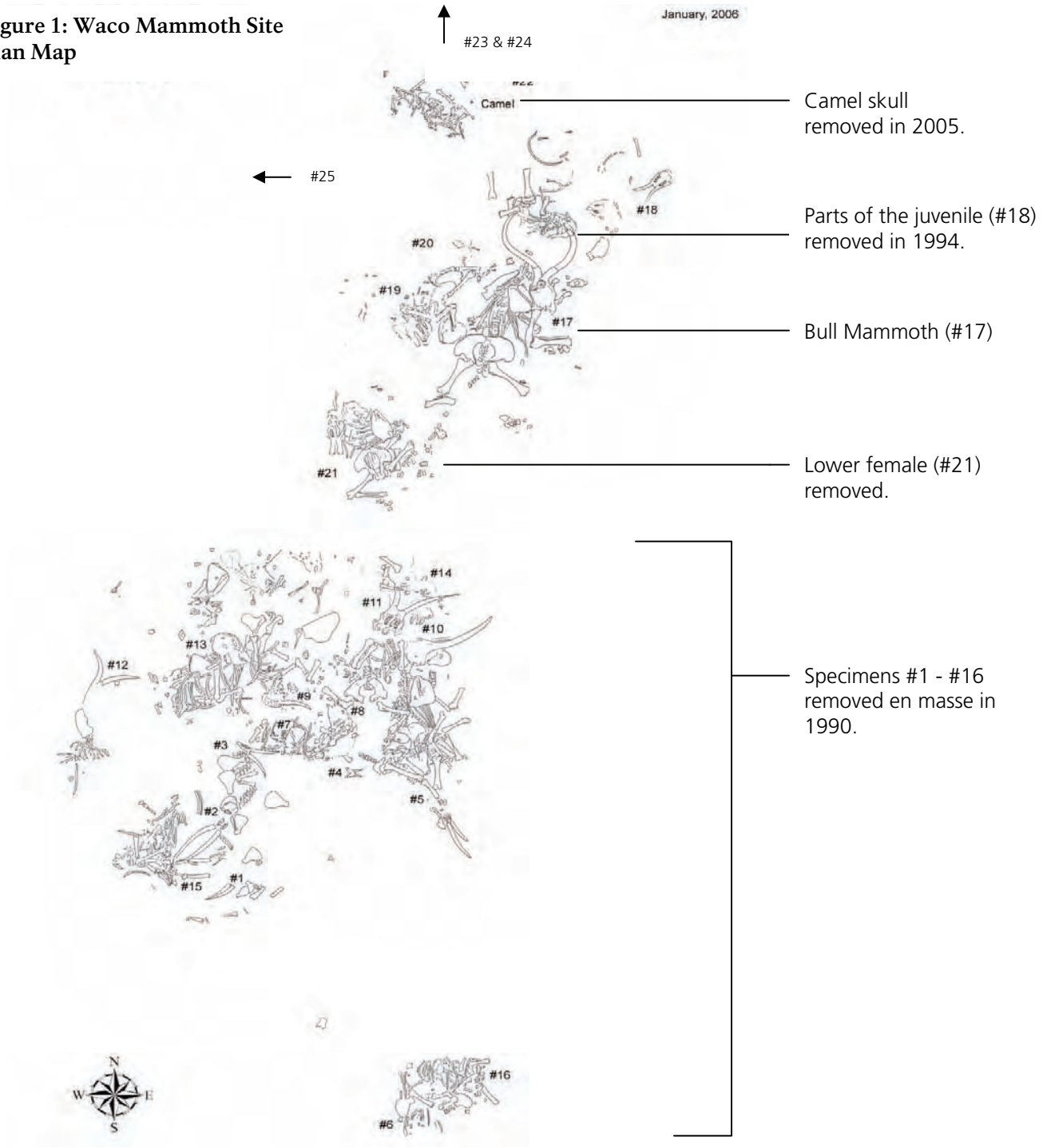


Figure 1 illustrates the original positions of 21 of the 24 known mammoth specimens and camel mapped by Ralph Vinson. Specimens #23, #24, and #25 have not as yet been recorded on the map. The female mammoth specimen #23 is only partially uncovered and located just north of the camel specimen #22. The 23rd mammoth (specimen #24) is approximately 75 feet northeast of the upper concentration and was encountered 11 feet below the ground surface during soil core sampling in 1996. This specimen has not been excavated. Bones from what appears to be the 24th mammoth (specimen #25) were partially revealed along the west wall after a storm event in 2007.

CHRONOLOGY OF EVENTS ASSOCIATED WITH THE WACO MAMMOTH SITE

Calvin Smith, who was the director of Baylor University's Strecker Museum from 1984 until his retirement in 2003, graciously provided a majority of the information regarding the years from 1978 through 2002 presented below.

1978 –1980 The remains of five Columbian mammoths were discovered by Eddie Bufkin and Paul Barron and excavated by David Lintz from the Strecker Museum and George Naryshkin of the Department of Geology at Baylor University.

1981 –1983 No excavation activities during this time.

1984 In February, three additional specimens were found eroding out of the bank.

Under the direction of Calvin Smith, the newly appointed director of the Strecker Museum, excavations were begun in May expanding the discovery to a total of eleven mammoths by July.

The first of many grants was received from the Cooper Foundation, $2,500 to explore the size and scope of the site.

A 5" rainfall inundated the site in October resulting in more animals being exposed.

Another grant was received from the Cooper Foundation, $26,800 to build a diversion dam, purchase and erect a tent over the excavated area, and to hire Ralph Vinson as the chief excavator and coordinator of the volunteer efforts.

By December a total of 15 mammoths had been identified including a 45 year old female with a juvenile lying across her tusks.

Dr. Gary Haynes visited the site for the first time and stated that it was "the largest concentration of extinct proboscideans to die from the same event known to science."

1985 –1986 Excavations of the specimens continued with only one additional mammoth discovered.

1987 At the request and encouragement of Dr. Haynes and with a $10,500 grant from the Cooper Foundation, the Strecker Museum and Baylor University in conjunction with the Annual Meeting of the Texas Archaeological Society hosted the symposium, "Mammoths, Mastodons and Human Interaction" which had 500 attendees from across the country.

1990 Baylor initiated a mass removal of 16 specimens from the site, utilizing the assistance of numerous volunteers including the Dallas Paleontological Society and the Central Texas Archaeological Society, many students from Baylor University, and another grant from the Cooper Foundation of

$16,975. The bones were placed in storage in Baylor University's Strecker Museum.

1991 Baylor University initiated additional explorations of the upper portion of the site. The herd bull that Dr. Haynes had predicted might be in the area was discovered with a juvenile over his right tusk. The Cooper Foundation provided additional grants of $7,975, $9,000, and $17,800 during this period of time.

1992 *Proboscidean and Paleoindian Interactions* edited by J.W. Fox, C. B. Smith, and K.T. Wilkins, was published by Baylor University Press. The book is a compilation of papers presented at the 1987 symposium "Mammoths, Mastodons and Human Interaction" held in Waco, Texas. Included in this publication under chapter four is *Herd Bunching at the Waco Mammoth Site: Preliminary Investigations, 1978-1987*.

1994 Calvin Smith contacted Joe Taylor of Mt. Blanco Casting Company from Crosbyton, Texas to cast the bull and juvenile *in situ* so their relative positions could be recorded. After receiving another grant for $14,300 from the Cooper Foundation, the largest field latex mold of an *in situ* specimen made to date was achieved between April 1st and June 3rd. This resulted in over 40 "mother molds" that could be separated and reassembled in the lab for the final process of pouring a fiberglass cast of the two specimens. The cast is currently exhibited in Baylor University's Mayborn Museum Complex, successor to the Strecker Museum.

The camel, the deciduous tooth from a saber-toothed cat, and the 22nd mammoth were discovered.

1996 Ground penetrating radar was attempted on areas surrounding the excavation site without success.

Sam Jack McGlasson donated 4.93 acres to the city of Waco (an area surrounding and including the excavation site). Conditions of the conveyance require the city to use the property for research, educational, and/or tourism purposes and for the city to enter into an agreement with Baylor University concerning the maintenance of the property as an educational resource for the citizens of Waco, visitors and researchers.

The 23rd Mammoth was discovered when a student doing soil core samples encountered what was believed to be a mammoth pelvis. This specimen is 75 feet from the upper excavation area and has not been excavated.

1997 Calvin Smith presented a paper on the site and its importance, to the 30th International Geological Congress in Beijing, China making it known to the global scientific community.

1999 The first development proposal for the site was commissioned by the city of Waco. The proposal recommended developing the site as a 200-acre regional park with recreational amenities, and included a master plan illustration for the site, building program, and cost estimates.

2000 A second development plan was produced and presented by Calvin Smith which included a modified program for the park, planning and funding goals, budget, time table, maps, and a proposal for a cooperative venture.

With gifts from Buddy Bostick and Don and Pam Moes to Baylor University, 55 acres of land connecting the site with the Bosque River was purchased by Baylor University.

2001 With a major reduction by Liz McGlasson in the asking price for an additional 50 acres bordering Steinbeck Bend Road and with an additional gift from Buddy Bostick, Baylor University purchased the remaining land encompassing the site to extend the buffer around the excavated area.

Congressman Chet Edwards introduced legislation to direct the secretary of the interior to conduct a special resource study of the Waco Mammoth Site.

2002 During the spring of 2002, the city commissioned a feasibility study of the resource by Lord Cultural Resources Planning and Management Inc. The effort included an analysis of conservation and preservation needs; potential visitor experience; space, facilities, and capital costs; governance and staffing; and market/financial analysis. Based on the recommendations of the study completed in June 2003, excavation efforts were discontinued and public access to the site was restricted to avoid resource degradation.

On December 16, Public Law 107-341 authorized the special resource study for the Waco Mammoth Site.

2004 In May, Baylor University's Mayborn Museum Complex (former Strecker Museum) was opened to the public. The collection and archives from the Waco Mammoth Site were moved from the Strecker Museum into the geology/paleontology collections room of the new museum. A full room interpretive exhibit of the Waco Mammoth Site was presented in the Hall of Natural History. A dynamic walk-in diorama featuring a cast of the skeletal remains of the herd's bull with a juvenile cradled in its tusks can be viewed through a thick glass floor over the exhibit. A continuous loop film depicts what is believed to be the last moments of the herd's survival before they perished. Static and interactive interpretive displays on mammoths were presented as well, and remain to interpret the site.

2005 The camel skull was removed as a protective measure due to emerging drainage channels forming in the excavation pit from stormwater runoff.

Baylor University graduate student John Bongino initiated research into the site's microstratigraphy. The goal of the study was to attempt to establish a timeline for the deaths of the mammoths, reconstruct the depositional history of the site, terrace formation, and the prehistoric relationship of the two river systems.

Funding to initiate the special resource study was first made available.

2006 Congressman Edwards secured a $200,000 grant through Save America's Treasures Program administered by the National Park Service for the purpose of replacing the tent and erecting a more durable shelter over the *in situ* specimens, enhancing site security, and making the site accessible to the public.

Waco Mammoth Foundation chartered by the city of Waco and Baylor University. The foundation initiated a major fundraising campaign to support resource protection efforts and visitor access accommodations for the site.

Design contract awarded to Coterra-Reed for the design of an excavation shelter to protect the *in situ* specimens and to provide for controlled public access to the Waco Mammoth Site.

2007 John Bongino completed his master thesis in August. His work has resulted in a refinement of the understanding of the circumstances surrounding the concentration of mammoths discovered there. His findings indicate that a herd of at least 19 adult female and juvenile mammoths succumbed in a single event, while also suggesting there were subsequent accumulations later in time.

2008 The Waco Mammoth Foundation succeeded in their fundraising efforts and collected over $3 million dollars to support the construction of an excavation shelter and to accommodate visitor access to the site. The city of Waco's Department of Parks and Recreation is planning to contract for the construction in 2008.

Chapter Three: Resource Evaluation

CHAPTER OVERVIEW

Proposals for new parks are carefully analyzed in a special resource study to ensure only the most outstanding resources are considered for addition to the national park system. In chapter three, the special resources of the Waco Mammoth Site are evaluated to determine if they are of national significance, and how suitable and feasible the resource may be for NPS designation, using criteria established by law and National Park Service policy.

EVALUATION OF NATIONAL SIGNIFICANCE

For the resources of the Waco Mammoth Site to be considered nationally significant, they must meet all four of the following standards:

- **Resource Quality** - It is an outstanding example of a particular resource type.
- **Interpretive Value** - It possesses exceptional value or quality in illustrating or interpreting the natural or cultural themes of our nation's heritage.
- **Potential for Use** - It offers superlative opportunities for recreation, public use and enjoyment, or scientific study.
- **Integrity** - It retains a high degree of integrity as a true, accurate, and relatively unspoiled example of the resource.

The study team used the Delphi process in the development of draft significance statements for the Waco Mammoth Site. The Delphi technique, originally developed by the Rand Corporation, is a structured process for collecting and distilling knowledge from a group of experts through a series of re-iterative questionnaires. This included identifying and inviting a panel of paleontological and other scientific experts to participate in the process. A series of questionnaires were distributed to the group for their input. In subsequent rounds, each participant received a composite of the feedback received from the entire panel in the previous round and was then asked to provide additional comment on the consolidated list. The process was repeated as necessary to help inform the documentation of the resource's significance.

The first round of the process included sending information on the Waco Mammoth Site to 32 individuals with an invitation to participate. This was initiated on November 22, 2005. We received positive responses to participate from 17 individuals.

The second round of the process was initiated on January 31, 2006, and included sending the following five questions to each of the 17 participants who had responded to the first round:

1. What do you think are the top three fossil sites, Pleistocene sites, and mammoth sites in the nation?

2. What criteria did you use to determine your choices?

3. What criteria would you use to classify a site as an exceptional example of paleontological resources in the United States?

4. What values do you believe a site should possess to further the understanding of paleontology in the United States?

5. What degree of integrity should a paleontological site retain to be considered a true, accurate, and relatively unspoiled example of a paleontological resource? Please explain.

6. Can the degree of integrity at a site be improved?

Five participants responded to the second round. The third round of the Delphi process was initiated on March 13, 2006, and included

sending the composite results of the input received from round two and asking for any additional input. Two participants transmitted additional comments to the composite.

The results of the third round provided the team with the parameters needed to craft an initial list of draft significance statements for the Waco Mammoth Site.

The fourth round of the Delphi process included transmitting this list on May 1, 2006, to all participants for their consideration and review.

Based on the input received throughout the process and further deliberation among the study team, the draft significance statements were refined and currently include the following findings regarding the four significance standards:

Resource Quality – Is the site an outstanding example of a resource type?

Fossil resources are found in over 180 units of the national park system and span the entire range of geological time from the Precambrian to the Pleistocene. Among these are parks specifically established because of their important fossil resources and include the following NPS units:

Agate Fossil Beds National Monument, Nebraska – Miocene

Badlands National Park, South Dakota – Cretaceous, Eocene, Oligocene

Dinosaur National Monument, Colorado – Utah – Jurassic

Florissant Fossil Beds National Monument, Colorado – Eocene

Fossil Butte National Monument, Wyoming – Eocene

Hagerman Fossil Beds National Monument, Idaho – Pliocene

John Day Fossil Beds National Monument, Oregon – Eocene, Oligocene, Miocene

Petrified Forest National Park, Arizona – Triassic

These parks are complemented by other parks that were not established specifically to protect fossil resources but are, nonetheless, equally important for the fossils they protect. These parks include the following NPS units:

Big Bend National Park, Texas – Cretaceous

Channel Islands National Park, California – Pleistocene

Death Valley National Park, California—Nevada – Paleozoic, Miocene

Grand Canyon National Park, Arizona – Paleozoic, Pleistocene

Guadalupe Mountains National Park, Texas – Permian, Pleistocene

While Pleistocene fossils occur in numerous parks, interpretation in these parks does not focus on the Pleistocene biota. In this respect, the Waco Mammoth Site is a distinctive type of fossil resource that represents a portion of geological time that completes the story told by these other parks and complements and enhances the story told by the small number of parks with Pleistocene fossils.

Even though mammoth remains are known from other NPS units, they—like most records of mammoths in North America—consist mostly of isolated remains. The combination of both *in situ* articulated skeletal remains and the excavated specimens from the Waco Mammoth Site represent the only recorded instance in the United States of a nursery herd of Pleistocene mammoths. It is further unique in that the nature of the herd's preservation suggests evidence of group behavior and survival instincts during a naturally occurring catastrophic event.

Interpretive Value – Is the site an exceptional value/quality in illustrating/interpreting the natural or cultural themes of our nation's heritage?

The Waco Mammoth Site possesses exceptional value and quality for interpreting the geological and paleontological history of the nation, with a special focus on the late Pleistocene conditions and events occurring 68,000 years ago along the interface of two physiographic provinces: the Great Plains and Gulf Coastal Plains. In addition to the Columbian mammoth herd, other associated faunal remains provide additional opportunities for enhancing our understanding of a broader representation of life forms present during the later phases of the Pleistocene Epoch. (National Park Service's Natural History Theme #19 Geologic History, subtheme: Oligocene – Recent epochs as described in *Natural History in the National Park System and on the National Registry of Natural Landmarks* 1990*)*

Columbian mammoths are one of the iconic species of the Ice Age in North America, having been found at multiple localities in the United States (see figure 2). They are displayed in museums as whole skeletons or isolated bones and teeth; often the displayed skeletons are composites from multiple individuals—rarely are complete associated skeletons known. Sites in which the remains of more then one individual have been recovered are even rarer (see table #2) and are often the result of accumulation of individual animals over long periods of time such as those found at the tar pits at Rancho La Brea in Los Angeles, California, or the Mammoth Site at Hot Springs, South Dakota. Many sites containing this extinct species are the result of human hunting activities; they cannot be considered indicative of the mammoth's natural history but rather of human history. The Waco Mammoth Site is the first recorded discovery in North America that contains the remains of multiple individuals of different ages that died during a restricted period of time, apparently due to a catastrophic event. Ongoing research at the site is suggesting that not all of the mammoths found there had died during this single event but the remains may include individuals that died earlier or later. This raises an interesting aspect as to site fidelity by Columbian mammoths; the site may have been used frequently over time and during one of these visits the catastrophic demise of a nursery herd occurred. Both components of the site add to its importance as a keystone to understanding the natural history of this extinct species. It can serve as a reference point to which previous discoveries can be reexamined and new discoveries compared.

The site represents an excellent, modern day example of how the power of community commitment can foster preservation of our nation's natural heritage. Local citizens, Baylor University, and the city of Waco have been actively involved as a group to promote the national recognition of this site, to initiate and continue to provide protective measures for the resource, to pursue fund raising activities to support continued resource preservation efforts, and to provide volunteer efforts with excavation activities at the site.

Potential for Use – Does the site provide superlative opportunities for public enjoyment or scientific study?

The Waco Mammoth Site provides superlative opportunities for public enjoyment and scientific study. Effective interpretative programs could be developed for various educational levels. Such an effort could include programs for school groups at all levels: elementary, middle, and high school. It could offer programs for the public at a general adult level of education. It could also include scientifically detailed programs for students in college and graduate school. Baylor University has established a precedent for taking school groups to the site. The university has already involved undergraduate and graduate students with the site through its museum studies and geology programs. The site has the scientific potential to directly engage other disciplines besides paleontology such as botany, zoology, and geology.

The catastrophic event that resulted in the death and preservation of the herd of Columbian mammoths at the Waco Mammoth Site provides a rare opportunity to study a social group in the fossil record and infer group behavior in an extinct species. As such the site provides an opportunity to contribute to modern zoology by allowing a comparison between the herd dynamics and behavior patterns in an extinct elephant species with those of modern elephants. The study of the transition of the living biota into the fossil record and the potential biases that may be introduced is called taphonomy. Recognition of these biases is critical to better understanding the ecology of an extinct species and how it can provide insight into understanding the historical origins of the ecology of its living relatives. The Waco Mammoth Site provides an opportunity to demonstrate and explain to the public this sub-discipline of paleoecology and the methodologies involved in understanding the ecology of an extinct species as well as provide opportunities for future research.

The Waco Mammoth Site provides scientifically valuable study opportunities to compare mammoth specimens found in a natural accumulation with mammoth specimens found elsewhere in Paleo-Indian kill or butcher sites. The Waco Mammoth Site offers excellent taphonomic comparison opportunities with sites similar to the Lubbock Lake Landmark site where Paleo-Indians hunted mammoths.

Opportunities present themselves for conducting research and teaching about the contribution of the Waco Mammoth Site to the science of paleontology because approximately 30% of the known Waco mammoth specimens are still *in situ*. This situation provides researchers and visitor opportunities to examine firsthand the physical conditions governing the site, how the fossil site was formed, and how it was initially excavated by archeologists and paleontologists. Additional research would help further our scientific understanding to interpret to the public the conditions and sequence of events that led to the collective death of the mammoth herd at Waco.

The Waco Mammoth Site affords exceptional opportunities not only for public enjoyment or scientific study, but also for the public enjoyment ***of*** scientific study. These opportunities amount to fostering an understanding, appreciation, and respect for the science of paleontology. The preservation of a portion of the bones of the mammoth herd *in situ* provides opportunities to teach about the scientific method in general and about paleontology in particular as a historical science. Along with geology and archeology, paleontology's goal is to reconstruct events that have already taken place by attempting to find out what happened and why. Historical scientific methodologies and techniques are essentially different from those employed in the experimental sciences of biology, chemistry, and physics. The Waco Mammoth Site provides opportunities to demonstrate how knowledge of the experimental sciences plays a critical role in collecting information to reconstruct past events of the Earth's history. Specifically, such knowledge is useful when applied to questions at Waco, particularly as to when, how, and why most if not all of the mammoths found there died, herded together some 68,000 years ago.

Integrity – Does the site retain a high degree of integrity as a true, accurate, and relatively unspoiled example of a resource?

The Waco Mammoth Site retains a high degree of integrity as many of the *in situ* and excavated skeletons represent fully articulated specimens. Their location and position have been recorded; removed specimens have been encased in plaster jackets and placed in storage at the nearby Baylor University's Mayborn Museum Complex. There are sufficient undisturbed deposits to provide material for future study as approximately 30% of the known specimens are still *in situ*. Soil pillars have been retained within the excavated pit to provide a reference for future sediment studies.

As a paleontological site, the Waco Mammoth Site is unusual in that it has only been excavated by a single institution; this means all specimens and the associated documentation are maintained by a single entity. Many sites, such as the Tar Pits at Rancho La Brea in Los Angeles, California, were excavated by multiple institutions and the specimens and data are housed in different places resulting in a logistical challenge to researchers. In other cases such as the Dent Mammoth site, in Colorado, while only a single institution excavated the site, some specimens were exchanged with other museums for exhibits; this requires an investigator to travel to multiple sites to examine the complete sample. At the Waco Mammoth Site, the housing of the excavated specimens and associated data together, along with the *in situ* material, creates a distinct advantage for researchers wishing to examine the entire sample.

While the actual paleontological resources at the site are finite, and at some point in the future all specimens will be uncovered, this is true for all fossil sites. It is merely a matter of scale. With regard to the Waco Mammoth Site, the point of complete discovery has not been attained; new material is still being discovered and could include additional individual mammoths. As these specimens are uncovered they also will presumably be left *in situ* which will add to the value of the site for both scientific research and educational opportunities. While other vertebrate species are not as well represented at the site as the mammoths, the presence of camel, tortoise, saber tooth cat, and antelope suggest that there is the potential for the recovery of additional taxa.

National Significance Findings

The paleontological resources of the Waco Mammoth Site meet the National Park Service's established criteria for national significance based on the following findings:

- The combination of both *in situ* articulated skeletal remains and the excavated specimens from the Waco Mammoth Site represents the nation's first and only recorded discovery of a nursery herd of Pleistocene mammoths. It is further unique in that the nature of the herd's preservation suggests evidence of group behavior and survival instincts during a naturally occurring catastrophic event.
- The site preserves at least two separate mammoth death events and provides an exceptional opportunity for scientific study, such as the opportunity to investigate Columbian mammoth herd dynamics. The matriarchal herd is represented by at least 19 of the mammoths uncovered so far which are from a single geomorphic surface and died during a single catastrophic event, while the presence of the other individuals not associated with this event indicates site fidelity by the mammoth. This site could serve as a keystone upon which previous discoveries of mammoths in other contexts can be re-examined and new discoveries compared. Future scientific studies will continue to inform the interpretation of the site for the benefit of the scientific community as well as the visiting public.
- The mammoth herd, together with the site's other recorded Pleistocene faunal remains provide an important opportunity for enhancing the interpretation and public understanding of a snapshot representation of biota existing along the interface of two physiographic provinces (Great Plains and Gulf Coastal Plains) during the late Pleistocene, better known as the Ice Age.

  The site also provides an exceptional opportunity to foster a public understanding of the science of paleontology. The *in situ* remains provide an opportunity to teach visitors about the scientific method and that paleontology, like geology and archeology, is a science in which researchers reconstruct events that have already taken place. Their methodologies are different from those in the experimental sciences such as chemistry, physics, and aspects of biology.

However, knowledge of the experimental sciences is critical to collecting the information needed to reconstruct an understanding of the earth's history and as such, the site provides a unique opportunity to link these two areas of science and provides a focal point to teach about all of the major sciences and how one discipline can contribute to another.

- The site retains a high degree of integrity. Many of the remains represent fully articulated specimens of varying age groups. Their location and position have been recorded; the stratigraphy of the site has been studied in detail; and removed specimens have been encased in plaster jackets and placed under the curatorial care of a single institution. Undisturbed deposits provide material for future study, as approximately 30% of the known specimens are still *in situ*.

EVALUATION OF SUITABILITY

An area that is nationally significant must also meet criteria for suitability to qualify as a potential addition to the national park system. To be determined suitable, the Waco Mammoth Site must represent a natural or cultural theme or type of recreational resource that is not already adequately represented in the national park system or is not comparably represented and protected for public enjoyment by another agency. Adequacy of representation is determined on a case-by-case basis by comparing the potential addition to other comparably managed areas representing the same resource type, while considering differences or similarities in the character, quality, quantity, or combination of resource values. The comparative analysis also addresses rarity of the resources, interpretive and educational potential, and similar resources already protected within the national park system or in other public or private ownership. The comparison results in a determination of whether the proposed new area would expand, enhance, or duplicate resource protection or visitor use opportunities found in other comparably managed areas.

Similar Resource Types Found Within the National Park System

The study team first examined whether or not this resource type is already adequately represented at other units of the national park system. Many national park system units contain fossil concentrations representing a broad range of geologic history. When asked "What criteria would you use to classify a site as an exceptional example of paleontological resources in the United States?" one of the Delphi participants noted…

> *"I would like to add that the National Park Service of the United States has identified over 180 units which have documented paleontological resources. Some of these were set aside specifically for the fossils such as Petrified Forest National Park or Dinosaur National Monument. Many are parks that fossils are contained in the geologic formations: Grand Canyon National Park, Big Bend National Park, etc. Collectively, these 180+ units of the national park system tell one great story about the history of life in the United States. From some very primitive blue green algae and bacteria preserved high in the mountains of Glacier National Park, to Pleistocene / Holocene wolves from caves in Yellowstone –fossils found in units of the national park system provide opportunities for science and education. Interestingly, we have parks that were set aside specifically to preserve fossils from many time periods within the Geologic Time Scale (i.e., Permian –Guadalupe Mountains NP; Triassic –Petrified Forest NP; Jurassic –Dinosaur NM; Cretaceous – Badlands NP; Eocene –Fossil Butte NM, John Day Fossil Beds NM; Oligocene –Florissant Fossil Beds NM; Miocene –Agate Fossil Beds NM; Pliocene –Hagerman Fossil Beds NM), however—and of real interest to this discussion—we do not have a park specifically set aside to tell the paleontological story of the Pleistocene. This is a real gap in terms of representation in the NPS."*

The search was further refined to examine national park system units containing

paleontological resources representing Pleistocene mammoths. When consulting scientific literature and the National Park Service's museum catalog system, 14 national park system units have recorded Pleistocene mammoth remains found within their boundaries:

Arches National Park
Isolated Columbian mammoth molars and bones

Bents Old Fort National Historic Site
Columbian mammoth tusk fragments

Bering Land Bridge National Preserve
Isolated woolly mammoth remains

Channel Islands National Park
Pygmy mammoth skeleton
Isolated pygmy and Columbian mammoth bones

Colorado National Monument
Columbian mammoth tooth

Craters of the Moon Nat'l Monument
Isolated Columbian mammoth bones

Death Valley National Park
Isolated Columbian mammoth molars and bones

Florissant Fossil Beds Nat'l Monument
Columbian mammoth bone fragments

Glen Canyon Nat'l Recreation Area
Columbian mammoth dung

Great Sand Dunes National Park
Columbian mammoth bone

Lake Mead Nat'l Recreation Area
Columbian mammoth bones

Nez Perce Nat'l Historical Park
Multiple Columbian mammoth skeletons

Wupatki National Monument
Isolated Columbian mammoth molars

Yukon-Charley Rivers National Preserve
Isolated woolly mammoth remains

These sites, containing resources relating to Pleistocene mammoths, represent less than 4% of the 390 units comprising the national park system. Even more interesting, there are only two units yielding articulated mammoth skeletons: Channel Islands National Park and Nez Perce National Historical Park.

In Channel Islands National Park, a nearly complete pygmy mammoth (*Mammuthus exilis*) fossil skeleton was discovered in 1994 on Santa Rosa Island. This was the first time an articulated specimen of this species was discovered. Previous to this find, descriptions of the pygmy mammoth were inferred from isolated bones recovered from park islands. The recovered specimen was determined to be an approximately 57-year-old bull that stood five and a half feet tall. He apparently died 13,000 years ago and was quickly covered by sand, accounting for the excellent articulation of the bones. The specimen was removed, fiberglass casts were made, and the replicas were placed on exhibit at the Santa Barbara Museum of Natural History and the Channel Islands National Park Visitor Center in Ventura, California.

Channel Islands National Park fully grown adult male pygmy mammoth.

The second national park system unit yielding complete skeletal remains of Pleistocene mammoths is Nez Perce National Historical Park's Tolo Lake unit. The park's purpose is to facilitate protection and offer interpretation of Nez Perce Indian sites in Idaho, Oregon, Washington, Montana, and Wyoming. The National Park Service owns nine of the thirty-eight sites included in the park.

The Tolo Lake unit is owned and managed by the state of Idaho. In 1994, a mammoth bone was discovered when the Idaho Department of Fish and Game lowered the level of the lake to initiate dredging for wildlife habitat enhancement. The Idaho State Historical Society, the University of Idaho, and the Idaho Museum of Natural History were subsequently involved in a cooperative excavation project that revealed a number of mammoth skeletons. While funding for investigative work did not allow for the full excavation of the find, approximately 400 bones of various animals including Columbian mammoths were recovered before the lake was refilled to its previous operational level.

The collection is currently housed in the Idaho Museum of Natural History, Pocatello, Idaho (460 miles southeast of Tolo Lake) where an exhibit of the reconstructed dig with interpretation of excavation methods and research findings is presented. Currently onsite interpretation of the discovery is not provided, although a resin replica of a Columbian mammoth is on display with interpretive information at nearby Eimers Park, managed by the Grangeville, Idaho, Chamber of Commerce.

Similar Resource Types Found Within Related Areas

In the General Authorities Act of 1970, an act to improve the administration of the national park system, a unit of the national park system was defined by law as any area of land and water administered by the secretary of the interior through the National Park Service for park, monument, historic, parkway, recreational or other purposes. The same law specifically excludes those properties that are neither federally owned nor directly administered by the National Park Service but are areas where the National Park Service provides assistance. These areas include four categories and are referred to as related areas. They include affiliated areas, national heritage areas, the national wild and scenic rivers system, and the national trails system. These areas and systems are closely linked in importance and purpose to units of the national park system, as they all preserve important elements of our nation's heritage. (*The National Parks: Index 2005 –2007)*

Affiliated areas comprise a variety of locations in the United States and Canada that preserve significant properties outside the national park system. Some of these have been recognized by acts of Congress, others have been designated national historic sites by the secretary of the interior under the authority of the Historic Sites Act of 1935. They represent properties that are neither federally owned nor directly administered by the National Park Service; however, the National Park Service is authorized to provide technical and/or financial assistance.

One affiliated area with related resources is Ice Age National Scientific Reserve. It includes nine nonfederal sites in Wisconsin containing nationally significant features of North American continental glaciations. While the focus of the interpretation is with the natural features shaped by glacial processes, there is limited interpretation of Pleistocene fauna.

The national trail system is the network of scenic, historic, and recreation trails created by the National Trails System Act of 1968. These trails provide for outdoor recreation needs, and promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources. The National Park Service administers 19 of the currently 24 designated national trails; three are classified as units of the national park system.

A unit of the national trail system, the Ice Age National Scenic Trail is a 1,200-mile-long trail connecting six of the nine sites of the Ice Age National Scientific Reserve; it also has a similar interpretive focus.

Another Ice Age-related trail, located across Western Montana, the Idaho Panhandle, eastern and central Washington, and northern Oregon, is currently being considered for national trail designation by Congress. The Ice

Age Floods National Geologic Trail is being proposed as an auto tour route following the pathways of the Glacial Lake Missoula Floods. Even though the primary focus of interpretation is on the outstanding geological features created by this catastrophic event occurring some 12,000-17,000 years ago, there is potential for integrating the interpretation of Pleistocene fauna.

Located within one of the national trail system units, a site has been identified as yielding Columbian mammoth skeletal remains. Big Bone Lick State Park, owned and managed by the state of Kentucky, is a nonfederal certified site along the Lewis and Clark National Historic Trail. Certified sites are places where visitors can learn about or experience the 1804 –1806 Lewis and Clark Expedition. The trail, established in 1978, includes water routes, hiking trails, and marked highways that follow the explorer's outbound and return routes. Among the more than 120 certified sites along the trail, only 5 are owned and managed by the National Park Service.

Lewis and Clark each conducted their own excavations of material from the Big Bone Lick site during the early 19th century. In 1803 when Captain Meriwether Lewis was traveling to join Captain William Clark and the men assembling in Louisville for the Corps of Discovery, he stopped at Big Bone Lick and sent a box of specimens back to President Thomas Jefferson, along with an extremely detailed letter describing the finds. In 1807, Captain William Clark was commissioned by the President to excavate bones from Big Bone Lick for scientific study. This was the nation's first organized vertebrate paleontology expedition establishing the site as the first official paleontological collecting site in North America (*Kentucky Geological Survey, 2006 and National Park Service's Lewis and Clark Expedition: A National Register of Historic Places Travel Itinerary website 2006*).

Specimens collected from this expedition included woolly and Columbian mammoths as well as other Pleistocene mega fauna. The collection was divided, and various sections went to the National Museum of Natural History in Paris, to the Academy of Natural Sciences in Philadelphia, and to Jefferson's personal collection (*The Academy of Natural Sciences 2006*).

Similar Resources outside the National Park System and Related Areas

Sites outside the national park system and related areas that have yielded Pleistocene mammoth remains include thousands of recorded sites found throughout North America. An illustration of this distribution, compiled by the Mammoth Site in Hot Springs, South Dakota, is shown in figure 2.

The sites in 31 states were further compared to identify sites with skeletons, sites with multiple individuals, sites of natural accumulation and sites with a cultural association (sites associated with Paleo-Indian activities).Table 1 presents this information. The information is based on a review of available scientific literature with supplemental information from different researchers. It is not meant to be comprehensive or exhaustive, as review or summary papers have not been done for many states.

It is interesting to note that of the 2,083 mammoth records for the 31 states listed; only 3.3% of the recorded sites have yielded skeletal remains, i.e., more than just an isolated tooth, bone fragments, or trace fossils. Sites that contain multiple individuals are rarer yet, representing less than 1.6% of the total sites recorded, while only 1.0%, or 21 sites, represents multiple individuals found as a natural accumulation without a cultural association, such as the Waco Site.

Table 2 represents a more refined comparison of just those sites containing multiple individuals similar to the Waco Mammoth Site. These sites were then further differentiated to identify only those sites currently under protection by another entity providing onsite interpretation as shown in figure 3.

Table 3 compares some of the attributes of these seven sites. The size of the comparison sites range between 8 to 546 acres. There does not appear to be a correlation between size and abundance of fossil concentrations. All comparison sites include an ancient water source; in some cases, the water source is in combination with another geological feature that apparently attracted mammoths and other Pleistocene fauna. Some were trapped in the natural feature or they were killed and butchered by Paleo-Indian hunters. Of the three sites reflecting natural accumulations, mammoths accumulated over an extended period of time, in some cases over thousands of years. This is unlike the Waco Mammoth Site where a majority of the mammoth specimens appear to have died in a single natural event capturing a life assemblage. With the exception of the Waco Mammoth site, all comparison sites have been recognized as either a national natural landmark or national historic landmark, or are in the National Register of Historic Places. Site ownership ranges from governmental (city, county, state), university, to a nonprofit organization. Site management is the responsibility of a single entity, with the exception of the Waco Mammoth Site, which is jointly managed and owned partly by Baylor University and partly by the city of Waco. Sites with national landmark designation have dedicated science and technical staff assigned to the site, have an active on-going research program, and have highly developed educational outreach programs. The two sites discovered prior to 1900s are currently designated state parks. All locations examined provide onsite interpretative experiences for the public.

Suitability Findings

The national park system does not currently include a unit specifically set aside to tell the paleontological story of Pleistocene mammoths. While 14 park units have yielded mammoth remains, there are only two sites within the national park system that have yielded articulated skeletal remains: Channel Islands National Park (pygmy mammoth) and Nez Perce National Historical Park (Tolo Lake Columbian mammoths).

Looking at comparable resources found outside of the national park system, there are thousands of recorded sites within North America yielding fossil resources related to the mammoth species, however only 21 known sites represent natural accumulations of multiple, articulated Columbian mammoth remains. Many of these sites have accumulated over an extended period of time; in some cases over thousands of years. Many sites have been fully excavated and the specimens removed from their initial location. Few sites still contain *in situ* specimens. Only the Waco Mammoth Site has yielded a representative herd of Columbian mammoths, making the site unique in this regard.

The resources of the Waco Mammoth Site meet the National Park Service's established suitability criteria for consideration as a new unit of the national park system. Including this site would expand and enhance the diversity of paleontological resources already represented by parks in the system. While Pleistocene fossils, including isolated remains of Columbian mammoth, are present in other parks, they are incidental to the criteria for the park's creation. The nursery herd of Columbian mammoths preserved at the Waco Mammoth Site is unique in North America and as such has high intrinsic scientific and educational values.

Figure 2: North American Mammoth Locations

Map compiled by the Mammoth Site, Hot Springs, South Dakota. The known site distribution includes southern mammoth, Columbian mammoth, woolly mammoth and pygmy mammoth records. The range of discoveries represent sites yielding a single isolated tooth or bone fragment to fully articulated specimens of individual or multiple mammoths. To further refine the focus, a comparison of mammoth records for selected states was compiled in table 1.

Table 1: Comparison of Mammoth Records for Selected States

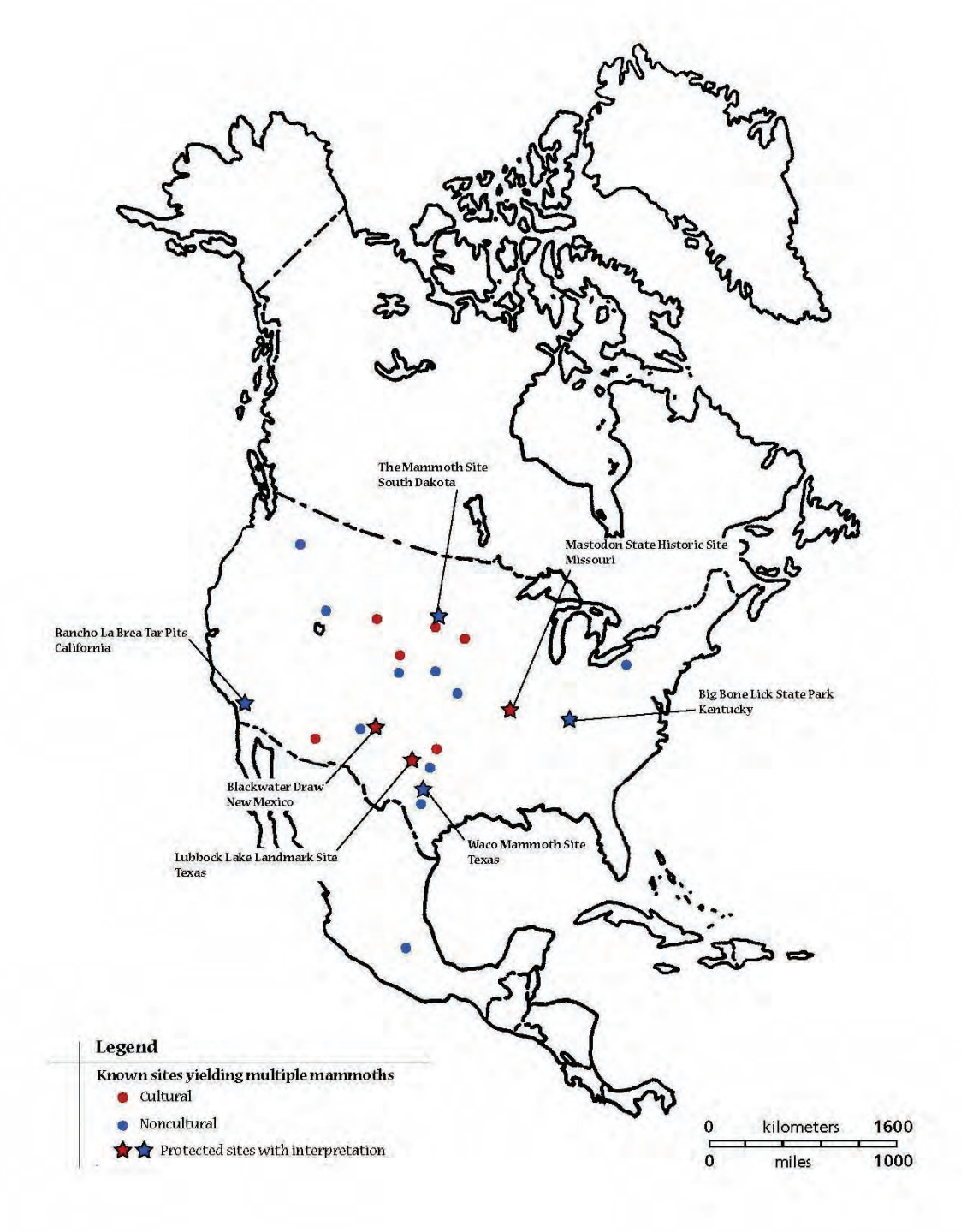
STATE	# of Mammoth Sites	Sites w/ Skeletons	% of Sites w/ Skeletons	Sites w/ Multiple Individuals	% of Sites w/ Multiple Individuals	Sites w/ Multiple Individuals Natural Accumulation	% Sites w/ Multiple Individuals Natural Accumulation	Sites w/ Cultural Association	% of Sites w/ Cultural Association	Reference/Source
Arizona	76	8	10.5%	2	2.6%	0	0.0%	6	7.9%	Mead et al, 2005
California	194	4	2.1%	4	2.1%	4	2.1%	0	0.0%	Jefferson, 1991
Colorado	94	1	1.1%	4	4.3%	1	1.1%	2	2.1%	Graham et al, 2003
Florida	84	3	3.6%	1	1.2%	1	1.2%	1	1.2%	FL Museum of Nat'l History
Idaho	48	2	4.2%	2	4.2%	1	2.1%	1	2.1%	Jefferson et al, 2002
Illinois	53	5	9.4%	0	0.0%	0	0.0%	0	0.0%	Saunders et al, 2006
Indiana	10	1	10.0%	0	0.0%	0	0.0%	0	0.0%	Richards 1984
Iowa	109	2	1.8%	0	0.0%	0	0.0%	0	0.0%	Agenbroad, 2002
Kansas	225	5	2.2%	1	0.4%	1	0.4%	0	0.0%	Kost 1987
Kentucky	6	0	0.0%	1	16.7%	1	16.7%	0	0.0%	Davis pers. communication
Michigan	49	2	4.1%	0	0.0%	0	0.0%	0	0.0%	Skeels 1962; Abraczinskas 2002
Minnesota	58	1	1.7%	0	0.0%	0	0.0%	0	0.0%	Agenbroad, 2002
Missouri	14	0	0.0%	2	14.3%	2	14.3%	0	0.0%	Saunders pers com 2006
Montana	36	1	2.8%	0	0.0%	0	0.0%	0	0.0%	Agenbroad, 2002; Hill, 2006
Nebraska	109	4	3.7%	1	0.9%	1	0.9%	0	0.0%	Agenbroad, 2002
Nevada	54	1	1.9%	0	0.0%	0	0.0%	1	1.9%	Jefferson et al, 2004
New Mexico	73	1	1.4%	2	2.7%	1	1.4%	2	2.7%	Lucas & Morgan, 2005
New York	15	0	0.0%	1	6.7%	1	6.7%	0	0.0%	Hartnagel & Bishop 1922
North Dakota	17	0	0.0%	0	0.0%	0	0.0%	0	0.0%	Agenbroad, 2002; Hoganson 2006
Ohio	57	1	1.8%	0	0.0%	0	0.0%	0	0.0%	McDonald, 1994
Oklahoma	40	2	5.0%	1	2.5%	0	0.0%	3	7.5%	Smith/Cifelli, Wyckoff & Czaplewski, 1997
Oregon	28	0	0.0%	0	0.0%	0	0.0%	0	0.0%	Jefferson et al, in prep A
South Carolina	3	0	0.0%	0	0.0%	0	0.0%	3	10.7%	Fields, personal communication, 2006
South Dakota	34	2	5.9%	2	5.9%	1	2.9%	1	2.9%	Agenbroad, 2002
Tennessee	4	0	0%	0	0%	0	0.0%	0	0.0%	Corgan and Breitburg, 1996
Texas	90	2	2.2%	6	6.7%	4	4.4%	4	4.4%	Fox et al, 1992
Utah	35	2	5.7%	0	0.0%	0	0.0%	0	0.0%	Jefferson et al, 1994
Virginia	3	0	0.0%	0	0.0%	0	0.0%	1	33.3%	Eshelman and Grady 1986
Washington	400	12	3.0%	2	0.5%	2	0.5%	0	0.0%	Jefferson et al, in prep B; Barton 1999,
Wisconsin	32	2	6.3%	0	0.0%	0	0.0%	0	0.0%	West and Dallman 1980; Johnson 2006
Wyoming	33	5	15.2%	1	3.0%	0	0.0%	2	6.1%	Agenbroad, 2002
TOTAL	2,083	69	3.3%	33	1.6%	21	1.0%	27	1.3%	

Table 2. Recorded Sites in the United States Yielding Multiple Columbian Mammoths

State	Locality	Site Ownership	Comments	Number of Individuals	Cultural Association	Articulated Skeletons	Bones Still *In Situ*	On-Site Interpretation	Status of Research	Potential for Future Mammoth Discoveries	Reference
Arizona	Lehner	Private	13 Clovis points found with 13 young mammoths, thought to indicate killing of family group.	13	Yes	Yes	No	No	Completed	Low	Haury et al. 1959
Arizona	Murray Springs	Private	Animals may have been scavenged by Clovis people rather than hunted. Has mammoth footprints preserved.	2	Yes	Yes	No	No	Completed	Low	Haynes, 1999
California	Rancho La Brea, Pit 9	City Park	Pit 9 is only tar pit at RLB in which mammoths were found. Long term accumulation.	29	No	No	Yes	Yes	Ongoing	High	Harris and Cox, 1993
Colorado	Dent	Private	First site in North America to provide unequivocal evidence of projectile points with mammoths. Skeletons exchanged to other museums by the Denver Museum.	14	Yes	Yes	No	No	Completed	Low	Saunders, 1999
Colorado	Dutton	Private	Isolated bones.	>5	No		No	No	Completed	Low	Agenbroad, 1984
Colorado	Lamb Spring	County Property	Associated stone tool and cobblestone brought into site.	30	No	No	Yes	No	Ongoing	Medium	Stanford et al, 1981
Colorado	Selby	Private	Isolated bones.	>5	No	No	No	No	Completed	Low	Agenbroad, 1984
Idaho	American Falls Reservoir	Bureau of Reclamation	Age of site is about 100,000 years. Isolated bones recovered.	8	No	No	No	No	Ongoing	Yes	Pinsof, 1998
Idaho	Tolo Lake	Idaho Dep't of Fish & Game	Site is only partially studied but appears to be a long term accumulation at a water hole.	10	No	Yes	Yes	No	Hiatus	High	Miller et al. 1998
Kansas	Penndennis	Private	Number of individuals based on count of isolated molars.	>50	No	No	No	No	Ongoing	Low	Agenbroad, 1984
Kentucky	Big Bone Lick	State Park	One of the first.	Unknown	No	No	No	Yes	Hiatus	Medium	Schultz et al, 1963 & 1967
Missouri	Kimmswick	State Park	Adult and juvenile based on isolated teeth.	>2	Yes	No	No	Yes	Completed	Medium	Haynes, 1999
Nebraska	Crawford	Private	Remains of two bull mammoths whose tusks became interlocked during a fight.	2	No	Yes	No	No	Completed	Low	Unpublished
New Mexico	Blackwater Draw	State Park	Series of mammoth sites, other species associated w/ extensive Paleo-Indian remains.	13	Yes	No	Yes	Yes	Completed	Low	Haynes, 1999
New Mexico	Mesa Redonda	Private	While the site contains multiple individuals no complete skeletons were recovered. The mammoth skeleton on display at NM Museum of Natural History is a composite.	6	No	Yes	No	No	Completed	Low	Morgan et al. 2001
Pennsylvania	Frankstown Cave	Private	Isolated bones.	7	No	No	No	No	Completed	Low	Agenbroad, 1984
South Dakota	Hot Springs	Private	All individuals at site are young male mammoths. Long term accumulation.	49	No	Yes	Yes	Yes	Ongoing	High	Agenbroad, 1990
South Dakota	Lange/Ferguson	Private	Adult and juvenile mammoth were butchered using tools made from a mammoth shoulder blade.	2	Yes	No	No	No	Completed	Low	Martin, 1987
Texas	Friesenhahn Cave	Private	Mammoth remains are of juvenile mammoths killed by the dirk tooth cat, *Homotherium*, and brought to den site.	>100	No	No	No	No	Completed	Low	Haynes, 1991
Texas	Lubbock Lake	State, managed by Texas Tech U.	Multiple cultural layers, small family units of three to five animals appeared to have been killed at different times.	2	Yes	No		Yes	Ongoing	Medium	Johnson and Holiday, 1985
Texas	Miami	Private	Mammoths found in association with Clovis artifacts.	5	Yes	No	No	No	Completed	Low	Sellards, 1938
Texas	Slaton	Private	There is no good age estimate of the Slaton Quarry. The mammoth has been identified as *Mammuthus imperator* suggesting it is much older than WMS.	4	No	No	No	No	Completed	Low	Agenbroad, 1984
Texas	Trinity River, Dallas	Private	Isolated bones of mammoths recovered from river channel deposits.	>28	No	No	No	No	Completed	Medium	Agenbroad, 1984
Texas	Waco	City	Matriarchal herd killed in single catastrophic event, possibly other individuals after.	24	No	Yes	Yes	No	Ongoing	High	Haynes, 1992
Wyoming	Colby	Private	An old stream channels where parts of mammoths were found stacked into piles, associated with stone points and a chopper.	7	Yes	No	No	No	Completed	Low	Frison, 1978; Frison and Todd, 1986; Madden, 1978

Note: The Waco Mammoth Site is highlighted in yellow. Characteristics of other locations similar to the Waco Mammoth Site are highlighted in gray, and locations that provide on-site interpretation are highlighted in red.

Figure 3: Known Sites in North America Yielding Multiple Mammoths



A comparative analysis was developed in table format between the Waco Mammoth Site and the protected sites yielding multiple mammoth remains with interpretation. The range of attributes compared include type, size, significance, site characteristics, ownership, management, science and technical staff, research activities, excavation efforts, specimens collected, education/outreach, and interpretation (see table 3).

Table 3. Comparative Analysis of Similar Resource Areas

	Waco Mammoth Site Waco, TX	**Rancho La Brea** Los Angeles, CA	**Big Bone Lick State Park** Boone County, KY	**Mastodon State Historic Site** Imperial, MO	**Blackwater Draw** Portalis, NM	**The Mammoth Site** Hot Springs, SD
Date of Site	~68,000 BP	~38,000 Before Present (BP)	~18,000 BP	~10,000-14,000 BP	~8,000-12,000 BP	~26,000 BP
Type of find	Natural en masse accumulation	Natural time-average accumulation	Natural time-average accumulation (?)	Clovis butcher site	Clovis to Archaic butcher site	Natural time-averaged accumulation
Size	~109 acres	23 acres	546 acres	425 acres	157 acres	8 acres
Significance	The only known site in North America to contain a Pleistocene herd of Columbian mammoths. Potential National Natural Landmark	One of the richest, most diverse, best preserved, and best studied assemblages of Pleistocene fossils (Ice Age flora and fauna) ever found. National Natural Landmark	First major New World fossil locality known to Europeans (1739), The first official paleontological collecting site in North America. Lewis and Clark each conducted their own excavations of material from the site during the early 19th century. Potential National Natural Landmark Lewis & Clark National Historic Trail (non-federal certified site) Nat'l Register of Historic Places	One of the first sites revealing solid evidence of the coexistence of prehistoric peoples and mega fauna. Nat'l Register of Historic Places	The site has yielded evidence of the fluted points and other stone and bone weapons, tools, and processing implements found in association with extinct Pleistocene mega fauna such as Columbian mammoth, ancient bison, large horses and large turtles. National Historic Landmark Nat'l Register of Historic Places	The world's largest Columbian mammoth exhibit and research center for Pleistocene studies. National Natural Landmark
Location	Northern edge of Waco, Texas	Downtown Los Angeles, California	Boone County, Kentucky	20 miles south of St. Louis, Missouri	8 miles north of Portales, New Mexico	Hot Springs, South Dakota
Site Characteristics	Narrow valley inset to a large paired alluvial terrace.	Tar pits where oil evaporated allowing water to pool atop the tar attracting thirsty animals and miring them in the sticky pitch.	Soft, swampy area surrounding salt and sulfur springs. Animals were attracted to the salt source.	The area was once swampy and contained mineral springs. Animals were attracted to the water source.	Small spring fed lake basins became popular hunting and resting spots for early North Americans and the mega fauna that coexisted with them.	Sinkhole formed 26,000 years ago warm artesian spring a steeply-sided pond. Animals were attracted to the water source.
Ownership	City of Waco & Baylor University	Los Angeles County	State of Kentucky	State of Missouri	Eastern New Mexico University	The Mammoth Site (501(c)(3))
Management	City of Waco & Baylor University	LA County's Natural History Museum	Kentucky Department of Parks	Missouri State Parks	Eastern New Mexico University (ENMU	The Mammoth Site (501(c)(3))
Research Activities	Baylor University graduate student just completed his master thesis (August 2007) which investigated the microstratigraphy and depositional history of the site.	Page Museum staff collect the sediment (matrix) around the fossils to learn about the microfossils—seeds and pollen, insects and mollusks, fish, amphibians and small birds and rodents—that provide paleontologists with detailed information about the habitats and climate present in Los Angeles during the waning phases of the last Ice Age. Preparation of excavated fossils continues today which are made available for research by professionals and students from around the world.	Dr. Glen Storrs, director of science research and curator of vertebrate paleontology for the Cincinnati Museum Center and board member of the Friends of Big Bone Lick, is promoting a partnership between the museum center, Northern Kentucky University, University of Cincinnati, and the University of Kentucky to prepare a comprehensive study of the site.	Research activities are not scheduled at this time.	Ongoing research is conducted by Eastern New Mexico University archaeologists, with periodic contributions from other institutions. The Smithsonian Institution conducted geological research under the direction of Dr. Dennis Stanford, with the principle investigator being Dr. Vance Haynes from the University of Arizona. Researchers from all over the world visit the site to view the archaeological excavations and further appreciate the importance of Paleo-Indian Studies.	The world's largest Columbian mammoth research center for Pleistocene studies. Sponsors the "Visiting Scientist" program every July, where a researcher is invited to study at the site during the month.

Table 3. Comparative Analysis of Similar Resource Areas (continued)

	Waco Mammoth Site Waco, TX	**Rancho La Brea** Los Angeles, CA	**Big Bone Lick State Park** Boone County, KY	**Mastodon State Historic Site** Imperial, MO	**Blackwater Draw** Portalis, NM	**The Mammoth Site** Hot Springs, SD
Highlights of Excavation Efforts	Active excavation activities were discontinued in 1994.	The first major excavations were conducted by the University of California, Berkeley in 1901 – 1912 Excavation activities in Pit 91 are scheduled every year over a two-month (usually July-August) summer season.	Baron Charles De Longueil, the commander of a French military expedition in 1739, collected some mastodon fossils and sent them to Paris for further study. Systematic excavations were conducted by the University of Nebraska in the 1960's. Most of the bones collected from this expedition are stored in a Nebraska paleontological warehouse although some bones are housed in the park's museum.	Beginning in 1839 Dr. Albert Koch unearthed skeletal remains which were later identified as *Mammut americanum* and later sold to the British Museum of Natural History in 1844 where they are still on display. Excavation activities were discontinued in 1984 to protect the bone bed.	Since its discovery, the Blackwater Locality #1 Site has been a focal point for scientific investigations by academic institutions and organizations from across the Nation. The Carnegie Institute, Smithsonian Institution, Academy of Natural Sciences, National Science Foundation, United States National Museum, National Geographic Society, and more than a dozen major universities either have funded or participated in research at Blackwater Draw.	Active on-site excavations which can be observed by visitors. Earth Watch Institute provides for a program for laymen assistant excavators during the summer months excavate and identify and study fossils.
Specimens Collected	18 Columbian mammoth specimens, giant tortoise, prehistoric camel skull stored at Mayborn Museum.	Nearly 3,500,000 specimens have been collected, over 650 species of Pleistocene plants and animals identified. Fossils recovered represent Columbian mammoth, mastodon, dire wolf, saber-toothed cat, short-faced bear, American lion, bobcat, coyote, weasel, ground sloth, dwarf pronghorn, extinct camel, peccary, tapir, llama, horse, bison, insect, plant, seed, bird, reptile, amphibian, and fish. One human skeleton ~9,000 BP and cultural artifacts.	Animals include mastodon, Wooly and Columbian mammoth, musk-ox, stag moose, ground sloth, extinct bison, extinct horse, deer and caribou.	Bones from more than 60 mastodons reportedly were taken from the pit in addition to Harlan's ground sloth and Columbian mammoths.	Pleistocene mega fauna such as Columbian mammoth, ancient bison, large horses, and large turtles. Other Pleistocene age animals visiting the site for food and water were tapir, camel, four-prong antelope, llama, tampulama, deer, dire wolf, ground sloth, short-faced bear, saber-tooth cat, shovel-toothed amebeledon, beaver, armadillos, and peccary.	Majority of fossils found are young adult, male Columbian mammoths. Evidence of three woolly Mammoths has also been discovered here, the first time both species have been found together. Fossils of other Ice Age animals have also been discovered; camel, llama, giant short-faced bear, wolf, coyote and prairie dog to name a few. Imprint fossils of bird feathers, complete fish skeletons, and thousands of mollusk shells have also been recovered.
Education, Outreach, and Interpretation	Interpretation off-site at the Baylor University's Mayborn Museum Complex.	Educational activities are ongoing Visitors can learn about Los Angeles as it was between 10,000 and 40,000 years ago, during the last Ice Age. A tank recreates how animals became stuck in the asphalt. Visitors can touch a massive leg bone of an extinct giant ground sloth or make a comparison of mastodon and mammoth by teeth, size, and diet. Life-size replicas of several extinct ice age mammals are featured. Special events are held annually.	Information available through the Earth Science Education Network (ESEN). website Outdoor museum presents the site history with displays of fossilized bones and artifacts from the last 18,000 years. A Discovery Trail gives visitors a glimpse of the drama that unfolded at the springs. Recreated grasslands, wetlands and wooded savannas lie along the trail leading to a "bog" diorama showing a woolly Mammoth, mastodon, giant sloth, bison, various skeletal remains, and scavengers feeding on the carcasses. The final portion of the loop, the Bison Trace, brings a live buffalo herd into view. Special events are held annually.	Museum admission and programs are free to student groups and their teachers/leaders. A variety of educational materials are free to teachers. Interpretive programs: slide show, interpreter-led presentation, museum tour and hike to the former excavation site. The program focuses on ice age mammals and early man. Other topics include: Prehistoric Life Skills; Early Man and Technology; and Fossils. A short trail accesses the bone bed. Special events are held annually.	An in-depth presentation of the site and its significance is on-line. A self guided ¼ mile interpretive trail is provided on-site. The Blackwater Draw Museum displays artifacts discovered at the site and interprets life at the site from Clovis times through recent historic period.	Staff available for outreach visits, "Mammoth In A Trunk" kits available, personal grade-level guided tours. Science Curricular Activities Booklets available for classroom or home schooling use, or interactive CD can be purchased. Guided tours into the sinkhole where the bones have been left *in situ*, exhibits in the Ice Age Exhibit Hall, peek in the windows of a working paleontology laboratory, view numerous short educational films on geology, Mammoth Site history, Hunting Mammoths with Dr. Larry Agenbroad, flint knapping techniques, and museum laboratory procedures.

EVALUATION OF FEASIBILITY

An area that is nationally significant and meets suitability criteria must also meet feasibility criteria to qualify as a potential addition to the national park system. To be considered feasible, an area's natural systems or historic settings must be of sufficient size and shape to ensure long-term protection of resources and accommodate public use. The area must also have potential for efficient administration at a reasonable cost.

In evaluating feasibility, the Park Service considers a variety of factors, including the following:

- Access
- Size
- Landownership patterns
- Boundary configurations
- Local planning and zoning
- Current and potential uses of the study area and surrounding lands
- Existing degradation of resources
- Current and potential threats to the resources
- Public enjoyment potential
- Staffing requirements
- Costs associated with acquisition, development, restoration, and operation
- Socioeconomic impacts of designation as a unit of the national park system
- Level of local and general public support (including landowners)

The feasibility evaluation also considers the ability of the National Park Service to undertake new management responsibilities in light of current and projected availability of funding and personnel.

Access

The Waco Mammoth Site is centrally located within the state of Texas; it is located 90 miles south of Dallas/Fort Worth, 90 miles north of Austin, and 180 miles northwest of Houston. The site is located within 200 miles of 80% of the state's population, and is located less than 12 miles from Interstate 35, a well-traveled, primary north/south transportation corridor traversing the Midwest section of the country. In 2003, average daily traffic travelling on I-35 through the Waco area was 46,512 vehicles. The site is also located within a few miles of the Waco Regional Airport which primarily provides commuter service to the Dallas-Fort Worth International Airport and Houston's Bush Intercontinental Airport.

The property includes 952 feet of frontage along New Steinbeck Bend Road, a local arterial collector road. The site also includes 461 feet of frontage along Bogey Lane, a residential collector street that provides access to a residential area just east of the site.

It is anticipated that there would be limited impacts to existing transportation systems and adjacent neighborhoods as additional traffic could easily be accommodated on existing arterial roads without reducing the level of service or introducing additional traffic volumes into residential areas.

The location of the site provides not only convenient access from existing major transportation corridors, but it also provides for easy access by a large number of visitors traveling from outside the region.

Size and Landownership Patterns

Collectively, the city of Waco and Baylor University have acquired 109.34 acres of land referred to as the Waco Mammoth Site. On October 4, 1996, Sam Jack and Liz McGlasson donated 4.93 acres to the city, which included the excavation area that covers less than 5% of the tract. Conditions of conveyance require the city to use the property for research, educational, or tourism purposes, and require the city to enter into an agreement with Baylor University concerning the maintenance of the property as an educational resource for the citizens of Waco, visitors, and researchers.

Prior to the McGlasson land conveyance to the city of Waco, it appears Dr. James Hetjmancik was the previous landowner

during the period of initial discovery in 1978 through the en masse excavation and collection effort in 1990. He is credited with donating the collected specimens to the Strecker Museum (Fox et al. 1992). Baylor University is currently researching their museum records to confirm the chain of collection agreements with landowners prior to the conveyance of the property to the city of Waco.

Between 2000 and 2001, Baylor University acquired three additional tracts through private donor support, totaling 104.41 acres surrounding the site and extending along New Steinbeck Bend Road and the Bosque River.

Both the city and university have expressed full support for establishing the Waco Mammoth Site as a new unit of the national park system, as well as their willingness to transfer their properties, the paleontological collections, and archives without cost to the National Park Service for this purpose.

Boundary Configurations

The boundary configuration would follow the outline of the combined properties owned by the city of Waco and Baylor University described above. Copies of the warranty deeds and tract map are included in the appendix D.

The current boundary provides ample buffering between the excavation site and adjacent properties on the north, west and south sides of the property. Maintaining the existing vegetation found along the northeast edge of the property would continue to provide a visual screen of the excavation area located 180 feet from the northeast boundary of the site that follows the southwest side of Bogey Lane and an adjacent residential neighborhood.

If excavation activities are reinitiated at the site at some time in the future, the full extent of the resource could be confirmed. This may require a re-evaluation of the boundary configuration needed to ensure long-term protection of the special resource. For the purposes of this study, it is assumed that the current boundary configuration provides an adequate protection and buffering capability for the special resource.

Local Planning and Zoning

The Waco Mammoth Site and the lands surrounding the site lie with the R-1B Zone which allows for single family residential development, agriculture use, and public uses such as parks. It is anticipated that existing land use patterns surrounding the site would remain fairly stable.

The site is also within the Brazos River Corridor overlay district. The *City Comprehensive Plan* (2000) designates the Brazos River corridor as mixed use. The corridor, because it is an overlay district, takes precedence over the underlying zoning. The purpose of the overlay district is to ensure the development of the Brazos River Corridor as a center for quality recreation, convention, tourism, housing, commercial, retail, and office facilities. The regulations are designed to protect the special environmental character of the corridor and to promote continued private and public investment. Some of the goals contained in the mission statement for the corridor include:

- Preserve, protect, and enhance the historically, culturally, architecturally, and archeologically significant sites and structures which impact a distinct aspect of the city and serve as visible reminders of the city's culture and history.
- Recognize and protect the special distinctive qualities and ecosystems of both the Brazos River and the Bosque River and their tributaries.
- Encourage developments that interconnect for pedestrian access and circulation.

The city of Waco has recognized the significance of the Waco Mammoth Site by including the site within the boundaries of the Brazos River Corridor. By connecting the Waco Mammoth Site to the rest of the corridor, the city has made a commitment to

encouraging compatible land uses in the vicinity of the site. In addition, the city owns the parcel to the southeast of the Waco Mammoth Site as well as parcels south of West Lake Shore Drive. It is the intent of the city to provide continuous pedestrian access through these parcels to the Waco Mammoth Site.

Current and Potential Uses of the Study Area and Surrounding Lands

Lands surrounding the study area are primarily undeveloped, agricultural lands occasionally used for cattle grazing, although there is an adjacent residential development just northeast of the site. A public golf course operates just to the east of the site. It is anticipated that privately owned agricultural lands would continue to be converted to residential use. City property borders the southeast corner of the site along the Bosque River, and it is anticipated that future development would be for recreational purposes.

The moratorium on excavation activities in 2003 also included restricting visitor access. Current uses of the site include scientific investigation, preservation, and maintenance activities by the city staff, university staff, and students.

Potential uses of the 4.93-acre city parcel are restricted by the conveyance conditions that require the site be used for research, educational, or tourism purposes. However, to successfully achieve this requirement, the primary use of the study area should focus on the long-term preservation and security of the *in situ* specimens and geologic context. Public access to this feature and facility development for enhanced interpretation and administrative space must be secondary to the long-term preservation and security needs of the site. Once protection and security can be assured, there are a number of opportunities for introducing the public to the excavation area and the interpretation of how these features contribute to our understanding of the nation's natural history.

Over the course of the last eight years, there have been a number of development proposals prepared for the site. In 1999, the city of Waco commissioned the first development proposal, which was prepared by Beth Francell of Rebloom Design. The plan recommended the acquisition of four adjacent properties totaling an additional 195 acres of land (including the 104 acres eventually acquired by Baylor University in 2000 and 2001) and the development of the site as a 200-acre regional park with recreational amenities. The development program included a 7,500-square-foot visitor center with gift shop, food service, and exhibits, a 35,000-square-foot pavilion over the mammoth excavation area, access and service roads, 800 parking spaces, site utilities, four comfort stations, prairie restoration for a bison and longhorn pasture, an arboretum and nature trail, a Pleistocene themed playground, 26-site picnic area, a campground with 42 tent sites and 57 travel trailer (RV) sites, and boat/canoe and fishing access to the Bosque River. It was anticipated that providing a full spectrum of recreational activities would qualify the site for matching grants from Texas Parks and Wildlife's Texas Recreation and Parks Account Program.

Using visitation rates (+100,000 visits per year) recorded at the Mammoth Site at Hot Springs, South Dakota, as an indicator of the potential interest in the Waco Mammoth Site, the proposal anticipated and annual attendance of between 75,000 and 150,000 visitors. Total revenues were projected between $250,000 and $400,000 generated through gate receipts, gift shop sales, food service, and camping fees, and were anticipated to partially offset the projected $560,000 in annual operational expenses. The total initial cost of the proposal was estimated at $6.6 million (1999 dollars). The Waco City Council expressed concerns with the initial and operational costs of the proposal and decided not to pursue development of the site at that time, but remained committed to maintaining and securing the site.

In 2000, a second development plan, prepared by Calvin Smith and others, was presented as a cooperative venture offering a modified, small-scaled version of the first proposal. This plan recommended the acquisition of the 104 acres which was eventually acquired by Baylor University in 2000 and 2001 and proposed utilizing 75 of the 109 acres for development of the Waco Mammoth Site, while reserving the balance of the acreage for a future nature center and preserve to be funded by a local philanthropist and Texas Parks and Wildlife grants. Amenities included a 35,000-square-foot, climate-controlled pavilion over the mammoth excavation area with interpretive exhibits, gift shop, limited food service, and restrooms; site utilities; access and service roads; 250 parking spaces; 2 comfort stations; prairie restoration; interpretive trails; playground; 15-site picnic area; canoe launch; and fishing pier.

Attendance was projected to range between 100,000 to 200,000 visitors per year. Total revenues from admission fees, gift shop, and concessions were projected to fully offset the projected $362,160 in annual operational expenses. The total initial cost of the modified proposal was estimated at $3 million (2000 dollars). The proposal also anticipated a $3 million endowment to meet future maintenance/operations expenses, staff research, and programming needs.

A third proposal, developed by students from Baylor, included a narrative of the visitor experience potential and facility program which outlined space requirements for exhibits, theater, gift shop, restrooms, snack/vending area, classrooms, library, collections storage, preparation lab, exhibit fabrication workshop, administrative offices, storage, and mechanical equipment. The team projected a total need of 44,820 square feet for the facility; however, estimates of the implementation costs were not included in the proposal.

In 2003, a feasibility study was commissioned by the city and submitted by Lord Cultural Resources Planning and Management, Inc. The study analyzed conservation and preservation needs, visitor experience opportunities, space and facility needs, capital investment cost estimates, staffing, and governance. Baylor University provided assistance on the governance and staffing portion of the report. In this proposal, it was assumed that the Mayborn Museum Complex would serve as the primary gateway visitor center for the Waco Mammoth Site and would feature orientation, ticketing, transportation, retail and information services, enhanced exhibits, and an introductory film of the catastrophe and ongoing scientific investigations. Amenities developed at the Waco Mammoth Site would include a 6,900-square-foot visitor center covering and featuring an exhibit of the bones that remain *in situ*, additional exhibit space, museum shop, multipurpose room, restrooms, office space, site utilities, access and service roads, 60 parking spaces, and a covered walkway with interpretive waysides that would surround the original discovery area and feature a forensic outline, etched in stone or terrazzo, of the original position of the mammoth bones removed from the site.

Projections for the attendance rate at the Waco Mammoth Site were re-evaluated based on market analysis, a more modest approach to the onsite development, and restricted, controlled access to the site to ensure resource protection and security. The study projected an attendance rate of 30,000 visitors per year after the third year of operation. They also projected annual operational expenses would range between $360,000 and $380,000, with anticipated revenue in the range of $131,000 to $196,000 from admissions, retail sales, and other self-generated revenue sources. Almost 60% of the operational expense would need to be subsidized to break even on operations.

Options to consider include securing an endowment, fundraising, grants, or contributed income. The total initial cost of the proposal was estimated at $5.5 million (2003 dollars).

In 2006, the city of Waco was awarded a $200,000 matching grant through the Save America's Treasures Program, a federal grant program administered by the National Park Service. The program was established to help preserve and protect nationally significant features. The grant was made for the purposes of providing protective measures for the resources of the Waco Mammoth Site. These measures include replacing the existing fabric tent that now covers the *in situ* specimens with a more durable shelter, redirecting site drainage away from the excavation area, providing for enhanced site security, and accommodating public access.

As part of the requirements for receiving grant-in-aid funds from the Save America's Treasures Program, the city entered into a 50-year conservation easement agreement with the Texas Historical Commission on July 17, 2007, for the purposes of assuring preservation of the property. The easement agreement further requires that the city provide public access to view the grant-assisted work or features no less than 12 days a year on an equitably spaced basis.

The city and Baylor University immediately pledged $100,000 each to match the grant and then chartered the Waco Mammoth Foundation to pursue additional fundraising to support the initiative. The city issued a request for proposals for the design of the structure and selected Cotera-Reed, an architectural firm based out of Austin, Texas, as the prime consultant for the work. Their design team included the landscape architectural firm EDAW office in Fort Collins, Colorado, as well as a number of engineering consultants. Part of the design services included the preparation of a master plan for the entire site so that the shelter could be developed within the context of the community's long-range vision for developing the site as a public park.

Once the master plan was completed by EDAW and accepted by the city's Department of Parks and Recreation, Phase I schematic designs were developed for the shelter structure. Provisions for accommodating controlled visitor access into the shelter were developed. In order to more fully protect the *in situ* specimens from the extremes of temperature and humidity, a climate control system was included. The expanded scope increased the total costs for Phase I to $3.2 million, which required a more intense fundraising effort by the Waco Mammoth Foundation. The local community rose to the challenge and from a variety of sources pledged an additional $2.5 million dollars, allowing the city to contract for construction of Phase I in 2008.

The development includes an 8,400-square-foot shelter, with limited air-conditioned interior space over the excavation area and *in situ* specimens. The development will also include interpretive exhibits, an access road, a small parking area with overflow parking that can accommodate bus and recreational vehicles, connecting trails to the excavation shelter, a small visitor contact station with restrooms, utility extensions, and enhanced security systems.

The Waco community's initiative ensures the excavation area will be protected from further erosion during storm events and other environmental threats, will protect the exposed *in situ* specimens from potential acts of vandalism; and for the first time, will allow for controlled public access into the area so that the resource can be shared with the local community as well as visitors to the area.

Figure 4: Waco Community's Phase I Plan for the Waco Mammoth Site

Existing Degradation of Resources

An assessment of the current condition of the site is based on two criteria: integrity of the geology and integrity of the fossil specimens. Both are critical to the long-term preservation of the *in situ* remains and the ability to conduct ongoing research critical to the interpretation of the site. Currently the site is covered by a large tent, which has provided some protection to the exposed geology and fossils. Unfortunately, while the tent has prevented direct impact to the fossils and geology from rain, it has not been completely effective. During the many years that the site has been exposed, it has suffered from water damage resulting from surface runoff; some of the runoff channeled by the tent. This has resulted in the erosion and collapse of the sides of the excavation, deposition of sediments in the bottom of the excavation, and pools of standing water that have contributed to the deterioration of bone and the growth of algae.

Despite the damage to the sides of the excavation, sediment columns left in place for reference have remained intact and there are major sections of the excavation walls that still retain sufficient detail to permit an analysis of the microstratigraphy of the site. If further water is prevented from flowing into the excavation, there should be no additional damage to the remaining exposed geology and bones.

Mammoth skeletons in the lowest part of the excavation, where water has collected and pooled, exhibit the most serious damage, primarily in the fragmentation of bones. Many of the bone fragments are still in their relative positions and repair should be possible although challenging. The primary concern is that they may become moved out of position making it more difficult to determine their original location and re-associate them with the source. Two mammoth skeletons, primarily a bull and a cow located at a higher level, have not been as severely damaged from surface runoff of water. The bull skeleton was molded with latex and it appears that most of the damage seen in this specimen, e.g. the fragmentation of individual bones, is the result of the molding process. The Mayborn Museum has initiated remedial action on the bull and is gluing bone fragments back together to ensure that pieces are not lost.

Once work has been completed on the bull mammoth, it should be followed by work on the other mammoths, preferably the two lowest ones. The upper female seems to be the least damaged and can be stabilized last. The camel skeleton appears to be in the best condition, although the skull was considered vulnerable and was removed. It is currently stored in a field jacket at the Mayborn Museum Complex. All repairs are being made with adhesives that are reversible and will allow for more permanent stabilization in the future.

Other forms of remediation that should be programmed include spraying all algae with a dilute bleach solution; this would reduce the growth of algae and would not negatively impact the bone.

Currently all collected fossil specimens and associated geological samples are stored in the geology/paleontology collections room at the Mayborn Museum Complex on the Baylor University campus. The mammoth fossils are primarily contained in their original field jackets with some individual bones and fragments stored in plastic bags or cardboard boxes. All specimens in field jackets are considered to be in stable condition, although prior to their current storage they were kept in a warehouse lacking environmental controls.

During part of the time in the warehouse, many of the jackets were open on top but have since been closed with plaster and burlap. Because they are currently sealed, it is not possible to assess if any damage has occurred to the bones during this time. Since it is anticipated that some of the jackets will be opened in order for sediment samples to be removed, it may be possible to conduct a preliminary condition assessment after they are opened. Some of the individual bones/fragments stored in boxes and bags may fit with bones in jackets. It is critical that all field identification numbers and other data remain associated with these specimens in order to facilitate their reattachment to these specimens.

Given the age of some of the original cardboard boxes and paper bags, Baylor University is currently repacking some of the specimens and placing them in recently purchased cabinets. In order for the scientific value of the site to be fully appreciated, all jacketed bones will eventually need to be prepared and this will be a multiyear project given the volume of material. Preparation is also needed in order for these specimens to be used in exhibits associated with the site. Based on a preliminary examination of material in boxes and bags, the bones appear to be in good shape, but the large number of fragments indicates the need for major efforts in the reassembly of broken specimens.

Current and Potential Threats to the Resource

Of primary concern is the current condition and continued protection of the exposed *in situ* specimens. Resource protection measures have been initiated by Baylor University by grants secured from the Cooper Foundation. In 1984, on the upper end of the drainage, a diversion dam was constructed to catch and divert storm water runoff. Additional fill has been placed at the upper end of the site to divert drainage. Spoil piles from the upper

excavation have been stockpiled downstream in the original discovery area. To enhance security, the city has erected a chain link fence with a locking gate completely around the excavation site. The site is patrolled by the Waco police to protect it from vandalism and unauthorized collecting, which have not proven to be a problem so far. Baylor University's Mayborn Museum personnel maintain the site and conduct site surveillance at least once a month in addition to reconnaissance after each rainfall event.

The 2003 feasibility study conducted by Lord Cultural Resources Planning and Management, Inc., outlined a number of protective actions to ensure long-term protection of the resource. These included stabilization and repair of all exposed specimens still in the ground, completion of documentation of the site, development of proper drainage away from the excavated area, and replacement of the existing temporary tent shelter with a more permanent shelter.

Following the completion of the report, excavation activities have been restricted to only those actions necessary to protect threatened resources such as the removal of the lower female mammoth and camel skull threatened by drainage patterns through the excavation pit.

The city of Waco, Baylor University, and the community are currently planning to contract for the installation of an 8,400-square-foot climate controlled excavation shelter to replace the existing tent over the exposed specimens. In addition, visitor access into the shelter will be accommodated. These efforts will protect the *in situ* remains from the effects of further erosion and weathering, as well as the potential for future vandalism.

Until the excavation shelter is completed, there is still potential damage resulting from animal activity. This includes mud dabber wasps that excavate wet mud in the vicinity of the bones. Their burrows were observed both on the sediment pedestals on which bones sit and in sediment filled cracks in larger bones. The incremental loss of the supporting soil structure continues to be a threat to exposed features. Since the site is open on the sides, it is regularly visited by skunks and raccoons which walk across specimens and cause minor damage. As long as the site remains open, it will not be possible to mitigate this problem.

Both from the standpoint of future scientific study and interpretation it is important that the current collection of specimens and their associated data remain intact as one unit and under single ownership/stewardship tied to the ownership and management of the site with material left *in situ*. Separation of these specimens will make their utilization more difficult and diminish their usefulness for future research. There are multiple options with regard to the curation and storage of these specimens. However, prior to curation, all specimens removed from the site will need to be prepared. Given the volume of material, this will be a lengthy and time-consuming process and will require a physical facility and support system to permit their proper and professional preparation.

Potential for Public Enjoyment or Scientific Study

The Waco Mammoth Site affords exceptional opportunities not only for public enjoyment ***or*** scientific study, but also for the public enjoyment ***of*** scientific study. These opportunities amount to fostering an appreciation and understanding of the science of paleontology. If access to the resource can be sensitively integrated with the needs for resource protection and security, the public could be provided a rare glimpse of a paleontological site like no other in the country. The preservation of a portion of the bones of the mammoth herd *in situ* provides opportunities to examine first hand the physical conditions governing the site, how the fossil site was formed, and how it was initially excavated by archeologists and paleontologists. It also affords opportunities to teach visitors about the scientific method and about how paleontology, along with

geology and archeology, is a historical science in which researchers are attempting to reconstruct events that have already taken place. Their methodologies are different from the experimental sciences such as chemistry, physics, and biology, although knowledge of the experimental sciences is critical to collecting the information needed to reconstruct an understanding of earth history. As such, the site provides a focal point to teach about all of the major sciences and how one discipline can contribute to another.

Effective interpretative programs could be developed at various educational levels, including programs for school groups at the elementary through high school levels, programs for the general public, and scientifically detailed programs for students in college and graduate school. Baylor University has established a precedent for utilizing the site for their museum studies and geology programs. The site has the potential to directly engage multiple scientific disciplines as well.

The Waco Mammoth Site provides scientifically valuable opportunities to compare mammoth specimens found in a natural state of death repose with mammoth specimens found elsewhere in Paleo-Indian kill or butcher sites. Questions related to such comparative research would be pertinent to paleontology because it is a historical science that deals with broad questions of evolution as well as detailed site-specific questions of taxonomy and how the arrangement of specimens like bones in the ground are influenced by ground disturbing events.

The Waco Mammoth Site also affords opportunities to study the behavior of a mammoth herd under duress. This provides opportunities to design research projects to compare past mammoth behavior with the present-day behavioral patterns and herd dynamics of modern elephants. Special opportunities exist at the Waco Mammoth Site to utilize this fossilized social behavior in studying a mammoth community's floral and faunal interactions. Past and present habitat ecology would be relevant here. Scientifically, the method of controlled comparison in both historic and modern contexts would be the aspect of the overall scientific method to be researched and taught.

Additional research would help further our understanding of the conditions and sequence of events that led to the conditions of the mammoth herd found at Waco. As additional research is conducted, findings can be continuously integrated into the interpretive messages as another opportunity to enhance public enjoyment.

The site has great potential for public enjoyment and scientific study. It provides many opportunities for the interpretation of a variety of scientific disciplines and an opportunity to encourage visitors to get excited by science.

Costs Associated with Acquisition, Development, Restoration, and Operation

Acquisition

The costs associated with land acquisition are not anticipated to include the purchase of the properties as both the city of Waco and Baylor University have stated a willingness to transfer their lands without cost to the National Park Service. However, based on conversations with staff of the Land Resources Program Center for the National Park Service Intermountain Region, there would be costs associated with conducting a full title search/ insurance, completing a hazardous material survey, and preparing a legislative map for the properties (estimated at $30,000), which would only occur if Congress decides to designate the Waco Mammoth Site as a new unit of the national park system.

The National Park Service may also need to pursue a waiver from the Department of Justice with regards to the specific language in the city of Waco tract due to the conveyance stipulation regarding land use (to be used for research, educational, and/or tourism purposes) and the requirement of the Grantee (city of Waco) to enter into an agreement with

Baylor University concerning maintenance of the property as an educational resource. The National Park Service may also consider entering into a cooperative agreement with Baylor University for the same.

Development

The extent of facility development and the associated cost is dependent on the long-term vision and direction for managing the resource and the visitor experience. If the Waco Mammoth Site were to become a new unit of the national park system, the long-term vision would be determined through the National Park Service's general management planning process.

Some major management decisions need to be made regarding whether or not to re-engage the excavation effort to determine the full extent of the resource. If the decision is made to investigate the limits of the find, a systematic approach under the direction of a paleontologist would be initiated. Once the limits have been determined, appropriate facility configuration designs could be developed and evaluated to determine the best method for insuring protection of the full extent of the resource, while also allowing for continued research, public access, and interpretation.

A more conservative approach would be to defer additional excavations and focus on the protection and preservation of the existing *in situ* remains and to initiate the preparation effort of the collected specimens. At some time in the future, once the park is fully staffed, management could then re-evaluate the option to extend the excavation or to remain focused on the existing excavation area.

Assuming site development for enhanced security, an access road, parking facilities, and utilities is accomplished through the Waco community effort currently underway, the remaining development needs would include providing for administrative and maintenance support facilities.

Storage of the collected specimens does not necessarily have to occur onsite as Baylor University has provided this service since the resource was first discovered. It is anticipated that this could continue through a partnership arrangement outlined in a cooperative agreement between the National Park Service and Baylor University. As there is a volume of preparation work required prior to specimen curation, the potential exists for providing a small paleo-lab that could be integrated with the onsite interpretive facility. Visitors could have the opportunity to observe scientists and volunteers at work preparing specimens for further study and curation.

The space requirements for administrative and management support should include provisions for office areas, storage of office supplies and interpretive materials, and mechanical equipment. Space requirements for maintenance support should include workshop area, storage of maintenance supplies, and storage of equipment.

Collection Preparation

The collected specimens will require the dedicated effort of a professional fossil preparator over an extended period of time. The preparation effort would include establishing protocols and documentation methods; removing specimens from field jackets; removing sediment from the bones; hardening the bones with plastic, if needed; reassembling broken pieces; re-associating separated material with original specimens; documenting, cataloging, and placing prepared specimens in cabinets or on shelving; and making them available for study or for casting for interpretive exhibits.

There are 93 plaster field jackets with specimens. Currently many jackets occupy 18-4'x8' shelves on open shelving. Others are on pallets with multiple jackets on some pallets.

Estimate of preparation effort (for a single person):

12 jackets: 12.0 months/jacket = 144 months
30 jackets: 3.0 months/jacket = 90 months
51 jackets: 0.5 months/jacket = 26 months

Total preparation time: 260 months
(over 21 person years)

Based on field photos the bones tend to be highly fragmented; reassembly and gluing of pieces could add to the estimated time for preparation. Preparation protocols also need to be established to ensure that potential information, such as dermestid beetle marks and bone weathering, are not lost during the preparation process.

Approximately 30 to 40% of the 137 boxes contain bones washed out from skeletons during 1978, 1981, 1984, and 1986. The museum is sorting these specimens and trying to associate them with specific skeletons. At this time, specimens are not being reassembled but are bagged together. The time required for the reassembly of these bones cannot be calculated and has not been included in the estimate of required preparation time.

Staffing

The level of staffing required for proper management and maintenance of the resource is influenced by the need to provide for the following functions:

- Overall management responsibility
- Paleontological expertise
- Resource and visitor protection
- Research coordination
- Collections preparation, curation, and management
- Interpretation
- Educational outreach
- Volunteer coordination
- Facility management and maintenance
- Administrative support

Each function does not necessarily require a full time allocation of staffing resources; some responsibilities could be combined under one position if qualified candidates could be assigned. It is anticipated that 9 –11 FTE (full time equivalent) positions would be needed; this estimate includes multiple seasonal positions for interpretation and maintenance.

The Waco Mammoth Site is located in close proximity to Lyndon B. Johnson National Historical Park (LBJ NHP), which is located 50 miles west of Austin, Texas, and 144 miles southwest of Waco, Texas. This suggests that a mentoring relationship between the two park staffs would be feasible in that the latter could handle certain administrative and oversight functions of the former. Such a relationship would help to reduce the initial operational expenditures and provide guidance to the site manager of the Waco Mammoth Site and his or her presumed small staff.

One potential management scenario for the Waco Mammoth Site could include staffing support from LBJ NHP for contracting, purchasing, and hiring. At the Waco Mammoth Site, a superintendent would be assigned with overall management responsibility for the site. Key support staff would include a facility manager, who would be assigned the management responsibilities for site operations, maintenance, and security.

The facility manager would supervise a small staff, supplemented with limited contracted services. It is anticipated that law enforcement would be managed through a concurrent jurisdiction arrangement with the city of Waco. If additional support is needed for special events or criminal investigations, law enforcement rangers could be dispatched from LBJ NHP. Complementing the role of facility manager, a resource manager would guide the scientific, educational, and interpretive component of the site. Preferably, this assignment would be made to a professional paleontologist who would supervise a small staff. Other duties envisioned would include site investigations,

monitoring, and research coordination. Staff assigned to the resource manager would include a collections manager/preparator, interpretation/education specialist/volunteer coordinator, and seasonal interpreters.

Socioeconomic Impacts of a New Unit Designation

In 2001, a report entitled *The Economic Impact of the Waco Mammoth Park on the Central Texas Region* was prepared by Dr. Tom Kelly, economist and Director of Baylor Center for Business and Economic Research. In this study, Dr. Kelly projected that basic income would come from two sources: 1) from the construction, operations, and maintenance of the facilities and 2) from visitors traveling from outside the region and spending within the local economy. Dr. Kelly applied the central Texas region's expenditure multiplier for construction of new educational facilities (2.325) and the expenditure multiplier for tourism visitors (2.827) according to an input-output model estimated by the Ray Perryman Group. He also projected that 10% of the visitors to the site would spend at least one additional day in the central Texas region. Dr. Kelly used initial construction costs of $1.94 million and anticipated attendance between 100,000 to 200,000 visitors per year. He projected that the construction phase would add $4.5 million to the central Texas region. Staff and operation spending ($347,000) would have an on-going beneficial economic impact of $980,000. The economic impact of other visitor spending would be between $2.25 and $4.5 million each year. The total economic impact of the Waco Mammoth Site, not including other benefits in the form of setting aside additional open space, would amount to a one time impact of between $8 and $10 million, with a continuing annual impact of between $3.23 and $5.48 million to the central Texas region.

Another scenario uses the more modest attendance projections outlined in the 2003 Lord Report (30,000 visitors per year by the third year of operation versus 100,000 to 200,000 cited above), the total costs for the Waco community's Phase I construction of $3.2 million, the estimated annual operational costs of $380,000 (Lord Report), and the same multipliers used by Dr. Kelly in his 2001 report. In this scenario, the adjusted economic impact from the construction phase would be a onetime impact of $7.44 million, staff and operations would be an ongoing annual beneficial economic impact of $1.07 million, and visitation would be an ongoing annual beneficial economic impact of $0.68 million. The combined economic impact would amount to a one time beneficial impact of $9.19 million with a continuing annual benefit of $1.75 million added to the central Texas regional economy.

If the Waco Mammoth Site were to become a new unit of the national park system or a new municipal park, the economic impact would be beneficial and long term to the community in the form of enhanced tourism and increased revenue generated by this influx and the addition of new employment opportunities for managing and maintaining the site. The greatest socioeconomic impact is projected to be beneficial and long term to the general public, local and regional school groups, and the scientific community. This would be realized through enhancing onsite access and interpretation of the Waco Mammoth Site, encouraging research activities to help broaden the understanding of what occurred here, and enhancing educational opportunities for local school groups as well as other groups that may travel to the site. There would also be beneficial and long-term socioeconomic impacts resulting from the intangible value of collective community pride for the citizens of Waco who have supported the notion of establishing the Waco Mammoth Site as a new unit of the national park system for the entire nation to enjoy.

Level of Local and General Public Support

Both of the landowners, the city of Waco and Baylor University, as well as the local community, the paleontological community, members of Congress, and others who know of this site have expressed overwhelming support for

designating the Waco Mammoth Site as a new unit of the national park system.

Feasibility Findings

The total acreage of the Waco Mammoth Site includes 109.34 acres that appear to be of sufficient size and appropriate configuration to ensure long-term, sustainable resource protection and visitor enjoyment.

Surrounding land uses are likely to remain stable and compatible with park values. The site is well situated for public access and protection. There is an abundance of untapped potential for providing public enjoyment. The scientific community, general public, members of Congress, and existing landowners have expressed unflagging support of the site's consideration for inclusion into the national park system.

It may be feasible, even under current and anticipated NPS budget constraints, for the National Park Service to manage, maintain, and operate the resources of the site. The city of Waco and Baylor University have stated a willingness to transfer the lands without cost to the National Park Service. There are opportunities for efficient administration by the National Park Service at a reasonable cost, especially if existing partnership support could be maintained and enhanced through the use of cooperative agreements. Cooperative agreements identify the roles and responsibilities of each partner and are instruments not only for role definition but also for transferring funds, if that should be appropriate. The city of Waco and Baylor University have already established a partnership to manage the site, and such arrangements could be developed, maintained, and enhanced for the future. The National Park Service could also enter into partnerships with either or both of these entities or with others who wish to support the Waco Mammoth Site.

Chapter Four: Alternatives for Management

CHAPTER OVERVIEW

The fourth criterion in the special resource study process includes an evaluation of whether the site requires direct management by the National Park Service instead of protection by another public agency or the private sector. Unless direct NPS management is identified as the clearly superior alternative, the National Park Service will recommend that others assume the lead management role, and that the area not be included in the national park system.

To complete the evaluation of this last requirement in the special resource study, the team initiated the following steps:

- Encouraged public opinion and ideas about managing the Waco Mammoth Site through a project website, press releases, scoping newsletter, and public meetings.
- Outlined a range of management alternatives and tested their viability with NPS leadership, with representatives from the city of Waco and Baylor University, and then with the public.
- Refined and more fully developed the range of management alternatives based on this input and identified potential environmental consequences associated with each alternative.

ISSUES AND PUBLIC CONCERNS

During the initial phases of the scoping process, stakeholders and the general public raised a number of ideas and recommendations for managing the resources of the Waco Mammoth Site. A summary of public input collected is presented below. The actual words of the members of the public who responded are paraphrased and condensed into overall categories of the different ideas expressed. Common threads of concern focused on the following primary themes: provide visitor access to the site, promote scientific research, maximize the educational potential, and balance resource protection with these activities.

Visitor Access

Convenient and meaningful access should be provided to the Waco Mammoth Site so that it becomes a destination point as a genuine national treasure to be popularly shared. The accommodations desired would be for people of all ages, interests, and abilities. Access should be available to individuals and to groups of varying sizes who might visit the site as a bonus to conventions or other businesses in Waco, or as an aspect of special events there. The Waco Mammoth Site should not only draw visitors from a national base, but also from a regional base that includes the relatively nearby population centers along the Interstate Highway I-35. Regional residents could easily become repeat visitors, coming to learn about the latest scientific findings from ongoing research as well as to bring family members and friends who have not yet seen the site.

Research

The excavation history of the site provides a context for research. Ongoing research should be a regular feature of the site. A multi-disciplinary approach should guide scientific research.

Education

The resource provides a wonderful opportunity for engaging and stimulating the imagination of children as well as adults. The site's educational potential is extraordinary and provides opportunities for interested people of all ages to contemplate the life forms and habitats that existed in the Waco area during the Pleistocene Epoch. Educational programs also can be directed towards how

science is carried out and how it contributes to the discovery process.

Resource Protection

Proper provisions for the physical protection of the site are vital for its long-term preservation. Resource protection should be undertaken to allow for ongoing research and the possibility of discovering more mammoth specimens as well as to allow for effective onsite interpretation for education and public enjoyment.

Supporting Comments

Other categories of comment from the public show tremendous community support for preserving the site and for making it available for public access. Various possibilities for partnering were suggested so that scientific research, visitor education, and community integration can be achieved in balanced harmony. Integrating the site effectively with Waco's other attractions such as the Cameron Park Zoo and the Mayborn Museum Complex of Baylor University is a desire. Some supporting comments cite socioeconomic data and population figures for Waco to become a major tourist attraction with the Waco Mammoth Site as a feature important to that desired result.

ALTERNATIVES DEVELOPMENT

In order to provide a philosophical foundation for future decision making regarding the management framework and range of potential uses appropriate for this special resource, the study team met with representatives of the city of Waco and Baylor University and developed the following list of guiding principles or purpose statements for the Waco Mammoth Site:

- Preserve and protect the outstanding paleontological site, collected specimens, and associated data known as the Waco Mammoth Site for present and future generations.
- Provide for the facilitation of orderly, regulated, and continuing research.
- Promote understanding and stewardship of resources by providing interpretive and educational opportunities.
- Provide opportunities to experience, understand, and enjoy the resource and surrounding area in a manner that is compatible with the preservation of resources.

Drawing from stakeholder and public input, the study team developed a range of management alternatives and tested their viability with current managers of the resource within the city of Waco and Baylor University and NPS leadership. Differences among alternatives related primarily as to who would manage the area and the approach or method to which the site's purpose would be achieved. Four potential management alternatives evolved and were outlined in a newsletter that was distributed for public review and comment during September 2007. Almost all of the public comments indicated that the alternatives presented in the newsletter represented a reasonable range of options to further develop and analyze in the special resource study. It was also interesting to note that a majority of the public comments submitted supported expanding the existing partnership between Baylor University and the city of Waco to include the National Park Service.

In accordance with the National Environmental Policy Act of 1969 (NEPA), one of the alternatives is a "no-action" alternative. This alternative represents continuing current management trends; it is alternative A in this document. This alternative also serves as the basis for comparing the environmental consequences of three other "action" alternative management scenarios. Two charts are provided at the end of this chapter to provide a quick comparison among alternatives. The first matrix provides a summary comparison of the components of each management alternative and the second matrix provides a summary comparison of the environmental consequences.

Elements Common to All Alternatives

There are a number of elements that are assumed to be common to all alternatives. They include a baseline level of development already underway by the Waco community to provide for resource protection and visitor access, accessibility, and the extent of the potential park boundary.

Level of Development

For the purposes of this study, it is assumed that Phase I construction initiated by the Waco community is underway and serves as the baseline level of park development for the site. The development includes an 8,400-square-foot shelter, with limited air-conditioned interior space over the excavation area and *in situ* specimens. The development will also include interpretive exhibits, an access road, a small parking area with overflow parking that can accommodate bus and recreational vehicles, connecting trails to the excavation shelter, a small visitor contact station with restrooms, utility extensions, and enhanced security systems.

Accessibility

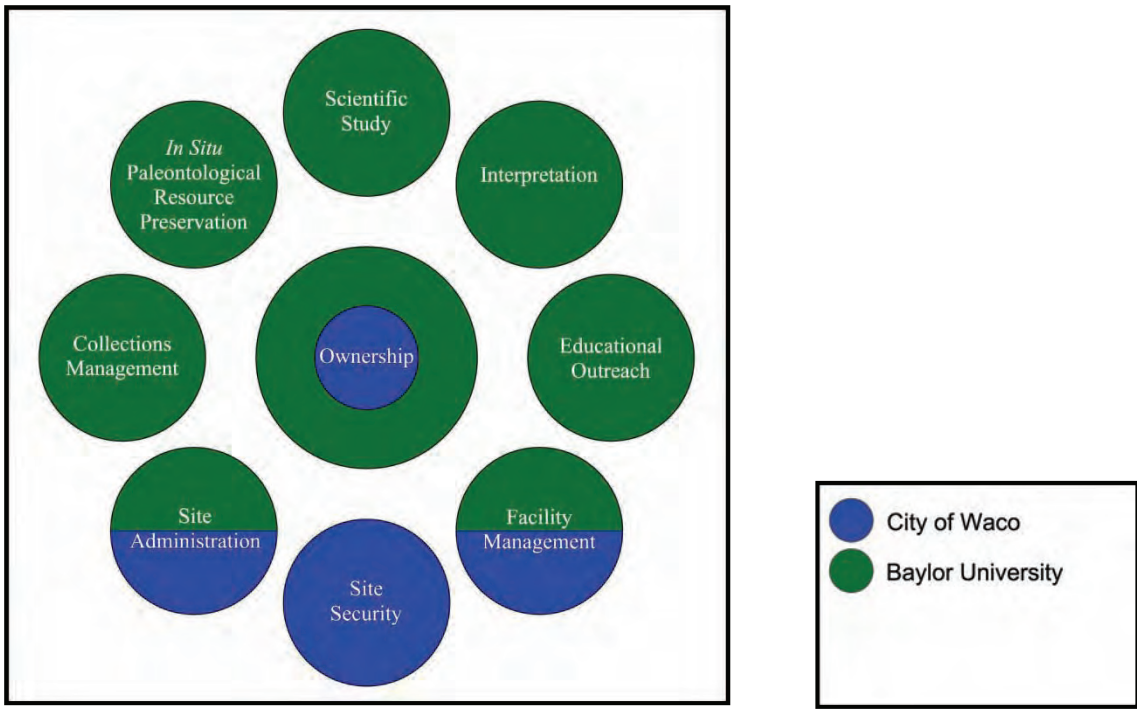
Any additional facility development would be accessible in accordance with the Architectural Barriers Act Accessibility Standards (ABAAS, May 8, 2006).

Park Boundary

The boundary of the potential park includes the 4.93-acre parcel containing the discovery site owned by the city of Waco and the surrounding three parcels totaling 104.41 acres owned by Baylor University. Acquisition of additional property beyond the collective 109.34 acres does not appear necessary at this time to ensure long-term protection of the special resource.

MITIGATION MEASURES

Mitigation measures are specific actions designed to minimize, reduce, or eliminate impacts of alternatives and to protect resources and visitors. The purpose of this special resource study is to evaluate the Waco Mammoth Site's potential for consideration as a new unit of the national park system. This phase of the study focuses on the evaluation of alternative management scenarios. If this site were to become a new unit of the national park system, additional planning and implementation proposals would be fully vetted through additional NEPA and NHPA compliance activities. This is where specific actions would be outlined to minimize, reduce, or eliminate impacts of alternatives and to protect resources and visitors, as well as also ensuring full compliance with the NEPA, NHPA, and NPS policy.



ALTERNATIVE A: CONTINUE CURRENT MANAGEMENT TRENDS (NO-ACTION)

Overview

The no-action alternative represents the continuation of current management trends at the Waco Mammoth Site and serves as a base-line measurement for comparing three proposed alternative management strategies. New programs, activities, or site development beyond the efforts currently underway by the Waco community are not considered in this alternative. For the purposes of this study, the following conditions and trends are presumed to continue.

Concept for Management

The Waco Mammoth Site is managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, working towards enhancing resource protection of the *in situ* specimens, and providing for onsite visitor enjoyment and understanding through local community efforts.

Overall Management Framework

The existing cooperative management arrangement between the city of Waco and Baylor University is continued. The city of Waco manages the security and maintenance of the 4.93-acre property containing the core paleontological site. Baylor University manages the surrounding 104.41 acres and provides preservation of the *in situ* and collected specimens, preservation of the archives, scientific research involving the site and the collections, and educational expertise supporting the interpretive program for the core paleontological site.

Resource Management

Resources continue to be monitored and protected by the city of Waco and Baylor University.

Baylor University would continue to ensure the *in situ* paleontological resources are

stabilized and preserved. The current moratorium on excavation activities would continue.

The larger specimens collected from the site would remain in plaster jackets while the smaller bone fragments and soil samples would remain in cataloged cardboard boxes and stored within Baylor University's Mayborn Museum Complex. Research reports and documentation of the site and excavation activities would continue to be archived at the Mayborn Museum Complex.

Scientific Study

The university would continue to conduct scientific study of the resource to further the understanding of the circumstances of the site.

Level of Development

For the purposes of this study, it is assumed that the Waco community efforts to erect a protective shelter over the excavation area and to provide for controlled visitor access to the site are underway. Under this alternative, there would be no expansion of development beyond this effort.

Visitor Experience

Visitor understanding and appreciation of the resource continues to be provided off-site by a dedicated exhibit room within the museum setting of Baylor University's Mayborn Museum Complex.

Once the excavation shelter and site improvements are completed, visitor access would be accommodated. Opportunities for visitor understanding and appreciation of the paleontological resources would be greatly enhanced through onsite interpretive waysides and through controlled visitor access into the excavation shelter where views of the *in situ* specimens would be provided. However, as additional operational funding has not been allocated to accommodate daily visitation, there would not be any permanent onsite staff. Visitor access would be on a limited basis, with at least 12 events scheduled throughout the year to accommodate visitors into the excavation shelter as required by the Save America's Treasures grant. It is anticipated that existing staff from the city and Mayborn Museum would manage these events. Educational outreach programming for local schools or other groups would be very limited.

Facility Management

When the excavation shelter is completed, the city will be responsible for maintaining and operating the onsite facilities that provide for the protection of the *in situ* specimens and the accommodation of visitors.

The collection storage area housing the Waco Mammoth Site's paleontological collection and archives would continue to be maintained off-site within the geology/paleontology collections room of Baylor University's Mayborn Museum Complex.

Site Administration and Security

The city of Waco and Baylor University would continue to share site administration responsibilities. The city would continue to provide security, police, fire, and emergency medical services for the site.

Potential Site Recognition

Based on the initial findings of the special resource study, the Waco Mammoth Site is a potential candidate for two categories of site recognition. The first category is based on the resource evaluation and initial findings of national significance, which indicate that the Waco Mammoth Site is a potential candidate for national natural landmark status. The second category is based on the resource evaluation and initial findings of national significance and suitability, which indicate that the Waco Mammoth Site is potentially eligible for Congressional designation as a National Park Service affiliated area. A brief outline of each of these two designations is presented below.

National Natural Landmarks: National natural landmark designation is a process by

which natural areas, in both public and private ownership, are recognized as outstanding examples of our nation's natural heritage. The secretary of the interior, with the landowner's consent, designates national natural landmarks. Nationwide, nearly 600 sites have received this special designation. Two sites were designated national natural landmarks in 2006: Ashfall Fossil Beds National Natural Landmark in Nebraska, and Irvine Ranch National Natural Landmark in California. Prior to 2006, it had been almost 18 years since a site was designated. The National Natural Landmarks Program encourages conservation of these outstanding natural features. The National Park Service administers the program, and if requested, can assist national natural landmark owners and managers with the conservation of these important sites. These services may include any of the following:

1) Assisting national natural landmark owners with grant applications to fund site conservation and interpretive projects.

2) Providing or brokering technical assistance to national natural landmark owners.

3) Building partnerships by coordinating for research and other purposes with the National Park Service Rivers, Trails, and Conservation Assistance Program and the network of Cooperative Ecosystems Study Units and collaborating with academic institutions in various aspects of achieving the National Natural Landmarks Program's objectives.

National Park Service Affiliated Areas: Affiliated areas include a variety of locations in the United States and Canada that preserve nationally significant properties outside the national park system. Congress designates affiliated status through legislation, which may also authorize the secretary of the interior, through the National Park Service, to provide technical and/or financial assistance.

Technical assistance may include access to training and/or services such as interpretation, historic preservation, and other resource protection and preservation. Congress may appropriate financial assistance for one-time studies or preservation projects, or it may appropriate annual funds to help manage the affiliated area. Affiliated areas are permitted to display the NPS arrowhead symbol in tandem with the partner's symbol and may use it in their printed and online literature and other interpretive media about the site.

Under this alternative, it is assumed that these options represent potential site recognition only, as neither of these designations is actively being pursued by the city of Waco, Baylor University, or Congress at this time.

Ownership

The core paleontological site remains under the ownership of the city of Waco, while the surrounding lands continue under the ownership of Baylor University.

Ownership of the collected specimens and archives continues under shared ownership between the city of Waco and Baylor University.

Cost Estimate

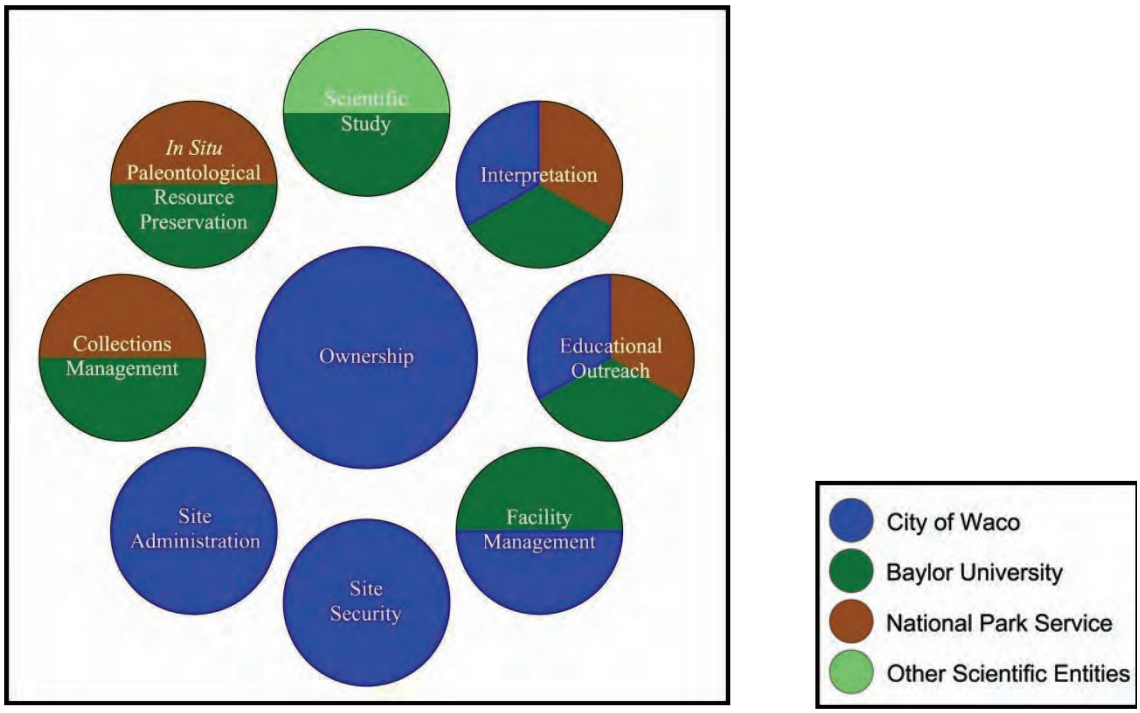
The current costs for managing the Waco Mammoth Site are difficult to quantify. Staff support for the site is an assigned collateral duty among other responsibilities. Under this alternative, it is assumed that no new funding for staffing, maintenance, and operations beyond what is currently being provided by Baylor University's Mayborn Museum Complex and the city of Waco's Department of Parks and Recreation would be provided. The costs to provide continued stewardship of the resource, as well as the added responsibilities for facility maintenance, utilities, security, and staffing when the site is open to visitors during the 12 scheduled events per year, would be covered by the city and the Mayborn Museum's existing funding levels.

Partnership Opportunities

The Waco Mammoth Foundation and the local community continue to play a key partnership role in supporting preservation

and public access initiatives for the Waco Mammoth Site.

The Waco Mammoth Foundation has spearheaded an energetic effort to seek public and private support for the Save America's Treasures initiative. Major donors include Baylor University, the city of Waco, McLennan County, the Cooper Foundation, the Waco Foundation, as well as a host of other foundations and private individuals.



ALTERNATIVE B: PARTNERSHIPS LED BY THE CITY OF WACO

Concept for Management

The Waco Mammoth Site would be managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, providing for onsite visitor enjoyment and understanding of the paleontological resources, and providing a range of environmental educational and recreational opportunities within the surrounding lands.

Overall Management Framework

The existing cooperative management arrangement between the city of Waco and Baylor University would be expanded with additional partners, with the city assuming the lead responsibility for managing the site as a municipal park.

National natural landmark status would be actively pursued, allowing the city to seek technical assistance from the National Park Service for paleontological resource preservation, interpretation, and educational outreach. Additional partnerships, such as local community initiatives, land trusts, foundations, nongovernmental organizations, and federal, state, and local governments, would also be sought to assist with developing and managing the site.

This alternative would protect and interpret the site, and provide opportunities for research of the core paleontological resources. It would also give the city freedom to pursue possible broader ideas such as providing environmental education and recreational opportunities.

Resource Management

Resources would be monitored and protected by the city of Waco and Baylor University. Baylor University, with technical assistance and guidance provided by National Park Service paleontologists and museum

specialists, would continue to ensure the *in situ* paleontological resources are stabilized and preserved. With the protection from the elements provided by the excavation shelter, the current moratorium on excavation activities could be lifted to allow for controlled investigations.

Technical assistance by the National Park Service could also be provided to Baylor University to develop protocols and methodologies for initiating preparation and cataloging of the specimens currently housed in plaster jackets and the smaller fragments and soil samples in cardboard boxes. Dedicated space for establishing a specimen preparation laboratory may be accommodated within the museum or within the onsite facilities developed by the city. The collection would continue to be housed within Baylor University's Mayborn Museum Complex. Research reports, documentation of the site and excavation activities would also continue to be archived there.

Scientific Study

Baylor University would continue to conduct scientific study of the site. The university would also actively network with and coordinate scientific study by other scientific entities. Opportunities would be pursued to establish an endowment to support continued scientific study of the resource.

Level of Development

The Waco community efforts to erect a protective shelter over the excavation area and to provide for controlled visitor access to the site are currently underway. However, under this alternative the level of development could be expanded to accommodate a broader range of onsite visitor opportunities. The city could pursue their long-range vision for developing a city park at the site. As funding permits, additional facilities may be provided that could include an environmental education center, research and specimen preparation laboratory (either onsite or within the Mayborn Museum Complex), interpretive plaza, expanded interpretive waysides, expanded parking, expanded restrooms, administration/ maintenance support structure, interpretive nature trails and connecting trails to the Bosque River and Brazos River Corridor, boat dock, and picnic and informal play areas.

Visitor Experience

Similar to the visitor experience described in alternative A, visitor understanding and appreciation of the resource would continue to be provided off-site by a dedicated exhibit room within the museum setting of Baylor University's Mayborn Museum Complex. However, visitors would be able to participate in a wider range of interpretation programs in alternative B than in alternative A.

Once the excavation shelter and site improvements are completed, visitor access to the core paleontological area and surrounding lands would be made available to the visiting public on a daily basis. Opportunities for visitor understanding and appreciation of the paleontological resources would be greatly enhanced through onsite interpretive waysides and through controlled visitor access into the excavation shelter where views of the *in situ* specimens would be provided.

After development of a comprehensive interpretive plan to guide interpretive programming for the resource, visitor understanding and appreciation of the paleontological resources would be enhanced through additional onsite interpretive mechanisms. Guided tours and interpretive programs for school groups, and special events would be provided.

In addition, the environmental education center would provide enhanced visitor understanding and appreciation of the mammoth site as well as the unique environment found along the interface of the Texas Hill Country and Gulf Coastal Plain. The city of Waco, Baylor University, and the National Park Service could collaborate on the development of the interpretive plan, program, and media. They could also collaborate on educational outreach programs

targeting school groups at the elementary through high school level, programs for the general public to promote life-long learning, and scientifically detailed programs for students at the post secondary education level.

An interactive website could be established to provide a "Portal to the Pleistocene" with an in-depth presentation of the site and its relationship to the Pleistocene, updates on the progress of ongoing scientific study conducted at the site and on the collected specimens, and links to other mammoth sites found throughout the country and potentially other locations around the world.

Recreational opportunities could be developed by the city by providing access to the Bosque Riverfront and Brazos River Corridor by way of connecting trails. Water taxis could be accommodated along the site's Bosque riverfront, which could extend additional connections to other community attractions.

Facility Management

The city would be responsible for maintaining and operating the onsite facilities that shelter the *in situ* specimens and provide visitor access as well as the expanded site infrastructure described above.

As is described in alternative A, the collection storage area housing the Waco Mammoth Site's paleontological collection would continue to be maintained off-site within the geology/paleontology collections room of Baylor University's Mayborn Museum Complex.

Site Administration and Security

The city of Waco would be responsible for site administration and would continue to provide city services such as security, police protection, fire suppression, and emergency medical response for the entire site.

Site Recognition

The city would actively pursue national natural landmark (NNL) designation through the National Park Service's NNL program. Another option under this alternative could include Congressional designation as a National Park Service "affiliated area" to further strengthen the possibility of National Park Service involvement.

Ownership

The core paleontological site would remain under the ownership of the city of Waco; however, the surrounding lands currently under the ownership of Baylor University could be transferred to the city of Waco for the purposes of allowing the city to more fully develop the site as a city park.

Ownership of the collected specimens and archives would continue as shared ownership between the city of Waco and Baylor University.

Cost Estimate

Capital improvement cost estimates for this alternative are based on the recent master planning effort commissioned by the city. It is anticipated that $8.1 million would be needed to implement the city's long-range vision for creating a municipal park at the Waco Mammoth Site.

The city projects that a staff increase of approximately 5.5 FTE (full-time equivalent) positions would be needed to provide entry control, schedule group tours, provide general information, and maintain facilities. Additional assistance for large ground maintenance could be provided by existing crews from the city's Department of Parks and Recreation. Their annual operational costs are estimated to be approximately $300,000. Baylor University's Mayborn Museum staff anticipates a need to provide a full time coordinator of volunteers to recruit, schedule and oversee volunteers at the site. The training of volunteers could be conducted by the existing education staff of the Mayborn Museum as part of their assigned duties. The annual estimated cost is projected to be $45,000. Existing museum staff and/or trained

volunteers could participate in the fossil preparation efforts.

Technical assistance could be provided to Mayborn Museum and city of Waco staff by National Park Service paleontologists, museum curators, fossil preparators, and interpretive planners to help guide preservation and interpretive/educational outreach programming efforts. It is anticipated that $10,000 to $25,000 per year in additional NPS funding would be needed for a five-year period to support NPS staff time and travel expenses.

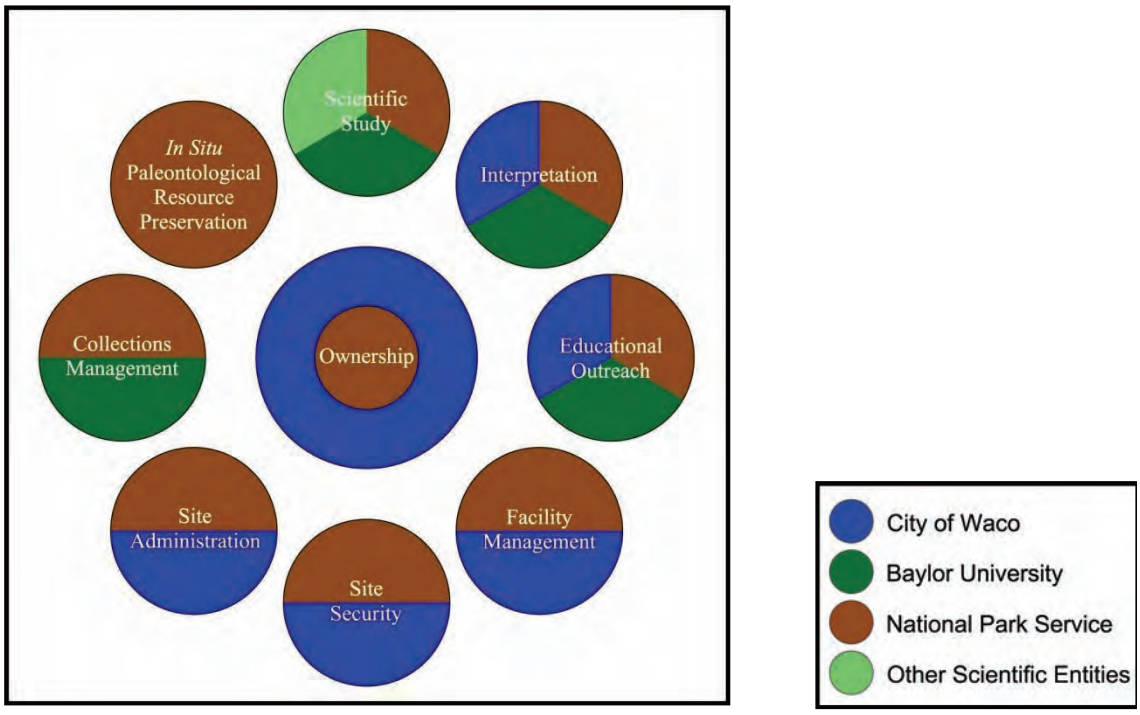
Partnership Opportunities

As in alternative A, the Waco Mammoth Foundation and the local community would continue to play key partnership roles in supporting preservation and public access initiatives for the site.

Technical assistance from the National Park Service could be provided if the city were to successfully pursue National Natural Landmark designation for the site. If Congress were to designate the Waco Mammoth Site as a National Park Service affiliated area, technical and potentially financial assistance could also be provided.

A number of other opportunities could be pursued to help support management of the site, including the following:

- donations or grants from government, corporate, and/or private sources
- community volunteers and student interns
- volunteer scholar and student led research activities
- entry fees could be charged to help offset operational expenses



ALTERNATIVE C: PARTNERSHIPS LED BY THE NATIONAL PARK SERVICE

Concept for Management

Similar to the management described in alternative B, in alternative C the Waco Mammoth Site would be managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, providing for onsite visitor enjoyment and understanding of the paleontological resources, and providing a range of recreational and environmental educational opportunities. Alternative C is different from alternative B in that management responsibilities for fulfilling this purpose would be delegated among the National Park Service, the city of Waco, and Baylor University, and there would be an expansion of partnership opportunities with others.

Overall Management Framework

The Waco Mammoth Site would be managed as a new unit of the national park system, in partnership with the city of Waco, Baylor University, and others.

The National Park Service would prepare a general management plan to guide future managers of the site by clearly defining what level of resource conditions and visitor experiences should be achieved and maintained over time. Developed in consultation with local governments, park stakeholders, and the general public, the plan would establish overarching resource management goals and provide guidance concerning the overall level and intensity of development appropriate for the site. A partnership development strategy would be included as an integral component of the plan. Under this alternative the National Park

Service would take the lead responsibility for ensuring the protection, scientific study, and visitor enjoyment of paleontological resources, enlisting the help of partners to accomplish this mission. The city of Waco or other partners would take the lead for initiating additional recreational, interpretive, and environmental educational opportunities on the site. For example, the National Park Service would make sure that *in situ* paleontological resources are protected and would provide opportunities for visitor enjoyment, but would not likely initiate major capital improvements for expanded visitor services or administrative facilities. Any major investments to provide a full service visitor center or environmental education facility, administrative facilities, and regional trail connections could be pursued by the city and other partners.

Resource Management

The National Park Service would develop a resource stewardship strategy including a collections management plan to guide resource management activities. For the purposes of this study, it is assumed that future resource management strategies would include the following recommendations:

The National Park Service would assume responsibilities for the core paleontological resources of the site. This would include monitoring the conditions of the *in situ* specimens and perhaps exploring other areas within the excavation shelter to acquire additional information about the circumstances of the site. Other site resources in the surrounding lands would be managed by the city of Waco.

The paleontological collections management would be divided between the National Park Service and Baylor University. The National Park Service would develop protocols and methodologies for initiating preparation and cataloging of the specimens currently housed in plaster jackets and the smaller fragments and soil samples in cardboard boxes. It is assumed that a specimen preparation laboratory could be incorporated into the city's proposed environmental education center at the site with the National Park Service operating the lab. The collection would continue to be housed within Baylor University's Mayborn Museum Complex, except that select portions of the collection may be housed onsite within the education center for the purposes of exhibiting prepared specimens and/or exhibiting the specimen preparation process to the public. Research reports and documentation of the site and excavation activities would be maintained onsite by the National Park Service. Similar to alternative B, this would benefit future researchers as access to prepared specimens would be made possible for the first time. It would also provide a benefit for the public as select fossils could be cast for exhibit purposes. However, under this alternative, it would provide an added benefit of integrating the specimen preparation activities into the interpretive experience at the site.

Scientific Study

To further the understanding of the site and its circumstances, the National Park Service would support and coordinate the scientific study of the core paleontological resources and geologic context. Opportunities would be pursued to establish an endowment to support continued scientific study of the resource. The National Park Service would consult with the Cooperative Ecosystem Studies Units (CESU) national network to help facilitate expanded research opportunities through other scientific institutions. Each CESU is structured as a working collaborative among federal agencies and universities that are focused on specific biogeographic regions of the country. The Waco Mammoth Site falls within the interface of three biographic regions: the Gulf Coast, Desert Southwest, and Great Plains. Baylor University could apply for inclusion in either of these units to expand their opportunities to apply for potential federal funding of future research initiatives for the site.

Level of Development

The National Park Service would initiate a general management planning effort to

provide guidance concerning the overall level and intensity of development appropriate for the site. For the purposes of this study, it is assumed that the level of development would be as follows.

Similar to alternative A, the Waco community efforts to erect a protective shelter over the excavation area and to provide for controlled visitor access to the site are underway. However, under this alternative the National Park Service would provide for enhanced interpretive mechanisms of the paleontological resources and would partner with others to initiate a broader range of other onsite visitor opportunities. For example, the city of Waco could pursue their long-range vision for developing a city park at the site that may include, as future funding permits, an environmental education center with expanded indoor and outdoor interpretive opportunities, interpretive nature trails connecting to the Bosque Riverfront and other regional trailways along the Brazos River corridor, boat access along the Bosque Riverfront, and picnic and informal play areas. It is also assumed that NPS staff could be accommodated within the administrative facilities developed by the city.

Visitor Experience

Visitors would be able to participate in a similar range of interpretation programs as outlined under alternative B.

Similar to that described in alternative A, visitors' understanding and appreciation of the resource would continue to be provided off-site by a dedicated exhibit room within the museum setting of Baylor University's Mayborn Museum Complex.

Once the excavation shelter and site improvements are completed, visitor access would be accommodated. Opportunities for visitor understanding and appreciation of the paleontological resources would be greatly enhanced through onsite interpretive waysides and through controlled visitor access into the excavation shelter where views of the *in situ* specimens would be provided. Access to the core paleontological area and surrounding lands would be made available to the visiting public on a daily basis.

Interpretive programs and media provided through the Waco community's Phase I park development efforts would be expanded through the collaborative efforts of the National Park Service, the city of Waco, and Baylor University. A comprehensive interpretive plan would be prepared to guide the development of enhanced interpretive mechanisms and programs for the resource. Guided tours and interpretation programs for school groups and special events would be provided. Opportunities to allow the visiting public to observe the specimen preparation work would be developed.

The partners would also collaborate on educational outreach programs targeting school groups at the elementary through high school level, programs for the general public to promote life-long learning, and scientifically detailed programs for students at the post-secondary education level.

In addition, an environmental education center would provide enhanced visitor understanding and appreciation of the mammoth site as well as of the distinctive environment found along the interface of the Texas Hill Country and Gulf Coastal Plain.

The specimen preparation laboratory with strategically placed viewing windows could be integrated into the city's environmental education center to provide opportunities for visitors to observe the fossil preparation process.

An interactive website could be established to provide a "Portal to the Pleistocene" with an in-depth presentation of the site and its relationship to the Pleistocene, updates on the progress of ongoing scientific study efforts, and links to other mammoth sites found throughout the country and potentially other locations around the world.

Recreational opportunities could be developed by the city by providing access to the Bosque Riverfront and Brazos River corridor by way of connecting trails. Water taxis could be accommodated along the site's Bosque riverfront, which would extend the additional connections to other community attractions.

Facility Management

The facilities constructed through the Waco community initiative providing protection of the *in situ* specimens and providing visitor access to the excavation area would be operated and maintained by the National Park Service.

Additional facilities developed by the city to enhance the environmental educational and recreational opportunities of the site would be operated and maintained by the city of Waco.

Similar to alternative A, the collection storage facility housing the Waco Mammoth Site's paleontological collection would continue to be maintained off-site within Baylor University's Mayborn Museum Complex.

Site Administration and Security

The National Park Service would be the primary manager of the 4.93-acre core paleontological site, while the city of Waco would be the primary manager of the surrounding 104-acre city park. The city would provide city services such as security, police protection, fire suppression, and emergency medical response for the entire site. It is assumed that shared jurisdiction for law enforcement would be established between the city of Waco and the National Park Service for areas under NPS management.

Site Recognition

Congress would designate the site as a new unit of the national park system. The process for national natural landmark designation could be pursued by the National Park Service.

Ownership

Enabling legislation would allow flexibility for a mixture of land ownership and management among the key entities that would best fulfill the mission. For example, while a National Park Service boundary may be authorized for the entire site, some or all of the land may remain with the city of Waco and Baylor University. It is assumed for the purposes of this study, that the federal government would acquire ownership of the core paleontological site, the collected specimens, and archives. The lands owned by Baylor University would be transferred to the city of Waco for the purpose of allowing the city to more fully develop the surrounding lands as a city park.

Cost Estimate

Similar to alternative B, capital improvement cost estimates for this alternative are based on the recent master planning effort commissioned by the city. It is anticipated that $8.1 million would be needed to implement the city's long-range vision for creating a municipal park at the Waco Mammoth Site.

The city projects a staff increase of approximately 5.5 FTE (full-time equivalent) positions would be needed to provide entry control, schedule group tours, provide general information, and maintain facilities. Additional assistance for large ground maintenance could be provided by existing crews from the city's Department of Parks and Recreation. Their annual operational costs are estimated to be approximately $300,000.

There would be no projected increases in staffing or operational expenses beyond current levels already provided by Baylor University's Mayborn Museum.

The National Park Service would program and develop enhanced interpretive mechanisms for the site as well as within the excavation pavilion. The projected estimated cost for enhanced interpretive media is $585,000. It is anticipated that NPS staff could be accommodated within the administrative spaces of city-owned facilities, so there would

be no additional capital improvement costs for NPS needs.

The estimated annual costs for NPS employees is based on the assumption that staff would be supervised and supported by the Lyndon B. Johnson National Historical Park located in Johnson City, 144 miles to the southwest of the site. At the fully staffed level, it is estimated that approximately 4 FTE (full-time equivalent) positions would work at the Waco Mammoth Site with a focus on the core paleontological area. Employees would include a paleontologist who would serve as the resource manager and research coordinator for the site; a collections manager/fossil preparator who would work with Mayborn Museum staff and trained volunteers to initiate specimen preparation efforts; an interpretive specialist who would oversee the interpretive/educational outreach programs, supervise seasonal interpreters, and serve as the volunteer coordinator; and two to three seasonal interpreters.

Annual staffing costs including benefits are estimated to total $246,000. Annual operational costs for supplies, materials, utilities, and equipment would be approximately $99,000 annually.

Partnership Opportunities

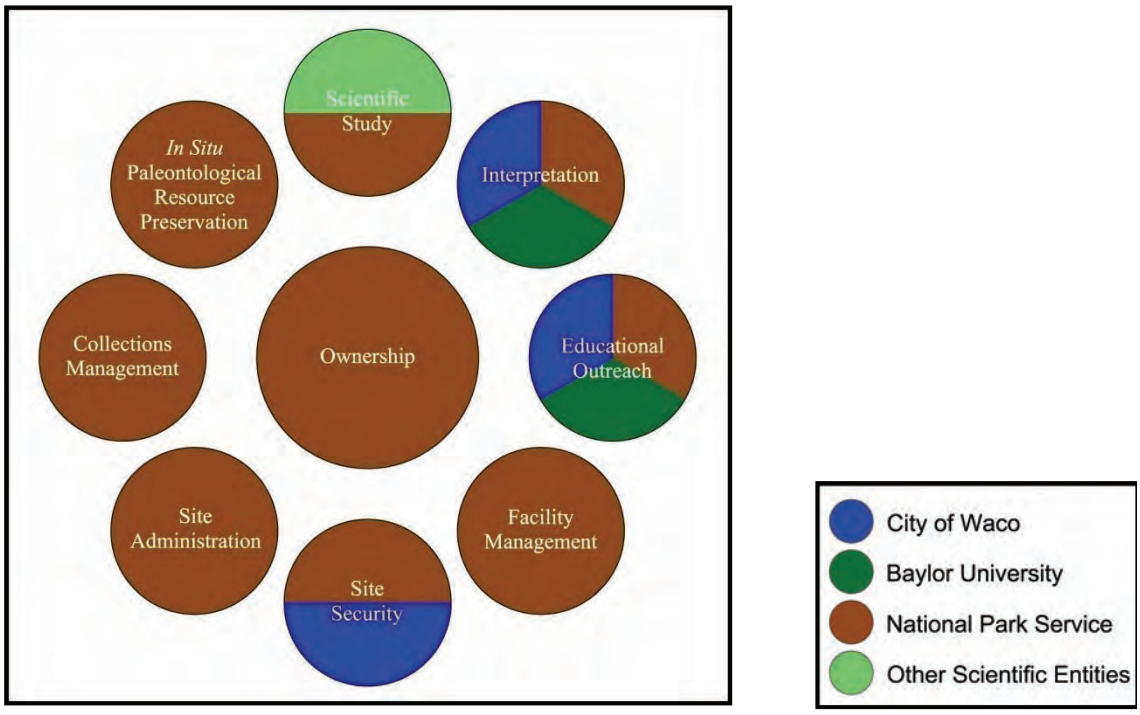
The National Park Service would join the existing management partnership between the city of Waco and Baylor University, taking the lead regarding the resource protection and visitor enjoyment of the fundamental paleontological resources.

As in alternative A, the Waco Mammoth Foundation and the local community would continue to play key partnership roles in supporting preservation and public access initiatives for the site. A written agreement could be developed between the National Park Service and the Waco Mammoth Foundation establishing the foundation as an NPS Friends Group. Additional partners would be invited to help support expanded resource protection and visitor enjoyment opportunities.

Cooperative agreements could be developed with the city and/or other partners for taking the lead in funding and managing a more fully developed surrounding parkland for enhanced visitor opportunities.

A number of other opportunities could be pursued to help support management of the site, including the following:

- donations or grants from government, corporate, and/or private sources
- community volunteers and student interns
- volunteer scholar and student led research activities
- entry fees could be charged to help offset operational expenses



ALTERNATIVE D: MANAGED AS A FOCUSED UNIT OF THE NATIONAL PARK SYSTEM

Concept for Management

As is in alternative A, in alternative D the Waco Mammoth Site is managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, and providing for onsite visitor enjoyment and understanding. Alternative D is different from alternative A in that the management responsibility for fulfilling this purpose is transferred to the National Park Service.

Overall Management Framework

Waco Mammoth Site would be managed as a new unit of the national park system; the federal government would own and the National Park Service would manage the entire paleontological resource (*in situ* fossils and the collection of fossils currently housed at Baylor University).

The National Park Service would prepare a general management plan to guide future managers of the site by clearly defining what level of resource conditions and visitor experiences should be achieved and maintained over time. In consultation with local governments, park stakeholders, and the general public, the plan would establish overarching resource management goals and provide guidance concerning the overall level and intensity of development appropriate for the site. A partnership development strategy would be included as an integral component of the plan.

Under this alternative, the National Park Service would focus on the core mission of protection, scientific study, and interpretation of the fundamental paleontological resources. The National Park Service would not likely expand beyond this core focus to initiate

other projects such as an environmental education or other recreational opportunities.

Partners would still play a role in educational outreach, interpretive programs, and site security to assist the National Park Service with achieving its core mission.

Resource Management

The National Park Service would develop a resource stewardship strategy including a collections management plan to guide resource management activities. For the purposes of this study, it is assumed that the following resource management strategies would be included.

Paleontological resources would be inventoried, monitored, and protected by the National Park Service. Other site resources in the surrounding lands would be inventoried, monitored, and protected as well. Resource stewardship plans would be developed to guide future management of these resources.

The National Park Service would ensure the *in situ* paleontological resources are stabilized and preserved. With the protection from the elements provided by the excavation shelter, the current moratorium on excavation activities could be lifted to allow for controlled investigations.

The National Park Service would develop protocols and methodologies for initiating preparation and cataloging of the specimens currently housed in plaster jackets and the smaller fragments and soil samples in cardboard boxes. The storage of collected specimens and archives would continue to be housed within Baylor University's Mayborn Museum Complex, until the collection could be accommodated in a new collection storage facility constructed onsite. This would require an exception from the NPS Intermountain Region museum collections strategic planning goal of moving management of museum collections towards regional repositories. The primary reason for deviating from this regional plan is that the integrity of the resource is tied to the fact that all of the fundamental paleontological resource components have been under the curatorial care of a single institution. This management alternative strives to maintain this condition; with a shift in resource stewardship from Baylor University to the National Park Service. The intent would be to keep the fundamental resources onsite; however, other collected specimens not related to the fundamental paleontological resources or geologic context may be housed in other regional repositories. A collections management plan would be prepared to help guide this distinction.

Scientific Study

As in alternative C, the National Park Service would support and coordinate scientific research to further the understanding of the site and its circumstances. Opportunities would be pursued to establish an endowment to support continued scientific study of the resource. The National Park Service would also consult with the Cooperative Ecosystem Studies Units (CESU) national network to help facilitate expanded research opportunities through other scientific institutions.

Level of Development

The National Park Service would prepare a general management plan to provide guidance concerning the overall level and intensities of development appropriate for the site. For the purposes of this study, the following is assumed.

As in alternative A, the Waco community efforts to erect a protective shelter over the excavation area and to provide for controlled visitor access to the site are underway.

However, under this alternative, additional development could be pursued by the National Park Service to house the entire paleontological collection onsite within a new collections storage facility that would include a specimen preparation laboratory. Administrative office space and maintenance support facilities would also be required.

Visitor Experience

As in alternative A, visitor understanding and appreciation of the resource would continue to be provided off-site by a dedicated exhibit room within the museum setting of Baylor University's Mayborn Museum Complex.

Once the excavation shelter and site improvements are completed, visitor access would be accommodated. Opportunities for visitor understanding and appreciation of the paleontological resources would be greatly enhanced through onsite interpretive waysides and through controlled visitor access into the excavation shelter where views of the *in situ* specimens would be provided. Access to the core paleontological area and surrounding lands would be made available to the visiting public on a daily basis.

Interpretive programs and media provided through the Waco community's Phase I park development efforts would be expanded through the collaborative efforts of the National Park Service, the city of Waco, and Baylor University. A comprehensive interpretive plan would be prepared to guide the development of enhanced interpretive mechanisms and programs for the resource. Guided tours and live interpretation programs for school groups and special events would be provided. Opportunities to allow the visiting public to observe the specimen preparation work would be developed.

The partners would also collaborate on educational outreach programs targeting school groups at the elementary through high school level, programs for the general public to promote life-long learning, and scientifically detailed programs for students at the post-secondary education level.

An interactive website, linked to the National Park Service website, could be established to provide a "Portal to the Pleistocene" with an in-depth presentation of the site and its relationship to the Pleistocene, updates on the progress of ongoing scientific study conducted at the site and on the collected specimens, and links to other mammoth sites found throughout the country.

Facility Management

The National Park Service would be responsible for maintaining and operating all facilities.

Site Administration and Security

The National Park Service would be responsible for site administration and security. It is assumed that shared jurisdiction for law enforcement could be established between the city of Waco and the National Park Service. It is also assumed that the city would provide fire suppression and emergency medical response to the site, as it would in the other alternatives.

Site Recognition

Congress would designate the site as a new unit of the national park system. The process for national natural landmark designation could be pursued by the National Park Service.

Ownership

The Waco Mammoth Site land parcels and the entire paleontological collection including associated documentation and archives would be transferred at no cost to the federal government.

Cost Estimate

National Park Service estimated costs are based on very broad needs typically associated with the development of a new unit of the national park system. If the site becomes a new unit of the national park system, the National Park Service would develop a general management plan that would better outline facility needs. For the purposes of this study, it is estimated that an additional $2.6 million in capital improvement costs would be needed to provide for enhanced interpretive mechanism, onsite administrative/maintenance support facilities, and collection storage facility. It is also anticipated that staff would lease administrative support space off-

site for a number of years until general management planning, compliance, and development plans would be complete and funding for capital improvements would be available. It is projected that leasing costs of $27,000 per year for a period of five years would be needed.

At the fully staffed level, it is estimated that approximately 10 FTE (full-time equivalent) positions would be needed at the Waco Mammoth Site. Employees would include park superintendent and administrative staff, paleontologist/resource manager/research coordinator, collections manager/fossil preparator, interpretive/ education specialist/volunteer coordinator, seasonal interpreters, maintenance personnel, and law enforcement rangers. Annual staffing costs including benefits are estimated to total $580,000. Annual operational costs for supplies, materials, utilities, and equipment will be approximately $188,500.

Partnership Opportunities

A written agreement could be developed between the National Park Service and the Waco Mammoth Foundation establishing the foundation as an NPS friends group. This would allow the Waco Mammoth Foundation to continue to play a key partnership role in supporting preservation and public access initiatives for the site. Additional partners would be invited to help support expanded resource protection and visitor enjoyment opportunities.

Opportunities to collaborate with the Mayborn Museum and the city of Waco regarding interpretive and educational outreach programs would be initiated.

A number of other opportunities could be pursued to help support management of the site including the following:

- donations or grants from government, corporate, and/or private sources
- community volunteers and student interns
- volunteer scholar and student led research activities
- entry fees could be charged to help offset operational expenses
- security and fire protection services could be substantially enhanced by partnerships between the National Park Service and the city of Waco.

ALTERNATIVES CONSIDERED BUT DISMISSED

During the study process, some additional management alternatives were raised through public comment or National Park Service concerns that were considered but dismissed. These included a number of scenarios in which the site would be managed by a single entity other than sole management by the National Park Service. This could include sole management by Baylor University, sole management by the city of Waco, sole management by the Texas Parks and Wildlife Department, or sole management by another entity such as a scientific association or other nonprofit group.

Both the city of Waco and Baylor University expressed concern that this approach would not be a viable management option. Transferring the sole management responsibilities to either the city or the university would compromise the effectiveness of maintaining the current level of resource stewardship. Both the city of Waco and Baylor University view their existing partnership as utilizing the strengths of each institution's expertise. With the recently chartered Waco Mammoth Foundation, a nonprofit organization and community advisory board for the site, the partnership has grown. The city and university view this expanded partnership as a strong one, which has made great strides in advancing protective measures for the site as well as in developing opportunities for public access and appreciation.

Conversations with personnel at the Texas Parks and Wildlife Department (TP&W) revealed that they are currently downsizing personnel and decommissioning a significant number of state park units due to fiscal constraints. At this time, it does not appear to be economically feasible for TP&W to assume the sole management responsibility for the site given the department's current financial challenges with maintaining the existing state park system.

The city of Waco and Baylor University do not see any advantage in transferring the sole management responsibility to another scientific association or nonprofit group, as they anticipate that a single entity would still rely on the existing partners to function successfully. However, the city and university did acknowledge the power of collaboration with other universities and scientific institutions to conduct research and enhance the understanding of the site, and that this type of partnership would always be an available option.

SUMMARY AND COMPARISON OF ALTERNATIVES

Alternative Highlights

Table 4 summarizes the differences among the alternatives by contrasting their major features and highlights. Table 5 summarizes the differences between the alternatives by contrasting their potential environmental impacts.

Environmentally Preferred Alternative

NEPA regulations and NPS policy require that this study identify the environmentally preferred alternative. The reader is reminded that **the environmentally preferred alternative should not be viewed as the National Park Service preferred alternative** or as a positive or negative recommendation by the National Park Service or the Department of the Interior for any future management strategy or action.

The environmentally preferred alternative is determined by applying criteria set forth in NEPA, as guided by direction from the Council on Environmental Quality (CEQ). The CEQ has stated that the environmentally preferred alternative is the alternative that will promote the national environmental policy as expressed in NEPA, Section 101, by meeting the following objectives:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

This special resource study evaluates management options and not detailed development proposals; therefore, the last objective, "Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources" would be more appropriately evaluated when subsequent implementation planning is developed, although all alternatives could incorporate this as a goal for future development proposals.

As the site is already under the stewardship of the city of Waco and Baylor University and is being protected from incompatible uses, each of the alternatives would fulfill the responsibilities of this generation as trustee of the site for succeeding generations. Similarly, the other goals listed above would be satisfied, only to a slightly greater or lesser degree, by each of the alternatives. However, alternatives B and C attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences. Under these alternatives, the lands surrounding the core paleontological resources accommodate expanded opportunities for enhanced visitor enjoyment of the other resources of the site. Therefore, alternatives B and C are considered the environmentally preferred alternatives.

Most Effective and Efficient Alternative

The 1998 Omnibus Parks Management Act (*Public Law 105-391 §303*) and NPS policy mandates that each special resource study identify the alternative or combination of alternatives which would, in the professional judgment of the director of the National Park Service, be most effective and efficient in protecting significant resources and providing opportunities for appropriate public enjoyment. For the purposes of this study, effectiveness and efficiency are defined as the capability to produce desired results with a minimum expenditure of energy, time, money, or materials.

While all of the alternatives provide for protection and public enjoyment of the special resources of the Waco Mammoth Site, there are distinct differences between the alternatives with regard to the degree of management effectiveness and efficiency.

A comparison of costs associated with each alternative indicates that alternative A, the no-action alternative that continues current management trends, would require the least expenditure of energy, time, money, and materials. However, alternative A does not include increases in staffing or operational funding; consequently accommodating visitor access to the site is limited under this alternative to only monthly scheduled events. This is not a reasonable level of public enjoyment for such a nationally significant treasure, and as such, alternative A is the least effective of all the alternatives.

Of the three action alternatives, alternative D requires the least expenditures of energy, time, money, and materials, although the range of visitor opportunities is limited to just those associated with the core paleontological resources. Alternatives B and C provide a greater range of visitor enjoyment opportunities without compromising resource integrity. Under both alternatives, the lands

surrounding the core paleontological resources are used to accommodate expanded opportunities for visitor understanding of the geological context of the site, establishing environmental education programs, and providing recreational access along the Bosque River. Alternatives B and C are more effective in providing a greater range of appropriate public enjoyment opportunities at the Waco Mammoth Site than alternative D.

When comparing the projected costs of alternatives B and C, alternative B requires a lower expenditure of energy, time, money, and materials, which would be supported from a number of funding sources: federal, municipal, and private. Under this city of Waco led partnership approach, NPS expertise is leveraged by providing technical assistance and guidance from NPS specialists to the existing managers of the site. This arrangement results in a very effective and efficient approach for protecting and enhancing the conditions of paleontological collection, enhancing interpretive and educational programs, and enabling an expanded level of scientific research and study related to the special resource.

While the range of visitor opportunities are similar under alternatives B and C, alternative C provides a greater level of assurance for maintaining long-term resource protection. Alternative C assumes a full time, onsite commitment of NPS specialists with experience in the management and interpretation of paleontological resources. The day-to-day efforts of NPS resource managers and interpreters under this alternative has the potential to provide a more stable and consistent approach for protecting and enhancing the conditions of paleontological collection, enhancing interpretive and educational programs, and enabling an expanded level of scientific research and study related to the special resource in comparison to the periodic NPS technical assistance provided under alternative B. Assuming initial and continued funding is made available to support this level of resource stewardship, alternative C is the most effective and efficient management alternative.

DETERMINATION OF NEED FOR DIRECT NPS MANAGEMENT

The review of the existing partnership between the city of Waco and Baylor University demonstrates that this partnership is currently providing adequate protection of the special resources of the Waco Mammoth Site and is working toward providing for visitor enjoyment. These were key factors in the finding that direct NPS management would not be the only practicable means for meeting the goals of protecting resources and furthering public use. However, to meet these goals to the fullest extent, there are significant roles that the National Park Service could have in guiding the preservation efforts of the paleontological collection, enhancing the interpretive and educational outreach programs, and enabling an expanded level of scientific research and study of this special resource.

Table 4: Summary Table of Alternative Highlights

	Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the city of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Overall Management Framework	The existing cooperative management arrangement between the city of Waco and Baylor University is continued.	The existing cooperative management arrangement between the city of Waco and Baylor University is expanded with additional partners, with the city assuming the lead responsibility for managing the site as a city park.	Waco Mammoth Site would be a new unit of the national park system, in partnership with the city of Waco, Baylor University, and others.	Waco Mammoth Site would be a new unit of the national park system, with the entire paleontological resource managed onsite by the National Park Service (*in situ* specimens and the paleontological collection currently housed at Baylor University).
Concept for Management	Managed for the continuing preservation and protection of the paleontological resources, conducting scientific study, and providing for onsite visitor enjoyment and understanding.	Same as alternative A, plus… A range of recreational and environmental educational opportunities could be provided by the city.		Same as alternative A.
Paleontological Resource Protection	**Discovery Site & Geologic Context** Moratorium on excavation activities continues. **In Situ Specimens** Stabilized and preserved **Collected Specimens** Storage at Baylor University's (BU) Mayborn Museum Complex. **Archives** Maintained by BU	**Discovery Site & Geologic Context** Controlled excavation activities may resume. **In Situ Specimens** Stabilized and preserved **Collected Specimens** Storage at Mayborn Museum Complex, specimen preparation and cataloging by BU with technical assistance provided by NPS. **Archives** Cataloged and maintained by BU	**Discovery Site & Geologic Context** Controlled excavation activities may resume. **In Situ Specimens** Stabilized and preserved **Collected Specimens** Storage at Mayborn Museum Complex and onsite by NPS. Specimen preparation and cataloging by NPS. **Archives** Cataloged and maintained by NPS	**Discovery Site & Geologic Context** Controlled excavation activities may resume. **In Situ Specimens** Stabilized and preserved **Collected Specimens** Storage, specimen preparation, and cataloging onsite by NPS. **Archives** Cataloged and maintained by NPS

Table 4: Summary Table of Alternative Highlights

	Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the city of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Scientific Study	Scientific study continues to be conducted by Baylor University.	Scientific study conducted by Baylor University and other scientific entities.	Scientific study conducted by BU, NPS, and other scientific entities. Cooperative Educational Study Units assist in networking with the scientific community.	Scientific study conducted by NPS and other scientific entities. Cooperative Educational Study Units assist in networking with the scientific community.
Interpretive Opportunities	The Waco community effort to construct an excavation shelter and provide for visitor access and interpretation are assumed to be complete. Interpretive opportunities would continue to be provided through controlled visitor access to the core paleontological area during at least 12 public events scheduled throughout the year.	Same as alternative A, except… Access to the core paleontological area and surrounding lands are made available to the visiting public on a daily basis. City of Waco, Baylor University, and NPS collaborate on the development of an expanded interpretive program and media. In addition, an environmental education center provides enhanced visitor understanding and appreciation of the mammoth site as well as the unique environment found along the interface of the Texas Hill Country and Gulf Coastal Plain.		Same as alternative A, except… Access to the core paleontological area is made available to the visiting public on a daily basis. City of Waco, Baylor University, and NPS collaborate on the development of an expanded interpretive program and media.
Educational Outreach	Educational outreach programs continue to be limited.	City of Waco, Baylor University, and the National Park Service collaborate to provide educational outreach programs targeting school groups at the elementary through high school level, programs for the general public to promote life-long learning, and scientifically detailed programs for students at the post secondary education level. Interactive "Portal to the Pleistocene" website could be established to provide an in-depth presentation of the site and its relationship to the Pleistocene, updates on the progress of ongoing scientific investigations, and links to other mammoth sites found throughout the country and potentially other locations around the world.		
Recreational Opportunities	Recreational opportunities are not currently provided.	Access to the Bosque Riverfront by way of connecting trails and water taxis service could be accommodated. Picnic areas area could also be provided.		Same as alternative A.

Table 4: Summary Table of Alternative Highlights

	Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the city of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Facility Management	City of Waco continues to provide for the maintenance and operations of onsite facilities. Baylor University continues to provide for the maintenance and operations of paleontological collection storage space at Mayborn Museum Complex.	Same as alternative A, although… Specimen preparation laboratory may be established and maintained by Baylor University within the Mayborn Museum Complex or established and maintained by the city of Waco onsite.	NPS provides for the maintenance and operations of the excavation shelter. City of Waco provides for the maintenance and operations of all other onsite facilities. Baylor University maintains paleontological collection storage space at Mayborn Museum Complex.	National Park Service provides for the maintenance and operations of all onsite facilities.
Site Security and Law Enforcement	City of Waco continues to provide city services such as security, police protection, fire suppression, and emergency medical response for the study area.		Same as alternative A, plus… Shared jurisdiction for law enforcement established between city of Waco and the National Park Service.	
Site Administration	City of Waco and Baylor University continue to share site administration responsibilities.	City of Waco is the primary manager of the site.	NPS is primary manager of the core paleontological area while the city of Waco is the primary manager of the surrounding lands.	NPS is the primary manager of the site.
Ownership	**Core paleontological site** City of Waco **Surrounding lands** Baylor University **Collections and Archives** Baylor University & city of Waco	**Core paleontological site** City of Waco **Surrounding lands** Baylor University transfers to the city of Waco. **Collections and Archives** Baylor University & city of Waco	**Core paleontological site** City of Waco transfers to NPS. **Surrounding lands** Baylor University transfers to the city of Waco. **Collections and Archives** Transfers to NPS.	All lands, collections, and archives transferred to the National Park Service.

Table 4: Summary Table of Alternative Highlights

	Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the city of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Level of Development	Waco community efforts to construct excavation shelter, interpretive waysides, access road, parking, visitor contact station, restrooms, security fencing, and connecting trails to the excavation shelter are assumed to be complete. The development is treated as an existing condition under this alternative.	Same as alternative A, plus… As funding permits, additional facilities may be provided onsite. This could include an environmental education center, research and specimen preparation laboratory (either onsite or within the Mayborn Museum Complex), interpretive plaza, expanded interpretive waysides, expanded parking, expanded restrooms, administration/maintenance support structure, interpretive nature trails and connecting trails to the Bosque River and Brazos River Corridor, boat dock, picnic and informal play areas.		Same as alternative A, plus… As funding permits, additional facilities may be provided onsite. This could include onsite collections storage, specimen preparation laboratory, and administration/ maintenance support structure.
Site Recognition	Potential National Natural Landmark Eligible for NPS Affiliated area status	The city pursues National Natural Landmark designation. National Park Service affiliated area status may be considered by Congress to further strengthen NPS involvement.	New unit of the national park system	
Initial Costs	(1)	Waco Community $8.1 million	Waco Community $8.1 million NPS $0.6 million	NPS $2.6 million
Annual Costs	(2)	City of Waco $300,000 Mayborn Museum $45,000 NPS (for 5 years) $25,000	City of Waco $300,000 Mayborn Museum (2) NPS $345,000	NPS $768,500

(1) It is assumed that the Waco community efforts to erect a protection shelter over the excavation area and to provide for controlled visitor access to the site are already underway. Funding for additional staffing, programs, or facilities is not included under the no-action alternative.

(2) Annual costs for managing the Waco Mammoth Site are difficult to quantify as staff support from the city of Waco and/or the Mayborn Museum Complex is an assigned collateral duty among a range of other responsibilities.

Table 5: Summary Table of Potential Environmental Consequences

		Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the City of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Fundamental Resources	***In Situ* Specimens** and **Geologic Context of the Discovery Site**	No impact Rationale: Current resource conditions continue to be stabilized. The current moratorium on additional excavations remains in place. There are no anticipated changes to the existing condition of the resource.	Moderate, long-term beneficial Rationale: Technical assistance from the NPS could enhance stabilization efforts and guide controlled excavation activities that could promote a greater understanding of the paleontological resource.	Moderate, long-term beneficial Rationale: Same as alternative B but with NPS taking the management lead for stabilization efforts and controlled excavations.	
	Paleontological Collection	No impact Rationale: The collection storage continues at the Mayborn museum. There are no anticipated changes to the existing condition of the resource.	Moderate, long-term beneficial Rationale: Technical assistance provided by NPS to develop protocols and methodologies to guide the specimen preparation and cataloging efforts by Mayborn Museum staff. The results of this effort would enhance the usefulness of the collection for future research as well as allow opportunities for casting of select fossils for interpretive purposes.	Moderate, long-term beneficial Rationale: Same as alternative B but with NPS taking the management lead for specimen preparation.	
Other Resources	**Soils** and **Prime Farmland**	No impact Rationale: There are no changes anticipated to the existing condition of the resource.	Minor, long-term adverse Rationale: To accommodate additional park development within the study area, some localized loss of soils and prime farmland are anticipated.		
	Floodplains and **Wetlands**	No impact Rationale: There are no changes anticipated to the existing condition of the resource.	Negligible to minor, long-term adverse Rationale: To accommodate connecting trails and water taxi service along the Bosque River, some construction is anticipated within the floodplains and potential wetland areas of the study area.		Same as alternative A.
	Vegetation, Wildlife, Habitat, and **Special Status Species**	No impact Rationale: There are no changes anticipated to the existing condition of the resource.	Minor, long-term adverse Rationale: To accommodate additional park development within the study area, some localized loss of vegetation and wildlife habitat are anticipated. As development plans are prepared, consultation with US Fish and Wildlife Service and the state of Texas would be needed to assess the potential for impacting special status species. Moderate, long-term beneficial Rationale: Resource management strategies are implemented to restore native vegetation and enhance wildlife habitat.		

Table 5: Summary Table of Potential Environmental Consequences

		Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the City of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
	Visitor Experience	Negligible to minor, long-term beneficial Rationale: Controlled visitor access to the core paleontological area with onsite interpretation mechanisms continues to be provided during at least 12 public events scheduled throughout the year.	Moderate, long-term beneficial Rationale: Daily access provided to the core paleontological area and surrounding lands with enhanced onsite interpretation mechanisms, potential environmental educational and recreational opportunities and facilities that partners led by the city of Waco might develop. Educational outreach programs are made available to local and regional communities.	Moderate, long-term beneficial Rationale: Same as alternative B but with NPS taking the management lead for enhanced interpretation of the core paleontological area. Provisions for accommodating visitor observation of the specimen preparation effort could be integrated into the interpretive experience. Educational outreach programs are made available to local and regional communities.	Moderate, long-term beneficial Rationale: Daily access provided to the core paleontological area and enhanced onsite interpretation mechanisms provided by the National Park Service. Provisions for accommodating visitor observation of the specimen preparation effort could be integrated into the interpretive experience. Educational outreach programs are made available to local and regional communities.
Management Operations	**City of Waco**	Minor, long-term adverse Rationale: Assume staffing levels stay the same; however additional operational funding needed to maintain the excavation shelter.	Moderate, long-term adverse Rationale: Expanded responsibilities assigned to city of Waco Parks and Recreation Department for managing a new city park.		Moderate, long-term beneficial Rationale: Management responsibilities for the study area are transferred to NPS.
	Mayborn Museum Complex	Negligible, long-term adverse Rationale: Assume staffing levels stay the same with little change in current museum operations.	Moderate, long-term adverse Rationale: Expanded responsibilities assigned to museum staff for providing interpretive and educational outreach programs for a new city park.	Negligible to minor, long-term adverse Rationale: Management responsibilities are shared with NPS.	Moderate, long-term beneficial Rationale: Management responsibilities for the study area are transferred to NPS.
	National Park Service	Not applicable	Minor, short-term adverse Rationale: No management responsibilities assigned, however a commitment for technical assistance would be provided.	Moderate, long-term adverse Rationale: Expanded responsibilities assigned to the NPS Intermountain Region for managing and operating a new unit of the national park system.	

Table 5: Summary Table of Potential Environmental Consequences

		Alternative A Continuation of current management trends	**Alternative B** Partnerships led by the City of Waco	**Alternative C** Partnerships led by the National Park Service	**Alternative D** Managed as a focused unit of the National Park System
Socioeconomic Environment	**Waco MSA Economy**	Negligible to minor, short-term beneficial Rationale: Anticipate limited increased visitor spending would occur within the community when public events are scheduled at the site.	Moderate, long-term beneficial Rationale: Anticipate daily increased visitor spending would occur within the community.		
	Central Texas Region Communities	Negligible, short-term beneficial Rationale: Limited opportunities for educational outreach programs provided.	Moderate, long-term beneficial Rationale: Expanded and enhanced educational outreach programs provided to central Texas regional school systems.		
	Adjacent Neighborhoods and Businesses	Negligible to minor, short-term adverse Rationale: With the monthly operation of a new park accessed by New Steinbeck Bend Road, it is anticipated that there would be an increase in traffic congestion when public events are scheduled at the site.	Minor, long-term, adverse Rationale: With the daily operation of a new park accessed by New Steinbeck Bend Road, it is anticipated that there would be a daily increase in traffic congestion.		

Chapter Five: Affected Environment

CHAPTER OVERVIEW

Chapters Five (Affected Environment) and Six (Environmental Consequences) provide the information and rationale for evaluating the fourth criteria for new parklands: whether or not the site requires direct management by the National Park Service instead of protection by another public agency or the private sector.

The descriptions, data, and analysis presented below focus on the general conditions or consequences that may result from implementing each management alternative. Chapter Five begins with a description of how environmental impact topics are addressed in the study. This is then followed by a description of the existing conditions that could be affected by the actions of the alternatives. This is intended to provide the reader a better understanding of the environmental context and to establish a benchmark by which the magnitude of environmental consequences can be developed for each management alternative.

IMPACT TOPICS

Impact topics, simply defined, are the resources and values that could be affected by the actions of the management alternatives considered in the study. They serve to focus the environmental analysis and to ensure the relevance of impact evaluation. Impact topics were identified based on federal laws and other legal requirements, Council on Environmental Quality (CEQ) guidelines, NPS management policies, staff subject-matter expertise, and issues and concerns expressed by the public and other agencies during the study process. This document addresses the impact topics in one of two ways: either a rationale is provide for dismissing the topic from further consideration or the topic is described in more detail under the following existing conditions section and included in the assessment and analysis described in chapter six.

IMPACT TOPICS DISMISSED

The following mandatory impact topics were dismissed from further consideration and analysis.

Possible Conflicts between the Proposal and Land Use Plans, Policies, or Controls for the Area Concerned

All alternatives include providing preservation of the paleontological resources and providing opportunities for visitor enjoyment, all compatible uses under current zoning and the city of Waco's Brazos River Corridor Overlay District requirements. As there are no anticipated conflicts with any of the actions outlined under each alternative, this impact topic has been dismissed from further consideration.

Environmental Justice

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires all federal agencies to incorporate environmental justice into their missions. This is to be done by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the Environmental Protection Agency, environmental justice is the

> *…fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic,*

or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

The goal of 'fair treatment' is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and mitigate for such impacts.

Waco, Texas, contains both a minority and low-income population; however, environmental justice is dismissed as an impact topic for the following reasons:

- The planning team actively solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of any of the proposed actions would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse effects on any minority or low-income population.
- Implementation of any of the proposed actions would not result in any identified effects that would be specific to any minority or low-income community.

Energy Requirements and Conservation Potential

A detailed analysis of energy requirements and potential for energy conservation is not possible at this level of planning as this special resource study presents only conceptual alternatives for managing the special resources of the Waco Mammoth Site. Because energy requirements and conservation potential would be addressed in future environmental compliance documents, as appropriate, this impact topic has been dismissed from further consideration.

Indian Trust Resources

Indian trust assets are owned by American Indians but are held in trust by the United States. Requirements are included in the Secretary of the Interior's Secretarial Order No. 3206, "American Indian Tribal Rites, Federal −Tribal Trust Responsibilities, and the Endangered Species Act," and Secretarial Order No. 3175, "Departmental Responsibilities for Indian Trust Resources." The study area has not been identified as an Indian Trust resource; therefore this impact topic has been dismissed from further consideration.

Indian Sacred Sites

Executive Order 13007, "Indian Sacred Sites," states that those with statutory or administrative responsibilities for the management of federal lands shall accommodate ceremonial use of and access to Indian sacred sites by Indian religious practitioners, as well as avoid affecting the physical integrity of the sacred site. An "Indian Sacred Site" means any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site. The Waco Indian Tribe was contacted during the study process and has provided no notification of any resources or traditional uses associated with the site. As the study area has not been identified as an Indian Sacred Site, this impact topic has been dismissed from further consideration.

Archeological Resources

Currently, there are no known sites with archeological resources within the Waco Mammoth Site. The Waco Mammoth Site itself is listed with a Texas Historical Commission archeological trinomial

(41ML207), perhaps because it at one time was thought to be Paleo-Indian as a possible kill site of mammoths circa 28,000 years ago. However, there have been no cultural materials found in the course of past paleontological excavations. As noted elsewhere in this document, more recent dating places the time of the mammoths' deaths at circa 68,000 years ago, well before the documented first appearance of Paleo-Indians in North America.

In the event that the Waco Mammoth Site should become a unit of the national park system, the National Park Service would conduct a systematic archeological survey within the boundaries of the Waco Mammoth Site on lands under its jurisdiction. Such research would include documenting and inventorying any evidence of archeological sites or other archeological resources such as isolated artifactual finds. The timing of the study would be subject to funding availability and would serve to inform about any prehistoric or historic archeological materials that might be found. Any archeological resources discovered would be evaluated for their eligibility for listing in the National Register of Historic Places.

For future paleontological excavations and ground disturbances of development under construction, known archeological resources would be avoided to the greatest extent possible or archeological monitoring procedures would be put into place to deal with any inadvertent discoveries of cultural artifacts. If discoveries were made, construction underway would be stopped immediately, the superintendent of the Waco Mammoth Site would be notified, and proper consultation would be initiated with the Texas Historical Commission's historic preservation officer (SHPO) and the Waco Indian Tribe in Oklahoma, which is traditionally associated with lands of the Waco area. Because (1) there is a dearth of known archeological resources, (2) such resources would be avoided in the future if they become known through archeological survey, and (3) monitoring and mitigation would continue through SHPO and tribal consultation, if necessary, archeological resources is dismissed as an impact topic for further consideration and analysis.

Cultural Landscapes

According to the National Park Service's *Cultural Resource Management Guideline* (DO-28), 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.*

The subject of cultural landscapes is dismissed as an impact topic for further consideration and analysis because none apply to the site and mammoth herd. A cultural landscape reflects human adaptation to the environment and the use of its natural resources. Such a landscape develops from inter-relationships among human-modified features and natural features and results in particular land-use patterns characteristic of certain activities. At the time of the life and death of the mammoth herd, no humans were there because the mammoth period at Waco occurred well before humans had entered the New World and migrated to the area. Thus, there can be no cultural landscapes associated with the site and the mammoth herd.

For interpretation to visitors, what might be termed a *Pleistocene landscape* for the propagation of Pleistocene plants could be inventoried, protected, and preserved to give visitors an idea of what the mammoths might have seen. However, such details would be part of a comprehensive interpretive plan for later development if the site should come into the national park system.

The remnant ranching structures mentioned below under historic structures could comprise a land-use pattern reminiscent of a ranching historic cultural landscape. However, as discussed below in the section on historic structures, the structures themselves lack significance related to the mammoth fossils and lack integrity in their own right as historic resources.

Historic Structures

The subject of historic structures is dismissed as an impact topic for further consideration and analysis because the remnant ranching structures are neither significant as contributing components to the paleontological resources constituting the purpose of the Waco Mammoth Site, nor do the remnant ranching structures possess integrity as historic resources due to their physical deterioration. Examples of the few outbuildings extant include a pump house to pump water to livestock, corrugated metal tubs and cement tubs to water livestock, and a pole barn and corral to hold cattle after a round-up. Eligibility for listing in the National Register of Historic Places would be very unlikely because of their lack of significance and integrity. In the event that the Waco Mammoth Site should become a unit of the national park system, the National Park Service would conduct a historic resource study. The research would include documenting the history of ranching on the site. The timing of the study would be subject to funding availability and would serve to inform and likely formally verify the initial NPS evaluation of national register ineligibility for the remnant ranching structures.

Ethnographic Resources

Ethnographic resources are defined by the National Park Service 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" (Director's Order 28: *Cultural Resource Management Guideline*).

The National Park Service recognizes that the Waco Indian Tribe once lived in the Waco area where the land was part of the tribe's traditional territory and that the Waco Indians in historic times lent their name to the European American settlement, town, and eventual city that grew up there. A written invitation to participate in the special resource study along with copies of the scoping summary and preliminary alternatives newsletters were sent October 4, 2007, to Mr. Gary McAdams, president of the Wichita and Affiliated Tribes in Oklahoma, of which the Waco Tribe is one of the affiliated tribes. The letter was seeking to inquire if he or other members of the tribal government would like to consult about the special resource study for the Waco Mammoth Site and any possible traditional uses associated with the site. There has been no response to date.

Cattle ranching occurred in recent times in relation to the land surrounding the core paleontological site. However, no ranchers and no ranching families have been identified whose use of Waco Mammoth Site lands might be traditional and pertinent to their cultural heritage.

Thus, neither with the Waco Indians nor with European American cattle ranchers has the National Park Service been able to identify any contemporary uses of the Waco Mammoth Site lands as ethnographic resources, or ethnographic resources eligible for listing in the National Register of Historic Places as traditional cultural properties. Therefore, the subject of ethnographic resources is dismissed from further consideration as an impact topic because none are known to exist at the site.

Hazardous Materials

Correspondence with the city of Waco's director of environmental services indicates that there are no known brownfield sites in the vicinity of the study area. However, the city is aware of an existing plating business approximately 1.29 miles west of the study area that is currently under orders from the Texas Commission on Environmental Quality

(TCEQ), the state environmental agency, to clean up chromium, which has leached into the groundwater around its facility. The business is currently conducting remediation activities, and the city does not anticipate any adverse affects on the study area. The remediation work is being constantly monitored by the city, groundwater retrieved is below hazardous levels and is pretreated before allowed to discharge into the sanitary sewer system, and the study area is not down gradient of the plating business. The two sites drain in parallel directions towards the Bosque River.

There has not been an onsite survey of the study area for hazardous materials. If the study area were to become a new unit of the national park system, this would need to be undertaken and mitigation completed before any land transfers could be accepted by the federal government.

Since there are no known onsite contaminates that would meet current state or federal requirements for remediation, this impact topic has been dismissed from further consideration.

IMPACT TOPICS CONSIDERED

Potential impacts to the special resources of the Waco Mammoth Site are a primary concern of this study and therefore merit their own impact category. They will be assessed under the category "Fundamental Resources of the Waco Mammoth Site." The existing conditions of the fundamental components (geological context of the discovery site, the *in situ* specimens, the collected specimens, and archival records) have already been described in "Chapter Two: Resource Description" and therefore will not be repeated under the existing conditions section that follows. This category also addresses the mandatory impact topics of "unique natural resources" and "important scientific resources," and the discretionary impact topic of "paleontological collections and archives" (typically referred to as museum collections).

A number of other mandatory impact topics will be addressed under the category "Other Resources" and include:

- Soils including Prime Farmlands
- Floodplains and Wetlands
- Vegetation, Wildlife, Habitat, and Special Status Species

In addition, the following topics were identified through public and agency scoping and therefore will be described as part of the existing conditions as well as included in the impacts analyzed under "Chapter Six: Environmental Consequences":

- Visitor Experience
- Management and Operations
- Socioeconomic Environment

For easier cross-referencing and to help simplify the presentation of the information and the analysis, the description of the existing conditions that follows is organized by the impact categories listed above. This organization was replicated in "Chapter Six: Environmental Consequences" to present the analysis and assumptions of impacts for each alternative under consideration.

DESCRIPTION OF EXISTING CONDITIONS

Regional Context

The Waco Mammoth Site is within McLennan County, in east central Texas, 230 miles inland from the Gulf of Mexico. The city of Waco, the county seat, is located at the confluence of the Bosque and Brazos rivers and at the intersection of Interstate Highway 35 and U.S. Highway 84, 90 miles south of Dallas and 90 miles north of Austin. Situated partially in the Grand Prairie and partially in the Blackland Prairie, McLennan County comprises 1,031 square miles of flat to rolling terrain at elevations ranging from 400 to 850 feet above sea level. The land in the western section of the county has varied terrain surfaced by

shallow, stony soils that support mountain cedar and oak. The eastern section is generally low rolling to flat, with black, waxy soils made up of clay and sand loams that support mesquite, scrub brush, and grasses. The county is bisected from southwest to northeast by the Balcones Fault, and the rolling prairie along the fault line is broken by locally steep slopes. The county lies entirely within the Brazos River basin and is drained primarily by the South and Middle Bosque rivers in the west and by the Tehuacana and Aquilla creeks in the east; the Brazos River crosses the county from northwest to southeast. *(The Handbook of Texas Online)*

McLennan County and Waco are located on the west boundary of the Gulf Coastal Plain, which experiences both a humid coastal climate and continental climate. The most commonly used climatic classification is humid subtropical. The southeastern breezes are usually moist and warm while the northern breezes are dry and cool. The continental features are most dramatic in the winter when polar air moves into the area and causes rapid changes in temperature, large variations in temperatures, and low temperatures extremes. The coastal climate is most evident in the spring when moist, warm air from the Gulf of Mexico brings humidity and precipitation to the area *(Environmental Atlas of McLennan County)*. The temperature and humidity extremes typical of this climate pose a risk to the *in situ* specimens. Drastic fluctuations may cause the bones to expand and contract leading to fracturing, crushing, and/or delamination of the bone.

The Gulf of Mexico is the primary source of moisture for the area. The major topographic high, the Bosque Escarpment, trends NE-SW and influences local climate by forcing warm, moist air to rise and cool, thus producing precipitation. This feature parallels the west bank of the Bosque River near the study area. Approximately 75% of the total precipitation is caused by thunderstorms and frontal storms *(Environmental Atlas of McLennan County)*. Major rainfall events over the past 30 years have repeatedly uncovered additional paleontological material within the excavation area. The erosion potential from these storm events continually poses a threat to the *in situ* specimens.

Soils, Including Prime Farmlands

Most of the soils in the McLennan County are formed under prairie vegetation and are dark colored clays, silty clays, or clay loams. In some areas on terraces along the Brazos River, the soils formed under post oak-savannah vegetation. These soils are mostly light colored sandy loams or loamy fine sands. *(McLennan County Soil Survey)*

Based on correspondence with the United States Department of Agriculture, Natural Resources Conservation Service, McLennan County Soil and Water Conservation District, nearly 47% of the soils (over 300,000 acres) found in McLennan County meet the requirements for prime farmland. Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. This category requires that the land is available for farming uses. Over three-quarters of the study area (over 80 acres) is designated prime farmland. Of the five soil types found there, the following four soil types are designated as prime farmland:

Bastsil Fine Sandy Loam (BaA): This deep, well-drained soil is found on slopes ranging from 0% – 2% on the upper terrace area of the site. The soil is well drained and the shrink-swell potential is low. Major limitations for development include the potential for seepage of effluent into groundwater in areas used for septic tank absorption fields as many areas are underlain by beds of sand and gravel. This soil type covers almost 35 acres or 31% of the study area and is found in four pockets surrounding almost 26 acres of *Wilson Clay Loam* (WnA), a claypan prairie soil, which is not considered prime farmland. This soil has a very slow permeability with a high shrink-swell potential. Major limitations to development include potential for septic systems to fail because of very slow

permeability and shrink-swell characteristics may cause infrastructure to crack or buckle.

Burleson Clay (BuA): This is a deep, fertile blackland clay soil, found in an isolated, upland 3-acre pocket in the west central portion of the site. The soil has a very slow permeability with a very high shrink-swell potential. Limitations for development are similar to the Wilson Clay described.

Frio Silt Clay (Fr): This is a deep, well-drained, fertile clay loam and loam alluvial soil found along the lower terrace floodplain area bordering the Bosque River. This soil type covers almost 8 acres or 7% of the site.

Sunev Clay Loam (SzB): This is a nearly level to rolling upland clayey soil found over 36% of the site between the Bastsil and Frio soils. The soil has a moderately slow permeability, moderate shrink-swell, and experiences occasional flooding. The major limitation to development is the severe hazard from flooding.

The study area is not currently under active cultivation; although previously the site has been actively grazed and was used for cattle ranching and/or dairy farming.

Floodplains and Wetlands

Executive Orders 11988 and 11990, "Floodplain Management" and "Wetlands," respectively, require analysis of impacts on floodplains and regulated wetlands. Based upon an examination of the FEMA Flood Insurance Rate Map (dated 1988) for the Waco area, the 100-year and 500-year floodplain both exist within the study area. The 100-year floodplain occurs along the lower terrace area of the site where the Frio silt clay soils border the Bosque River. The 500-year floodplain extends upslope within portions of the same drainage swale where the mammoths were first discovered. It appears that the upper fringe of the 500-year floodplain terminates at or just prior to the excavation area.

The Army Corp of Engineers does not have any records of a wetland delineation being prepared for the site. It is assumed that a wetland fringe exists along the lower terrace area of the site containing Frio silt clay soils bordering the Bosque River.

Vegetation, Wildlife, Habitat, and Special Status Species

Onsite surveys of vegetation were not conducted as a part of this study. The vegetation mapping provided by the Environmental Atlas of McLennan County was consulted as the primary reference for this section.

Along the Brazos terrace areas, the major vegetation type is dominated by post oak and blackjack oak in canopy and prairie species such as little false bluestem in the understory. Much of the terrace area has been grazed and the post oaks are found as isolated patches protected by fences. Where cattle have been allowed to graze, the trees are in savannah, and where the trees are protected from grazing they are in thicket. Mesquite is an invader that is often enhanced with overgrazing. Grazing also encourages increased amounts of short grasses, annuals, pricklypear, elm, and juniper.

Along the Bosque riverfront alluvium, large deciduous tress such as pecan, cottonwood, willow, and elm are typical. Grassland appears between these large deciduous trees and the terrace scarps. Other floodplain trees include bur oak, live oak, hackberry, and sycamore. The deep alluvial soils and the abundance of water allow these trees to become very large.

Onsite surveys of wildlife and special status species were not conducted as a part of this special resource study. However, according to the Handbook of Texas Online and other published accounts, some of the more common wildlife species found in McLennan County include whitetailed deer (*Odocoileus virginiana*), beavers *(Castor Canadensis)*, bobcat *(Lynx rufus)*, fox (*Vulpes vulpes)* coyote *(Canis latrans)*, raccoon (*Procyon lotor*),

striped skunk (*Mephitis mephitis*), eastern spotted skunk (*Spilogale putorius*), opossum (*Didelphis virginiana*), cotton tail rabbit (*Sylvilagus floridana*), fox squirrel (*Sciurus niger*), turkey (*Meleagris gallopavo)*, bobwhite quail (*Colinus virginianus*), and mourning dove (*Zenaida macroura*). Prior to extensive settlement, the county's wildlife also included antelope, bison, bear, and javelina.

Consultation with the U.S. Fish and Wildlife Service, Austin Ecological Service Office, as of August 11, 2005 and the Texas Parks and Wildlife Department, Wildlife Division, Non-game and Rare Species and Habitat Assessment programs, County Lists of Texas' Special Species, McLennan County revised June 2, 2005 revealed the following list of special status species with confirmed sightings and/or are known to migrate through McLennan County. A review of the federal and state lists published online was conducted February 12, 2008. Changes noted include the federal delisting of the bald eagle, the addition of two more state listed endangered species: the American peregrine falcon and the red wolf, and one more state listed rare species: the western burrowing owl. Based on the site conditions of the Waco Mammoth Site, the following special status species could potentially inhabit or utilize the study area as stop-over habitat:

Federally listed endangered species

Black-capped vireo (*Vireo atricapilla*) prefer habitat that is low brush on steep slopes in the vicinity of dry streambeds.

Golden-cheeked warbler (*Dendroica chrysoparia*), which is also listed as state endangered, require juniper-oak woodlands; dependent on juniper (also known as cedar) for long bark strips that are only available from mature trees for nest construction. Nests are built in trees other than juniper. Forage for insects in broad-leaved trees and shrubs.

Interior Least Tern (*Sterna antillarum athalassos*), which is also listed as state endangered, is a potential migratory species that nests along sand and gravel bars within braided streams/rivers. Also known to nest on manmade structures such as inland beaches, wastewater treatment plants, gravel mines.

Whooping Crane (*Grus americana*), which is also listed as state endangered, is a potential migratory species with a preferred habitat that includes large wetland areas.

Piping plover *(Charadrius melodus)* is a potential migratory species with a preferred habitat of sandy beaches and lakeshores.

Texas-listed endangered species

American Peregrine Falcon (*Falco peregrines antum*) is a year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along the coast and farther south; occupies wide range of habitats during migration.

Golden-cheeked Warbler

Interior Least Tern

Whooping Crane

Red wolf (*Canis rufus*) is an extirpated species, formerly known throughout the eastern half of Texas in brushy and forested areas, as well as coastal prairies.

Texas-listed threatened species

Artic Peregrine Falcon (*Falco peregrinus tundris*), federally delisted, is a potential migratory species that prefer meadows, mudflats, beaches, marshes, and lakes where birds are abundant. They nest on cliff edges.

Bald Eagle (*Haliaeetus leucocephalus*), a recently federally delisted threatened species, is typically found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water.

Timber/Canebrake Rattlesnake (*Crotalus horridus*) is found in swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland,

limestone bluffs. Soils may be sandy or dense clay and prefers dense ground cover.

Texas listed rare species

Henslow's Sparrow (*Ammodramus henslowii*) Wintering individuals are found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles. A key component is bare ground for running/walking.

Plains Spotted Skunk (*Spilogale putorius interrupta*) is found in a variety of habitats: open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands although it prefers wooded brushy areas with tall grass prairie.

Texas garter snake (*Thamnophis sirtalis annectens*) is a terrestrial species, generally found in dry, lightly wooded areas.

Western Burrowing Owl (*Athene cunicularia hypugaea*) prefers open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows.

Visitor Experience

During the study scoping process, the public expressed great concern with the lack of access to this remarkable resource. At present, interpretation of the Waco Mammoth Site is currently provided off-site within Baylor University's Mayborn Museum Complex. A full room interpretive exhibit of the Waco Mammoth Site is presented in the Hall of Natural History. A dynamic walk-in diorama featuring a cast of the skeletal remains of the herd's bull with a juvenile cradled in its tusks can be viewed through a thick glass floor over the exhibit. A continuous loop film depicts what is believed to be the last moments of the herd's survival before they perished. Static and interactive interpretive displays on mammoths are presented as well.

The site remains essentially undeveloped for visitor use. However, as described under the elements common to all alternatives contained in chapter four, efforts by the Waco community are underway to erect a protective shelter over the excavation area and *in situ* specimens as well as developing the site to accommodate visitor use. It is anticipated that these improvements will be completed by 2009.

Management and Operations

The management and operations of the city of Waco, Baylor University, and the National Park Service could potentially be affected by the actions outlined in the four management alternatives. A brief description of each entity is provided below.

City of Waco

The city of Waco is composed of a number of departments that manage a variety of city services. The Parks and Recreation Department manages the city's park system, which consists of more than 60 facilities and open spaces including a zoo, 19 neighborhood parks, 4 community parks, 7 regional parks, a regional tennis center, golf course, and three recreation centers.

The city manager, with support from the city's Parks and Recreation Department, provides for the maintenance and security of the Waco Mammoth Site.

Baylor University

Baylor University, founded in 1845, is a private, Baptist-affiliated, research university located in Waco, Texas. It is the largest Baptist university in the world by enrollment. In 2006, the university had 11,800 undergraduate and 2,200 graduate and professional students in 145 baccalaureate programs, 76 masters, and 22 doctoral programs. Enrollment includes students from all 50 states and 90 foreign countries. There are 804 full-time faculty members, of which 50% are tenured. The campus is located just southeast of downtown Waco.

Baylor is one of the few universities in the United States to offer both undergraduate and graduate degrees in Museum Studies.

The director of Baylor University's Mayborn Museum Complex and her staff provide stewardship for the collected and *in situ* paleontological specimens of the Waco Mammoth Site. Collected specimens and archives are currently housed in a collection storage room in the Mayborn Museum Complex.

The Mayborn Museum has a collections manager on staff who has specific training in the preparation of fossils and their curation. She is also the only person who has done research specifically on the care of *in situ* fossils.

Baylor University has a vertebrate paleontologist on staff whose primary research is on Pleistocene mammals.

National Park Service

The National Park Service (NPS) is an agency within the United States Department of the Interior. It is headed by a director, and the organization consists of a headquarters office based in Washington, D.C., seven regional offices and multiple park and support units. The National Park Service provides stewardship for nearly 400 units of the national park system representing natural, cultural, and recreational sites across the nation.

Beyond national parks, the National Park Service helps communities across America preserve and enhance important local heritage and close-to-home recreational opportunities. Grants and assistance are offered to register, record, and save historic places; create community parks and local recreation facilities; conserve rivers and streams, and develop trails and greenways.

The state of Texas lies within the geographic range of the National Park Service's Intermountain Region. The region covers eight states (Montana, Wyoming, Colorado, Oklahoma, Utah, New Mexico, Arizona, and Texas) and includes 91 units of the national park system from Glacier National Park located in Northern Montana to Palo Alto Battlefield National Historic Park in Brownsville, Texas. The regional office is headquartered in Denver, Colorado. The closest national park unit to the Waco Mammoth Site is the 647 acre Lyndon B. Johnson National Historical Park located in Johnson City, 120 miles southwest of Waco. The park was established by Congress in 1969 for two main purposes:

- To research, preserve, and interpret significant resources and influences associated with the life and heritage of Lyndon B. Johnson.
- To provide a variety of opportunities to experience the local and regional context that shaped the last frontier president, informed his policies and programs, and defined his legacy.

The park has provided logistical support for the special resource study effort, and could potentially provide management support for the Waco Mammoth Site if it were designated a new unit of the national park system.

Socioeconomic Environment

For purposes of this socioeconomic analysis, it is assumed that the primary area of influence encompasses all inhabitants and related economic activity within the Waco, Texas, Metropolitan Statistical Area (MSA) that is also coincident with McLennan County, Texas.

Based on the Texas Comptroller's 13-region economic model of Texas, the Waco MSA is a part of the central Texas region, a 20-county area that also includes Temple-Killeen and Bryan-College Station metropolitan areas. Located halfway between Dallas and Austin on Interstate 35, the region is central to all major Texas markets.

Central Texas Regional Trends

In 2002, the comptroller issued a report outlining economic conditions and forecasts

for the state as a whole as well as for each of the state's thirteen regions. The following excerpts highlight some of the major findings for the central Texas region.

Table 6: Central Texas Region Employment

Employment Area	1980	1990	2000
Wholesale/Retail Trade	47,173	54,793	71,035
Local Government	26,308	35,958	47,811
Agriculture	35,813	39,353	44,981
Tourism	18,326	27,605	39,162
Healthcare	20,336	29,413	38,233
Construction	25,405	21,942	37,589
Finance, Insurance and Real Estate	19,772	23,824	34,379
State Government	19,409	28,204	33,552
Services to Business	6,474	14,406	29,234
Personal Services	12,157	17,165	23,736
Other Services	12,775	15,261	19,608
Other Durable Goods Manufacturing	12,470	12,466	15,107
High Tech, Communications, Aviation and Electronics	8,154	12,067	14,203
Federal Government	12,363	14,086	13,020
Other Non-Durable Goods Manufacturing	11,636	12,426	11,423
Other Transportation and Public Utilities	9,217	7,826	10,784
Other	3,396	4,183	3,961
Oil and Gas Production, Refining and Petrochemicals	2,981	2,876	3,356

Sources: Carole Keeton Rylander, Texas State Comptroller of Public Accounts; and Regional Economic Modules, Inc.

The region saw astounding growth during the last 30 years of the 20th century. In real terms (1992 dollars), gross regional product in this region—the sum total of all value added within the region—increased nearly three-fold, rising from $7.9 billion in 1970 to $21.8 billion in 2000. This is an average annual growth rate of 3.4 percent.

In terms of jobs, growth in this region was very strong during much of the 1970s and 1980s. The average annual growth rate in regional employment between 1980 through 2000 reflects a 7.8% increase in services to business, followed by a half as robust 3.9% increase in tourism and entertainment. Personal services; healthcare; local government; high tech, communications, aviation and electronics; and finance also experienced a range of increases from 2.8% to 3.4%.

During this time, the population of the central Texas region increased more than 62 percent, rising from 564,300 to 916,300. As a result of strong growth in the value of production in the region and somewhat slower population growth, per capita real incomes rose dramatically over the last 30 years from $11,050 in 1970 to $19,400 in 2000.

Waco MSA Demographics

Looking more specifically at the community surrounding the study area, the Waco MSA has also experienced considerable growth over the past decades. The areas in the city that are experiencing growth are north and considerably west of the study area. McLennan County has a population of 213,726, reflecting a racial makeup of 72% White, 18% Hispanic, and 15% African American. *(2000 U.S. Census)* It is estimate that the current total work force is approximately 102,000. *(Wikipedia)*

There are 78,859 households, 67% of which are family households. One third of these families have children under the age of 18 living with them. Almost 50% are married couples living together, 14% have a female householder with no husband present. Nonfamily households make up the remaining 33%, with 26% percent of the householder living alone, of which 10% are 65 years of age or older. The average household size is 2.6 and the average family size is 3.2. *(2000 U.S. Census)*

The city of Waco, the centrally located county seat of McLennan County, has a population of 113,726. The city has 42,279 households representing over 50% of the total households in McLennan County. The median household

income is $26,264, with the per capita income at $14,584. *(2000 U.S. Census)*

Downtown Waco is small compared to most other cities, such as Dallas or Houston, however, each day 17,000 people commute into downtown for work. Downtown Waco was built around the Waco Suspension Bridge, which was a crucial crossing of the Brazos River. In May 1953, the worst tornado in Texas history struck downtown Waco killing 114, and injuring hundreds. It caused millions of dollars in damage, and for decades since growth focused on other areas west of downtown. Recent efforts by the community have initiated a number of major redevelopment projects within the downtown Waco area that are helping to re-establish the city center. (*Wikipedia*)

Employment

Waco is characterized by a large number of education and health care employees due to the presence of Baylor University, Texas State Technical College, McLennan Community College, two full service hospitals, and several clinics and medical offices. *(Kelley 2005 Economic Forecast for Central Texas)*

Waco's hospitality industry is becoming one of its most important components, reaching over 9 thousand jobs. The outlook for the hospitality and leisure industry in Waco is increasingly positive with the Cameron Park Zoo addition, the potential addition of a four-star hotel and conference center, Waco Convention Center renovations, and development of activities and properties in Downtown Waco and the Brazos River Corridor. Waco is developing sufficient family based tourist attractions to encourage more overnight stays at local hotels. *(Kelley 2005 Economic Forecast for Central Texas)*

Manufacturing income remains an important contributor to basic income in the Waco MSA, but other important sectors contribute basic income. The export of higher education services (spending by students from households outside the county), regional health care services provided by our area hospitals that reach beyond the county, tourist and convention spending by out-of-county visitors, regional shopping facilities that attract out-of-county visitors, and business and professional services that extend beyond the immediate area. *(Kelley 2007 Central Texas Forecasts)*

Local Planning and Zoning

The Waco Mammoth Site and the lands surrounding the site lie with the R-1B Zone that allows for single-family residential development, agriculture use, and public uses such as parks. It is anticipated that existing land use patterns surrounding the site would remain fairly stable.

The site is also within the Brazos River Corridor overlay district. In 2000, the *City Comprehensive Plan* designated the Brazos River Corridor as an overlay district, which takes precedence over the underlying zoning. The purpose of the overlay district is to ensure the development of the Brazos River Corridor as a center for quality recreation, convention, tourism, housing, commercial, retail, and office facilities. The regulations are designed to protect the special environmental character of the corridor and to promote continued private and public investment. Some of the goals contained in the mission statement for the corridor include the following:

- Preserve, protect, and enhance the historically, culturally, architecturally, and archeologically significant sites and structures which impact a distinct aspect of the city and serve as visible reminders of the city's culture and history.
- Recognize and protect the special distinctive qualities and ecosystems of both the Brazos River and the Bosque River and their tributaries.
- Encourage developments that interconnect for pedestrian access and circulation.

The city of Waco has recognized the significance of the Waco Mammoth Site by including the site within the boundaries of the Brazos River Corridor overlay district. By connecting the Waco Mammoth Site to the

rest of the corridor, the city has made a commitment to encouraging compatible land uses in the vicinity of the site. In addition, the city owns the parcel to the south east of the Waco Mammoth Site as well as parcels south of West Lake Shore Drive. It is the intent of the city to provide continuous access through these parcels to the Waco Mammoth Site.

Transportation

The Waco Mammoth Site is centrally located within the state of Texas, with a travel distance of 90 miles south of Dallas/Fort Worth, 90 miles north of Austin, 180 miles northwest of Houston, and within 200 miles of 80% of the state's population. The total population for the state of Texas in 2000 was almost 21 million people. The study area is located less than 12 miles from Interstate 35, a well traveled, primary north/south transportation corridor traversing the Midwest section of the country. Annual average daily traffic recorded in 2003 was 46,512. The study area has almost 1,000 feet of frontage along New Steinbeck Bend Road, a local arterial collector road that currently experiences low volume traffic, as the surrounding areas are mostly undeveloped.

The Waco transit system provides safe and reliable public transportation to the citizens of Waco and the surrounding communities. Services include a fixed route bus service within the city of Waco, the Baylor University Shuttle (BUS), and the Para Transit van service for individuals with special transportation needs.

The study area is also located within a few miles of the Waco Regional Airport, which primarily provides commuter service to the Dallas-Fort Worth Airport and Houston-Bush International Airport.

An industrial airport is located at Texas State Technical College which accommodates Air Force One when President George W. Bush visits his Prairie Chapel Ranch, also known as the Western White House, in Crawford, Texas. The ranch is located just 10 miles west of the city of Waco.

Tourism

A majority of Waco's tourist destinations are within the Brazos River Corridor, or near enough to the corridor to be influenced by it. For many who visit Waco, the corridor represents an important first impression of the community. Some of Waco's major attractions include the following:

Baylor University's **Mayborn Museum Complex** opened in May 2004; it is a natural science and cultural history museum. The 143,000-square-foot building includes the collection from university's former Strecker Museum, the Jeanes Discovery Center, a 5,000-square-foot traveling exhibit hall, 178-tiered-seat theater, museum store, and café.

The complex also includes the faculty and administration offices for Baylor University's Department of Museum Studies, as well as collections storage and preparation areas. The collected specimens from the Waco Mammoth Site are currently being housed in one of the collections storage rooms.

Within the Waco at the Crossroads of Texas Natural History Exhibits are four exploration stations focusing on geology, paleontology, natural history, and archaeology and three walk-in dioramas showcasing a limestone cave, a Texas forest, and the Waco Mammoth site. Within the mammoth exhibit, visitors can walk over a transparent floor and look down upon a cast of the bones of the Columbian mammoth bull with the juvenile laying over his tusks displayed exactly as they were unearthed at the Waco Mammoth Site.

There are sixteen discovery rooms in the Jeanes Discovery Center with themes from vertebrates to weather designed to provide hands-on, interactive learning.

Outside the museum, a number of vintage wooden structures have been assembled into the 13-acre Governor Bill & Vara Daniel

Historic Village, giving visitors a visual sample of Texan community life from the latter part of the 19th century into the early 20th century.

Located just over 2 miles from downtown Waco and I-35, **Cameron Park** is a 416-acre municipal park that includes a series of bluffs and gullies along the banks and confluence of the Brazos and Bosque rivers. It is one of the largest municipal parks in the state. Fishing, canoeing, or kayaking on both rivers is made possible by easily accessible boat ramps. Mountain-biking trails, bridle paths, volleyball, disc golf courses, and picnic facilities are provided along almost 2.5 miles of parkland adjacent to the rivers.

Located within the southeast end of Cameron Park, the **Cameron Park Zoo** is a 52-acre natural habitat zoo that shares with the Waco Mammoth Site a similar history of community initiative and support for its establishment. This zoo was originally established by local citizens to create recreation and educational opportunities for central Texas residents. In 1981, a master plan was prepared to build a new zoological park and a countywide bond issue was passed to fund the development. Subsequent gifts from the community as well as approved bond requests have continued to provide an expanded menu of exhibit opportunities at the zoo. This history of exceptional public support and positive growth is possible due to the cooperative working relationship between the Zoological Society, the city of Waco, and McLennan County. The county has supported a number of bond elections while the city is responsible for the operation and maintenance of the zoo. The Zoological Society manages and handles capital fundraising for the zoo, along with all special events, development projects, and guest service arrangements.

Lake Waco is a manmade reservoir located 3 miles upstream from the Waco Mammoth Site. The lake was created by the construction of an earthen embankment and concrete dam on the Bosque River. The work was completed by the U.S. Army Corps of Engineers, Fort Worth District, in 1965 for the purposes of flood control, water supply, and recreation. There a number of developed parks around the perimeter of the lake that provide for boat access, marina services, fishing, trailer camping, swim beach areas, picnic areas, recreational fields, playgrounds, and hiking trails. There is also a wetland restoration area along the northwest inlet.

Located within downtown Waco, the **Dr Pepper Museum** commemorates the soft drink's history and includes the original 1906 bottling plant and spring source. Dr. Pepper was originally developed in 1885 by Dr. Charles Alderton in his Waco drugstore for medicinal purposes. The museum holds an impressive collection of soft drink memorabilia and provides drink service from a reconstructed old-style soda fountain.

The **Texas Ranger Hall of Fame and Museum,** located adjacent to I-35 and the Brazos River in Waco provides exhibits and information on the history of the Texas Rangers, a legendary symbol of Texas and the American West. It also serves as the principal repository for artifacts and archives relating to the Texas Rangers. The museum is one of the better attended venues in the city.

Chapter Six: Environmental Consequences

CHAPTER OVERVIEW

The National Environmental Policy Act (NEPA) requires that federal agencies disclose, prior to taking action, the environmental impacts of that action, feasible alternatives to that action, and any adverse environmental effects that cannot be avoided if a proposed action is implemented. In this case, the proposed federal action includes preparing for Congress, a special resource study report and recommendation on whether or not the Waco Mammoth Site should be considered for designation as a new unit of the National Park System.

The following section of this study analyzes the potential impacts of implementing four alternative management frameworks for resource protection and visitor enjoyment of the special resources of the Waco Mammoth Site. The analysis focuses specifically on the consequences of each alternative on the **fundamental resources** of the Waco Mammoth Site, the **other resources** found there, the potential **visitor experience,** the **management and operations** of each managing entity, and the surrounding **socioeconomic environment**. This analysis provides the basis for comparing the consequences of implementing any of the management alternatives so that the most effective and efficient management framework for the Waco Mammoth Site can be identified.

There are number of assumptions made in this analysis that address the general level of development required to support each management scenario. However, it is important to remember that if the site were to become a new unit of the National Park System, NPS management policies require that a General Management Plan be prepared to clearly define what resource conditions and visitor experiences should be achieved and maintained over time. General Management Plans provide a general framework and focus for future managers and include:

1) Measures for the preservation of the area's special resources as well as other resources found there (types of studies, inventories, and implementation and stewardship strategies).
2) Types and general intensities of development associated with public enjoyment & use of the area (including general locations, timing of implementation, and associated costs).
3) Implementation commitments for visitor carrying capacities for all areas of the unit.
4) Justifications for potential boundary modifications.

This chapter begins with a description of the methods and assumptions used for analyzing each impact topic. The analysis is organized by alternative and then by impact category and topic. The existing conditions for all of the impact topics that are analyzed were identified in "Chapter Five: Affected Environment." All of the impact topics are assessed for each alternative. For each impact topic, there is a description of the specific actions under each alternative that would result in either a beneficial or adverse impact and a discussion of cumulative effects.

The impacts of each alternative are summarized in table 5 found at the end of "Chapter Four: Alternatives for Management."

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Methodology

Generally, the methodology for resource impact assessments follows direction

provided in the Council on Environmental Quality (CEQ) Regulations for Implementing the National Environmental Policy Act, Parts 1502 and 1508. Additional guidance has been provided by the National Park Service Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision Making*. The impacts from the four alternatives were evaluated in terms of their context, type, intensity, and duration as defined below.

Context and Type

Each impact topic addresses impacts on resources inside and outside the project study area; to the extent those impacts are traceable to the actions described in each alternative. If there are impacts, they can either provide a benefit (beneficial) or create a negative consequence (adverse) on a particular resource or value.

Intensity and Duration

Impacts are analyzed in terms of their intensity and their duration. The criteria used to define the thresholds for assigning intensity are presented in the Impact Intensity Threshold Definitions Matrix (Table 7). Duration can be short-term or long-term. Short-term impacts are typically impacts that last for a temporary period of time (usually not more than 1-3 years) or may be intermittent depending on the activity. Long-term impacts are those impacts that persist indefinitely beyond an action or activity.

Direct and Indirect Impacts

Direct impacts would be caused by an action and would occur at the same time and place as the action. Indirect impacts would be caused by the action and would be reasonably foreseeable but would occur later in time, at another place, or to another resource. Impacts are assumed to be direct unless otherwise indicated.

Cumulative Impacts

Regulations implementing NEPA issued by the CEQ require the assessment of cumulative impacts in the decision-making process for federal actions. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Impact Analysis

The impacts of the action alternatives (alternatives B, C, and D) describe the *difference* between implementing the no-action alternative (alternative A) and implementing the action alternatives. To understand a complete "picture" of the impacts of implementing any of the action alternatives, the reader must also take into consideration the impacts that would occur under the no-action alternative.

The study team based the impact analysis described in this chapter primarily on the information gathered through consultations with the staff of Baylor University's Mayborn Museum Complex, the city of Waco, and other agencies; guidance provided by NPS subject matter experts; a review of existing literature and studies; and professional judgment.

Table 7: Impact Intensity Threshold Definitions

Impact Intensity/ Impact Topic		Negligible Impact	Minor Impact	Moderate Impact	Major Impact
Fundamental Resources	***In Situ* Specimens** and **Geological Context** of the **Discovery Site**	Impacts are at the lowest level of detection—barely perceptible and not easily measured.	Impacts are slight but detectable. The impact affects an area of the site with modest data potential.	Impacts are readily apparent. The impact affects an area of the site with high data potential.	Impacts are severe or of exceptional benefit. The impact affects an area of the site with exceptional data potential.
	Paleontology Collections (museum collections)	Impacts are at the lowest levels of detection—barely perceptible and not easily measured.	**Adverse impact**-would affect integrity of a few items in the museum collection but would not degrade the usefulness for future research and interpretation. **Beneficial impact**-would stabilize current conditions of museum collections and/or its constituent components to minimize degradation.	**Adverse impact**- would affect integrity of many items in the museum collection or archives and diminish the usefulness of the collection or archives for future research and interpretation. **Beneficial impact**-would improve conditions of museum collections, protect its constituent components from threats of degradation, and/or enhance the usefulness for research or interpretation.	**Adverse impact**- would affect the integrity of most items in the museum collection and destroy the usefulness of the collection and/or archives for future research and interpretation. **Beneficial impact**-would secure conditions of museum collections as a whole or its constituent components from threats of further degradation and enhance the usefulness for research or interpretation.
Other Resources	**Soils** and **Prime Farmlands**	Impacts are at the lowest level of detection—barely perceptible and not easily measured.	Impacts would be detectable and result in a change to soil character and productivity over a relatively small area.	Impacts would be readily apparent and result in a change to soil character and productivity over a relatively wide area.	Impacts would be readily apparent and substantially change the soil character and productivity over a majority of the study area.
	Floodplains	There would be no detectable change in a floodplain values and fluctuations or the ability to convey floodwaters.	Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be measurable and local. Addition of structures within the floodplain would have a very limited potential to increase flood levels.	Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be appreciable and local. Addition of structures within the floodplain would have the potential to increase flood levels.	Changes in the ability of a floodplain to convey floodwaters, or its values and functions, would be considerable, and widespread. Addition or removal of structures in the floodplain would change flood levels.

Table 7: Impact Intensity Threshold Definitions

Impact Intensity/ Impact Topic		Negligible Impact	Minor Impact	Moderate Impact	Major Impact
Other Resources	**Wetlands**	No measurable or perceptible changes in wetland size, integrity, or continuity would occur.	The impact would be measurable or perceptible, but slight. A small change in size, integrity, or continuity could occur due to short-term indirect effects such as construction-related runoff. However, the overall viability of the resource would not be affected.	The impact would be sufficient to cause a measurable change in the size, integrity or continuity of the wetland or would result in a small, but permanent, loss or gain in wetland acreage.	The action would result in a measurable change in all three parameters (size, integrity, and continuity) or a permanent loss of large wetland areas. The impact would be substantial and highly noticeable.
	Vegetation	Individual native plants may be impacted, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur.	Impacts on native plants would be measurable or perceptible, but would impact a small area. The viability of the plant community would not be impacted and the community, if left alone, would recover.	A change would occur over a relatively large area in the native plant community that would be readily measurable in terms of abundance, distribution, quantity, or quality.	Impacts on native plant communities would be readily apparent, and would substantially change vegetation community types over a large area. Changes might have effects on the viability of some species.
	Wildlife and **Wildlife Habitat**	There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural population fluctuations.	Impacts would be detectable, but they are not expected to be outside the natural range of variability of native species' populations, their habitats, or the natural processes sustaining them.	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability.	Impacts on native species, their habitats, or natural processes sustaining them would be detectable, and expected to be outside the natural range of variability. Key ecosystem processes might be affected. Changes to habitat might have effects on the viability of some species.
	Special Status Species Definitions are consistent with section 7 of the Endangered Species Act.	*No effect:* The action would cause no effect on the species or critical habitat.	*Not likely to adversely affect:* The action would be expected to result in insignificant and discountable effects on a species or critical habitat (i.e., extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated), or it would be completely beneficial.	*Likely to adversely affect:* The action would result in a direct or indirect adverse effect on a species or critical habitat, and the effect would not be discountable or completely beneficial.	*Likely to adversely affect:* The action would result in a direct or indirect adverse effect on a species or critical habitat, and the effect would not be discountable or completely beneficial.

Table 7: Impact Intensity Threshold Definitions

Impact Intensity/ Impact Topic	Negligible Impact	Minor Impact	Moderate Impact	Major Impact
Visitor Experience	Visitors would likely be unaware of any effects associated with implementation of the alternative.	Some characteristics of visitor use and/or experience would change, and visitors would likely be aware of the effects associated with implementation of the alternative.	Multiple characteristics of visitor experience would change. Visitors would be aware of the effects associated with implementation of the alternative.	Areas of the park containing fundamental resources are made available and accessible for visitor experience opportunities for the first time. Multiple characteristics of visitor experience would change substantially. Visitors would be aware of the effects associated with implementation of the alternative.
Management Operations (City of Waco, Mayborn Museum Complex, and National Park Service)	Impacts to an entity's operations that would be at a low level of detection and would not appreciable change their current operations.	Impact to an entity's operations that may increase (adverse) or decrease (beneficial) operational expenses, but would not require changes in current staffing levels.	Impact to an entity's operations that would be readily apparent and result in increases (adverse) or decreases (beneficial) in staffing and/or operational expenses. Programs and/or efforts would need to be re-prioritized to accommodate expanded responsibilities.	Impact to an entity's operations that would be readily apparent, result in substantial increases (adverse) or decreases (beneficial) in staffing and/or operational expenses, and would be markedly different from their current operations.
Socioeconomic Environment	Impacts to the economic environment are at the lowest level of detection—barely perceptible and not easily measured.	Impacts to the economic conditions would be slight but detectable.	Impacts to the economic conditions would be readily apparent. Any effects would result in changes to economic conditions at the Waco MSA level.	Impacts to the economic conditions would be readily apparent. Measurable changes in economic conditions at the central Texas regional level occur. The impact is severely adverse or exceptionally beneficial in the affected area.
	Impacts to the community are at the lowest level of detection—barely perceptible and not easily measured.	Impacts to the community would be detectable and only affect a small portion of the surrounding population.	Impacts would be readily apparent and affect community conditions.	Impacts to the community would be readily apparent and affect community conditions. The impact is severely adverse or exceptionally beneficial in the affected area.

IMPACT TOPICS AND CUMULATIVE EFFECTS SCENARIOS

The team's method for analyzing each impact topic is further described below.

Also, in order to assist in the analysis of the cumulative effects resulting from the actions in each alternative, a "Cumulative Effects Scenario" was developed for each impact topic. To determine potential cumulative effects, other actions within and surrounding the Waco Mammoth Site were identified. Depending on the impact topic, the context included the central Texas region, McLennan County, the city of Waco, Baylor University's Mayborn Museum, or the National Park Service. To establish an understanding of the cumulative effects scenario, a short description of relevant past, present, and reasonably foreseeable future actions is included under the introduction of each impact topic that follows this section.

An assessment is made to determine the *effects of these other actions* on each impact topic, which is later combined with the impacts described for each alternative under the environmental consequences section to determine the overall cumulative impact for that component of the environment. The effect of each alternative relative to the overall cumulative impact is also identified.

Fundamental Resources of the Waco Mammoth Site

This impact category considers the effects of each management alternative on the fundamental resource components that collectively represent the special resources of the Waco Mammoth Site. This was examined under two impact topics. The first examines potential impacts to the *in situ* specimens and the geologic context of the discovery site; the second examines potential impacts to the paleontological collections that include the collected specimens and the archival record (typically referred to as museum collections in the National Park Service).

Cumulative Effects Scenario for the In Situ Specimens and Geologic Context

The context for potential cumulative effects under this impact topic covers the *in situ* specimens and geologic context of the Waco Mammoth Site. Other past, present or foreseeable future actions that were considered as part of the *cumulative effect* analysis included the following activities.

Since the initial discovery of the site in 1978 through 1996, staff from Baylor University's former Strecker Museum as well as a host of volunteers from the Waco community have actively investigated the site. Their efforts have preserved vital information relating to the geologic context of the site, and include topographic surveys of bone positions, a photographic record of excavation activities, and collected soil samples.

The recent research conducted by John Bongino as a part of his masters' thesis through Baylor University's Department of Geology has provided valuable additional information and interpretation of the soil stratigraphy and geologic context of the discovery site. His work has resulted in a refinement of the understanding of the circumstances surrounding the concentration of mammoths discovered there. His findings indicate that a herd of 19 adult female and juvenile mammoths succumbed in a single event, while also suggesting there were subsequent accumulations later in time.

Current actions underway by the Waco community—erecting the protective shelter over the discovery site and improving site drainage to arrest further soil erosion threatening the resource—should stabilize current conditions. This initiative will ensure the long-term protection of the geologic context by preserving the soil stratigraphy surrounding the *in situ* specimens and assuring that future scientific research opportunities could continue to provide information to enhance the understanding of this special resource. These actions will also allow for the accommodation of controlled visitor access into the shelter to view the *in situ*

mammoth specimens and protect the resource from potential vandalism.

Since all of these activities focus on areas of exceptional data potential, collectively they represent a major, long-term beneficial impact on the *in situ* specimens and geological context of the Waco Mammoth Site.

Cumulative Effects Scenario for the Paleontological Collections (museum collections)

The context for potential cumulative effects under this impact topic covers the museum collections of the Baylor University's Mayborn Museum Complex as this is the current location of the Waco Mammoth Site's paleontological collection. It also includes the museum collections of the National Park Service's Intermountain Region as some alternatives consider including the Waco Mammoth Site's collection into the museum collections of the National Park Service. Other past, present or foreseeable future actions and activities that were considered as part of the *cumulative effect* analysis include:

The construction of Baylor University's $23 million Mayborn Museum Complex in 2004, vastly improved the conditions of the University's Strecker Museum collections. The Strecker Museum was the oldest continuously operating museum in the state until it closed in 2003, and the collections were moved to the new 35,000 square foot complex. The Waco Mammoth Site's paleontological collections and archives were previously housed within the Strecker Museum. The museum was located in the basement of Baylor University's Sid Richardson Science Building which had limitations on space (5,000 square feet), security, and climate control capabilities. This location did not provide ideal conditions for the long-term curatorial care of the collection. With the new facility, museum staff can continue to accession and catalogue for curation of prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens from the central Texas region. As these actions secure the condition of the collection and archives from threats of further degradation they represent a major, long-term beneficial impact on the University's central Texas museum collections.

Looking at National Park Service museum management practices, the current trend has been to provide designated centralized repositories with space for collections meeting museum standards in accordance with the approved NPS *Museum Collection Facilities Strategy, Intermountain Region* (National Park Service 2005b). Following this protocol, a number of National Park Service units within the state of Texas have made arrangements with the University of Texas at Austin to provide for the curatorial care of their paleontological collections. This represents a moderate, long-term beneficial impact on the National Park Service's Intermountain Region's museum collections as park units have not had to invest in duplicate collections storage facilities and the research community is provided a convenient centralized location to study and compare specimens found across a wide region of the state and beyond.

Other Resources of the Waco Mammoth Site

This impact category evaluated the general anticipated effects of the alternatives on several components of the natural environment such as soils and prime farmland; floodplains and wetlands; vegetation, wildlife, habitat, and special status species.

Cumulative Effects Scenario for Soils and Prime Farmlands

The context for potential cumulative effects under this impact topic covers the soils and prime farmlands within McLennan County. Other past, present or foreseeable future actions and activities that were considered as part of the *cumulative effect* analysis include:

Under current actions already underway by the Waco community, the study area would be

minimally developed to protect paleontological resources and to provide for visitor access to the Waco Mammoth Site. It is anticipated that there would be minor, long-term adverse impacts resulting from the localized loss of soil and prime farmland to accommodate the construction of the excavation shelter and infrastructure needed to protect the resource and provide for visitor access.

Looking beyond the study area, previous and continuing development activities within McLennan County have converted prime farmland into residential neighborhoods, commercial centers, industrial parks, and other uses that have resulted in major, long-term adverse impacts on these resources.

Collectively, since these changes are readily apparent and result in a change to soil character and productivity over a relatively wide area of McLennan County, they represent a moderate, long-term adverse impact on this resource.

Cumulative Effects Scenario for Floodplains and Wetlands

The context for potential cumulative effects under this impact topic covers floodplains and wetlands of the Bosque River watershed within McLennan County. Other past, present or foreseeable future actions and activities that were considered as part of the *cumulative effect* analysis include:

Looking beyond the study area, previous agricultural practices, urban and residential development have incrementally adversely affected floodplains and wetland areas within the Bosque River watershed.

The creation of Lake Waco in 1965 has provided the Waco community the benefits of flood control, water supply, and recreation. By design, the dam has altered the frequency of river flooding downstream of this structure. The creation of the Lake Waco Wetland Area has provided some mitigation for the resource impacts of the reservoir.

Since collectively these changes are readily apparent and have altered floodplain and wetland values and functions over a relatively large area of the watershed, they represent a moderate, long-term adverse impact on these resources.

Cumulative Effects Scenario for Vegetation, Wildlife, Habitat, and Special Status Species

The context for potential cumulative effects under this impact topic covers the vegetation, wildlife, habitat, and special status species of McLennan County. The following past, present or foreseeable future actions and activities were considered as part of the *cumulative effect* analysis.

Previous ranching activities and the attendant cattle grazing within the study area have altered native vegetation patterns and wildlife habitat resulting in moderately adverse although reversible effects on the site.

Under current actions underway by the Waco community, the study area would be minimally developed to protect paleontological resources and to provide for visitor access to the Waco Mammoth Site. These actions would create minor, long-term adverse impacts on existing vegetation, wildlife, habitat, and special status species by dedicating a portion of the landscape to infrastructure and thereby removing a portion of the study area's vegetation and wildlife habitat to accommodate protection and presentation of these special resources.

Looking beyond the study area, previous urban and residential development along with widespread agricultural activities within McLennan County has resulted in a substantially modified natural environment. These activities have essentially carved the county into isolated islands of native vegetation and wildlife habitat. The website Texas Handbook Online references a number of extirpated species: antelope, bison, bear, and javelins that once existed within McLennan County prior to its extensive settlement. Other actions such as the creation of Lake Waco, has resulted in a loss of habitat

for some species while creating habitat for others. The creation of the Lake Waco Wetland Area has provided some measure of mitigation for habitat loss. Future actions, such as increasing population growth and urbanization could further reduce and adversely impact these resources.

Since collectively these activities have substantially changed vegetation community types and wildlife habitat over a large area of the county resulting in a number of extirpated species and a number of designated special status species, they represent a major, long-term adverse impact on the vegetation, wildlife, habitat, and special status species of McLennan County.

Visitor Experience

Throughout the study process, the public has expressed an unwavering desire to experience the special resources of the Waco Mammoth Site. This impact topic includes various aspects of visitor use at the Waco Mammoth Site, including the effects on visitors' ability to access and experience the site's fundamental resources; opportunities for orientation, interpretation, and education; the freedom to experience the resources at one's own pace; and opportunities for the scientific community to conduct research.

Cumulative Effects Scenario for the Visitor Experience

The context for potential cumulative effects under this impact topic covers the visitor experience opportunities within the city of Waco. The following past, present or foreseeable future actions and activities were considered as part of the *cumulative effects* analysis.

Currently, visitor access to the Waco Mammoth Site is restricted and would continue to be so until the current actions already underway by the Waco community to erect an excavation shelter and provide for visitor access are completed. This would be the first time that public access would be accommodated at the site and marks a very special milestone for members of the Waco community who have been actively involved in preservation efforts there for almost 30 years. At least 12 public events at the site would be scheduled throughout the year during the early phases of the park's establishment. However, it is assumed that this schedule would be expanded with the assistance of the Waco Mammoth Foundation. Since public access to the fundamental resources of the Waco Mammoth Site will be provided for the first time by this community effort, this represents a major, long-term, beneficial impact to the visitor experience.

There are a number of other visitor experience opportunities available for folks who live within the surrounding community and for those visiting the greater Waco area. They include Baylor University's Mayborn Museum Complex, a natural science and cultural history museum focusing on the central Texas region; Cameron Park, a 416-acre municipal park along the Bosque and Brazos river corridors; the Cameron Park Zoo, a 52-acre natural habitat zoo located along the Brazos River corridor; Lake Waco, a manmade recreational reservoir located on the Brazos River 3 miles upstream of the study area; the Dr. Pepper Museum, which commemorates the creation of this popular beverage in the Waco area as well as the soft drink industry; the Texas Ranger Hall of Fame and Museum and the contemporary headquarters station of Ranger Company F of the Texas Rangers; and the Taylor Museum of Waco History.

There are a number of foreseeable future actions planned for the Waco area that will continue to enhance visitor experience opportunities there. Renovations are planned for the Convention Center, Texas Ranger Hall of Fame, the library, and Cameron Park.

Since all of these activities collectively contribute to a greatly enhanced array of visitor experience opportunities available within the city of Waco, they represent a

major, long-term beneficial impact on the visitor experience opportunities within the city of Waco.

Management and Operations

The impact topic includes evaluating the effects of the alternatives on existing management and operations of the city of Waco, Baylor University, and National Park Service. The analysis was conducted in terms of how operations, staffing, and expenses might vary for each group under each management scenario.

Cumulative Effects Scenario for Management and Operations

The context for potential cumulative effects under this impact topic covers the management and operations of the city of Waco, Baylor University's Mayborn Museum Complex, and the National Park Service. Other past, present or foreseeable future actions and activities that were considered as part of the *cumulative effect* analysis include:

Under current actions planned by the Waco community, the construction of the excavation shelter and infrastructure to protect the resource and to accommodate visitor use, the city of Waco Parks and Recreation Department would acquire additional facility management responsibilities.

As the city of Waco grows, the need to provide for expanded city services will also grow. Depending on the health of the city's economy, this may or may not strain city budgets to maintain the level of services currently provided throughout the city. This potentially represents a minor to moderate, long-term adverse impact on the management and operations of the city of Waco.

The construction of the 35,000-square-foot Mayborn Museum Complex at Baylor University has greatly enhanced the management of the museum collections previously housed in the University's former Strecker Museum (5,000 square feet). The opening of the new museum expanded their museum operations, which required an increase in staffing and expenses to operate and maintain this larger museum complex. This represents a minor to moderate, long-term adverse impact on the management and operations of the Mayborn Museum Complex.

The National Park Service continues management and operations of nearly 400 units nationwide. Work on reducing the backlog of deferred maintenance effects on park infrastructure throughout the system continues to be addressed. The implementation of inventory and monitoring programs for park resources continues. Operational funding levels are maintained without appreciable increases to offset the effects of inflation or new mandates, although there is the potential for increased annual funding through the Centennial Challenge program currently under consideration by Congress. NPS managers continue to balance the accommodation of visitor use with the resource protection needs of these units. This represents a minor to moderate, long-term adverse impact on the management and operations of the National Park Service.

Socioeconomic Environment

To evaluate the socioeconomic impacts of each alternative, this impact topic was broken down into two components. The first component examines the effects on the economic environment and the second component examines the effects on the surrounding community.

Economic Environment

In 2001, a report titled "*The Economic Impact of the Waco Mammoth Park on the Central Texas Region*" was prepared by Dr. Tom Kelly, economist and Director of Baylor Center for Business and Economic Research. In this study, Dr. Kelly projected that basic income would come from two sources: 1) from the construction, operations, and maintenance of the facilities and 2) from visitors traveling from outside the region and spending within the local economy.

Dr. Kelly applied the central Texas region's expenditure multiplier for construction of new educational facilities (2.325) and the expenditure multiplier for tourism visitors (2.827) according to an input-output model estimated by the Ray Perryman Group. He also projected that 10% of the visitors to the site would spend at least one additional person day (and $80 per person) in the central Texas region.

For the purposes of this analysis, Dr. Kelly's methodology has been applied to each of the alternatives to project their economic impact. Projected visitation rates were based on the more conservative assumptions identified in the 2003 Lord Report, which projected 30,000 visitors per year after the third year of operation. The initial construction costs and annual operating costs were developed by the assumptions listed for level of development and delegation of management responsibilities identified under each alternative.

Community

This second component of the socioeconomic environment includes qualitatively analyzing the consequences of the management alternatives on the characteristics and components of the surrounding community that included adjacent landowners, the greater Waco area, and the central Texas region.

Cumulative Effects Scenario for the Socioeconomic Environment

The context for potential cumulative effects under this impact topic covers socioeconomic environment within the Waco MSA and central Texas region. Other past, present or foreseeable future actions and activities that were considered as part of the *cumulative effect* analysis include:

Under current actions planned by the Waco community, the construction of the excavation shelter and infrastructure to protect the resource and to accommodate visitor use will provide a onetime impact on the economy of the Waco MSA. Using the central Texas region's expenditure multiplier for the construction of new educational facilities (2.325), the $3.2 million effort could potentially provide over $7.4 million to the Waco MSA. When visitor access is accommodated, this would also provide additional on-going beneficial economic impacts from visitor spending in the area.

Looking beyond the study area, past, present and future population growth and urban development would continue to affect the social and economic environment.

In addition to the Waco community initiative to erect a protective shelter and provide for visitor access at the Waco Mammoth Site, the community is involved in a number of other initiatives. The Greater Waco Strategic Economic Development Plan, completed in 2005, identified a number of goals to achieve a stronger, more sustainable economy and quality of life in the area. These included strengthening the economy, developing the workforce, retaining and attracting more businesses, residents, and visitors, revitalizing strategic community areas such as reinvigorating the downtown area and the Brazos riverfront.

A number of projects currently underway in the downtown area include the renovation of the Hilton Hotel, the construction of a new $4 million building for the Greater Waco Chamber of Commerce, and a $60 million mixed-use private development called Waco Town Square.

There are a number of foreseeable future actions planned for the Waco area. Last May (2007), city of Waco voters approved the first city bond issue in 40 years. They approved a $63 million bond package to refurbish the Convention Center ($17.5 million), build a new library and improve the central library ($12 million), add two fire stations ($6.8 million), move police headquarters ($13 million), renovate Knox Hall at the Texas Ranger Hall of Fame ($2 million), and renovate parks ($11.7 million) which includes Cameron Park ($6.9 million) which is

approaching its 100 year anniversary in 2010, Cameron Park East ($2.1 million), and trail improvements ($0.9 million).

The city is actively promoting the enhancement of the Brazos River Corridor throughout the downtown area as well as in the vicinity of the Waco Mammoth Site. Greenway corridors and connecting trails are planned to connect the Waco Mammoth Site with other features along the corridor.

As improvements to Waco's downtown and enhancements to their park system are implemented, it projected that this would increase business activity and tourism in the area. This in turn would generate increased visitor spending in the area and generate revenue for the business community as well as local and state governments providing a moderate, long-term economic benefit to the Waco MSA and central Texas region.

Waco residents could potentially experience minor, long-term adverse impacts from the increase in traffic generated by these improvements. Although, it is equally expected that the enhanced range of shopping and entertainment opportunities would provide moderate, long-term benefits to the community.

Collectively, these changes represent moderate long-term beneficial impacts on the socioeconomic environment of the Waco MSA.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE A

Continue Current Management Trends (No-Action Alternative)

Impacts on Fundamental Resources of the Waco Mammoth Site

In Situ Specimens and Geologic Context of the Discovery Site

Analysis. Under this alternative, the staff at Baylor University's Mayborn Museum Complex would continue to monitor conditions and ensure the *in situ* paleontological resources are stabilized and preserved. The current moratorium on further excavation activities would remain in place. As a result of these actions, it is anticipated that there would be no impact to the current conditions of the *in situ* specimens and geologic context of the discovery site.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the *in situ* specimens and the geological context of the discovery site are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. Alternative A would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently, there would be no cumulative impacts to the *in situ* specimens and the geological context of the discovery site under alternative A.

Conclusion. There would be no impacts to the *in situ* specimens and geologic context of the discovery site from the actions under alternative A. Correspondingly, there would be no cumulative effect.

Paleontological Collections (Museum Collections)

Analysis. Baylor University's Mayborn Museum Complex would continue to provide climate-controlled secured storage of the paleontological collections and archives, which include the records of site excavation and research. Access to the collections would continue to be convenient. Specimens in plaster jackets would continue to be stored but not prepared as the museum does not have preparation laboratory for paleontological specimens. In the reasonably foreseeable future for protection and preservation of these resources, it is expected that the current conditions would remain unchanged and therefore there would be no impact to these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the Mayborn Museum's museum collections are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. Alternative A would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently, there would be no cumulative impacts to paleontological collections of the Mayborn Museum under alternative A.

Conclusion. There would be no impact to the paleontological collections and archives of the Waco Mammoth Site from the actions under alternative A. Correspondingly, there would be no cumulative effect.

Impacts on Other Resources

Soils including Prime Farmlands

Analysis. Under this alternative, it is assumed that the study area would not be further developed, thereby preserving a majority of the soils and prime farmland found there. Consequently, there would be no impact to the current condition of these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the soils and prime farmland of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter . Alternative A would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently,

there would be no cumulative impacts to soils and prime farmland of McLennan County under alternative A.

Conclusion. There would be no impact to the soils and prime farmland within the study area from the actions under alternative A. Correspondingly, there would be no cumulative effect.

Floodplains and Wetlands

Analysis. Under this alternative, there are no management actions or activities proposed within the floodplain or potential wetlands along the Bosque River section of the study area. Consequently, there would be no impact to the current condition of these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the floodplains and wetlands of the Bosque River watershed within McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. Alternative A would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently, there would be no cumulative impacts to floodplains and wetlands of the Bosque River watershed within McLennan County under this alternative.

Conclusion. There would be no impact to the floodplains and potential wetlands found within the study area from the actions under alternative A. Correspondingly, there would be no cumulative effect.

Vegetation, Wildlife, Habitat, and Special Status Species

Analysis. Under this alternative, it is assumed that the study area would not be further developed, thereby preserving a majority of the vegetation and wildlife habitat found there. It is also assumed that resource management strategies would not be developed for these resources such as conducting inventories to determine the composition of native, nonnative, and/or special status species inhabiting the study area; or developing management strategies for restoring native vegetation patterns and enhancing wildlife habitat. Consequently, it is anticipated that there would be no impact to the current condition of these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the vegetation, wildlife, habitat, and special status species of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. Alternative A would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently, there would be no cumulative impacts to vegetation, wildlife, habitat, and special status species of McLennan County under alternative A.

Conclusion. There would be no impact to the vegetation, wildlife, and wildlife habitat; and no effect on special status species within the study area from the actions under alternative A. Correspondingly, there would be no cumulative effect.

Impacts on Visitor Experience

Analysis. Under alternative A, the city of Waco and Baylor University would continue to accommodate visitor access to the Waco Mammoth Site through scheduled public events at the site. It is also assumed that they would continue working through local community efforts to enhance visitor enjoyment and understanding. These efforts would result in ongoing, negligible to minor, beneficial impacts on the visitor experience.

School groups of the central Texas region would benefit from the added although limited opportunity to engage in onsite educational opportunities.

The expectation for the area surrounding the core paleontological site, which is owned by Baylor University, is that it will not be developed for visitor use but simply provide a natural buffer for the protection and preservation of the core paleontological site.

Consequently, there would be no impacts to the visitor experience in this area.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting visitor experience opportunities within the Waco area are described in the. "Impact Topics and Cumulative Effects Scenario" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term beneficial cumulative impacts since a number of projects have greatly enhanced the visitor experience opportunities found within the city. Although alternative A adds a unique component to this mix, it is nonetheless a very small increment due to the limited schedule of visitor access to the site when compared to the vast array of engaging visitor experience opportunities already available within the Waco area.

Conclusion. Alternative A would result in negligible to minor, long-term beneficial impacts to the visitor experience opportunities at the Waco Mammoth Site. The cumulative effect of this alternative on the visitor experience opportunities within the Waco area would be very small.

Impacts on Management and Operations

Analysis. Under this no-action alternative, the management and operations of the Waco Mammoth Site would continue through the partnership efforts of the city of Waco and Baylor University. It is assumed that existing staffing levels would remain the same and programs to recruit and train volunteers would not be initiated. It is also assumed that once the excavation shelter is complete, visitation to the site would be accommodated with existing staff during at least 12 public events scheduled throughout the year. The city of Waco Parks and Recreation Department would acquire additional facility management responsibilities with the new excavation shelter added to their inventory of park structures to operate and maintain. There would be minor, long-term adverse impacts on the city of Waco operations resulting from the need to maintain a new facility.

Baylor University would continue to provide for the curatorial care of the *in situ* specimens at the site and the paleontological collections within their Mayborn Museum Complex. It would also be expected that museum staff would continue to assist in conducting public events at the site. It is anticipated that there would be relatively little change in how they currently manage and operate the site.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting management and operations of the city of Waco and Baylor University's Mayborn Museum are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in minor to moderate, long-term adverse cumulative impacts on the operations of the city of Waco and Baylor University's Mayborn Museum Complex. The contribution of alternative A relative to these cumulative impacts is expected to be a very small increment.

Conclusion. The impacts of alternative A on management and operations would vary depending on the managing entity. There could be minor, long-term, adverse impacts on the city of Waco operations and negligible, long-term, adverse impacts on Baylor University's Mayborn Museum Complex operations. Overall, the cumulative effect of this alternative on the management and operations of the city of Waco and Baylor University's Mayborn Museum complex is very small.

Impacts on Socioeconomic Environment

Analysis. Under this alternative, the city of Waco and Baylor University would accommodate limited visitor access to the Waco Mammoth Site during at least 12 public events scheduled throughout the year. It is expected that this minimal level of visitor

access to the site would not measurably contribute to the range of tourism opportunities or visitor spending within the city.

Communities in the central Texas region would benefit from the added although limited educational outreach programs.

Residents living in the surrounding area may experience increased traffic congestion during scheduled public events at the site. However, impacts would be minimal since access to the site would be by New Steinbeck Bend Road, a local arterial connector road that currently experiences low volume traffic as the surrounding areas are mostly undeveloped.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the socioeconomic environment of the Waco MSA are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term beneficial cumulative impacts on the Waco MSA socioeconomic environment. The incremental effect of alternative A relative to these cumulative impacts would be a very small component when compared to the vast array of other economic activity and community initiatives previously completed or underway.

Conclusion. The impacts of alternative A would be negligible to minor, (intermittent) short-term beneficial on the Waco MSA economic environment resulting from increased visitor spending within the community during those times when public events are scheduled at the site. Impacts to the communities within the central Texas region would be negligible, (intermittent) short-term beneficial impacts resulting from limited educational outreach programs. Impacts would be negligible to minor, (intermittent) short-term adverse to the residents of the surrounding area due to increased traffic congestion generated during times when public events are scheduled at the site. Overall, the cumulative effect of this alternative on the economic environment of the Waco MSA and the communities of the central Texas region would be very small.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B

Partnerships Led by the City of Waco

Impacts on Fundamental Resources of the Waco Mammoth Site

In Situ Specimens and Geologic Context of the Discovery Site

Analysis. Similar to alternative A, the staff at Baylor University's Mayborn Museum Complex would continue to monitor conditions and ensure the *in situ* paleontological resources are stabilized and preserved. What is different under this alternative is that the current moratorium on excavation activities may be lifted to allow for controlled investigations of the site. Technical assistance from the National Park Service would be provided to help guide the stabilization, preservation, and controlled investigation efforts. These changes would enhance resource conditions and promote a greater understanding of the paleontological resource. As this would affect areas with high data potential, these actions would result in moderate, long-term, beneficial impacts.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the *in situ* specimens and the geological context of the discovery site are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts on the *in situ* specimens and geologic context of the discovery site. The contribution of alternative B relative to these cumulative impacts would be an appreciably beneficial component.

Conclusion. Impacts would be moderate, long-term, and beneficial on the *in situ* specimens and geologic context of the discovery site from the actions under alternative B. The cumulative effect of this alternative on the *in situ* specimens and geologic context of the discovery site would be an appreciable benefit.

Paleontological Collections (Museum Collections)

Analysis. Similar to alternative A, the actions under this alternative call for continued storage of the paleontological collections and archives at Baylor University's Mayborn Museum Complex. Paleontological collections, including the archived records of excavation, would continue under adequate temperature, humidity, and security conditions and controls. Access to the collections would continue to be convenient because storage would continue at the Mayborn Museum Complex of Baylor University.

However, under alternative B, technical assistance from the National Park Service could be provided to assist Mayborn Museum staff develop protocols and methodologies for initiating preparation and cataloging of the specimens currently housed in plaster jackets as well as the smaller fragments and soil samples in card board boxes. It is assumed that climate-controlled space could be dedicated for a specimen preparation laboratory within the Mayborn Museum or the preparation lab could be incorporated into the city's proposed environmental education center at the site. This would benefit future researchers as access to prepared specimens would be made possible for the first time. It would also provide a benefit for the public as select fossils could be caste for exhibit purposes. This change would result in a moderate, long-term, beneficial impact on paleontological collections of the Waco Mammoth Site under this alternative.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the Mayborn museum collections and archives are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in minor,

long-term, beneficial cumulative impacts to the Mayborn Museum's central Texas collection as specimen preparation activities could be conducted on fossils found in other areas of the region unconnected with the Waco Mammoth Site. The incremental effect of alternative B relative to these cumulative impacts would be appreciably beneficial.

Conclusion. Impacts would be moderate, long-term, and beneficial on the paleontological collections of the Waco Mammoth Site under alternative B. The cumulative effect of this alternative on the Mayborn Museum's central Texas collection would be an appreciable benefit.

Impacts on Other Resources

Soils including Prime Farmlands

Analysis. Under this alternative, the city envisions additional park development to provide for an environmental education center and connecting trails to the Bosque River to compliment the paleontological features of the site. To accommodate this additional park infrastructure, there would be localized loss of soils and prime farmland within the study area. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5-10%) and that the majority of the site would remain undeveloped and managed as a nature preserve. These changes would result in minor, long-term, adverse impacts to soils and potentially minor, long-term, adverse impacts to prime farmland in the study area.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the soils and prime farmland of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, adverse cumulative impacts on the soils and prime farmland of McLennan County as these changes are readily apparent and occur throughout the county. The incremental effect of alternative B relative to these cumulative impacts would be a very small component.

Conclusion. Impacts would be minor, long-term, and adverse on soils and potentially minor, long-term, and adverse on the prime farmland in the study area. The cumulative effect of this alternative on the soils and prime farmland of McLennan County would be very small.

Floodplains and Wetlands

Analysis. Under this alternative, the city's long-range vision for accommodating water taxi service along the Bosque River and connecting to regional trailways along the Brazos River Corridor would entail a minor level of development on a portion of the study area adjacent to the Bosque River. Features such as a boat dock and trails may be constructed within the floodplain and wetlands areas and would affect relatively small, localized areas of these resources. This would result in negligible to minor, long-term, adverse impacts. The city would be required to consult and coordinate with the Army Corp of Engineers to obtain permits for these activities.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the floodplains and wetlands of the Bosque River watershed within McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, adverse cumulative impacts on the floodplains and wetlands of the Bosque River watershed, as these changes are readily apparent and have occurred throughout the watershed. The incremental effect of alternative B relative to these cumulative impacts would be a very small component.

Conclusion. Impacts from the actions under alternative B would be negligible to minor, long-term, and adverse to the floodplains and potential wetlands found within the study area. The cumulative effect of this alternative

on the floodplains and wetlands of the Bosque River watershed within McLennan County would be very small.

Vegetation, Wildlife, Habitat, and Special Status Species

Analysis. Under this alternative, the city envisions additional park development to provide for an environmental education center and connecting trails to the Bosque River to compliment the paleontological features of the site. There would be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the site to accommodate park development. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5% – 10%) and that the majority of the site would remain undeveloped and managed as a nature preserve.

There could be on-going minor, adverse impacts to vegetation and wildlife from the increase in human activities at the site that may result in the dispersal of wildlife and habitat degradation.

When more detailed site planning is initiated, consultation with US Fish and Wildlife Service and the state of Texas would be needed to assess the potential for impacting special status species.

As part of the environmental education focus of this alternative, resource management plans could be initiated by the city and Baylor University for the undeveloped portions of the site such as conducting inventories to determine the composition of native, non-native, and/or special status species inhabiting the study area; and developing management strategies for restoring native vegetation patterns and enhancing wildlife habitat. This would result in moderate, long-term, beneficial impacts for these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the vegetation, wildlife, habitat, and special status species of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, adverse cumulative impacts as substantial changes to vegetation communities and wildlife habitat over a large area of the county have resulted in a number of extirpated species and the designation of a number of special status species. The incremental effect of alternative B relative to these cumulative impacts would provide a small beneficial offset to the countywide loss of native vegetation and wildlife habitat by providing restoration and enhancement of these resources over a majority of the 109-acre study area.

Conclusion. Impacts would be minor to moderate, long-term, and adverse or beneficial, depending on the particular action being taken under alternative B. There could be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the site to accommodate park development and increased human activity. Moderate, long-term, beneficial impacts are anticipated when resource management strategies are implemented to restore native vegetation and enhance wildlife habitat throughout the study area. The cumulative effect of this alternative on the vegetation, wildlife, habitat, and special status species of McLennan County would provide a small beneficial offset.

Impacts on Visitor Experience

Analysis. Under alternative B, visitor experience opportunities at the Waco Mammoth Site would expand markedly. Instead of the limited operational schedule (12 scheduled events) described under alternative A, visitors to the site would be accommodated on a daily basis.

Under the three action alternatives, the visitor experience would be governed by a tripartite division of labor and responsibility among the city of Waco, Baylor University, and the National Park Service. In particular, under

this alternative, the National Park Service would likely become involved by providing technical assistance in cooperation with the city and university to interpret the core paleontological site to visitors once the Waco Mammoth Site achieves National Natural Landmark status, which would be actively pursued under this alternative. The educational quality of probable exhibits at the core paleontological site and educational outreach programs would be enhanced by NPS input.

It is projected there would be moderate, long-term, beneficial impacts to the communities within the central Texas region and within the scientific community. This would be realized by enhancing onsite access and interpretation of the Waco Mammoth Site, encouraging research activities to help broaden the understanding of what occurred there, and enhancing educational opportunities for local and regional school groups.

For the area surrounding the core paleontological site, which the city of Waco could potentially acquire from Baylor University, the city could pursue ideas involving environmental education and recreation. Visitors would benefit from this expanded range of visitor opportunities.

Change from the no-action alternative under this alternative involves the potential of enhanced and expanded site-interpretation mechanisms, educational outreach programs, and environmental educational and recreational facilities. This would provide on-going benefits to the visitor experience.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting visitor experience opportunities within the Waco area are described in the. "Impact Topics and Cumulative Effects Scenario" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts since a number of projects have greatly enhanced the range of visitor experience opportunities found within the city. Under alternative B, the study area would be available daily to the visiting public and represents an appreciable beneficial increment to the vast array of engaging visitor experience opportunities found in the Waco area.

Conclusion. Under alternative B, the impact to the visitor experience would be moderate, long-term, and beneficial. The cumulative effect of this alternative on the visitor experience opportunities within the Waco area would be an appreciable benefit.

Impacts on Management and Operations

Analysis. Under this alternative, the existing cooperative management arrangement between the city of Waco and Baylor University is expanded with additional partners, with the city assuming the lead responsibility for managing the site as a city park. The city of Waco envisions additional park development to provide for an environmental education center and connecting trails to the Bosque River to compliment the paleontological features of the site. This would result in an expanded range of management responsibilities for the city of Waco Parks Department, requiring increases in staff and park operational funds. Impacts to the city of Waco's operations would be moderate, long-term, and adverse with the need to hire additional staff and allocate additional operational funding for managing a new city park.

Similar to alternative A, Baylor University's Mayborn Museum Complex would continue to provide for the curatorial care of the *in situ* specimens at the site and the paleontological collections within their Mayborn Museum Complex. However, under this alternative the Mayborn Museum staff would take on a more active role for initiating a preparation program for the collected specimen, initiating resource management strategies for the other resources of the site, and developing onsite interpretive and educational programs as well as educational outreach programs. The impacts

on Baylor University's Mayborn Museum Complex operations would be moderate, long-term, and adverse with the need to hire additional staff and allocate additional operational funding to accommodate an expanded range of management responsibilities.

Under this alternative, the National Park Service could provide technical assistance to the city and university in the areas of resource management, interpretation, and educational outreach. This would be accomplished through existing programs and staffing of the service. The impacts to the National Park Service operations would be minor, short-term, and adverse resulting from the need to allocate additional funding to support technical assistance activities and travel costs.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting management and operations of the city of Waco, Baylor University's Mayborn Museum Complex, and the National Park Service are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in minor to moderate, long-term, adverse cumulative impacts on the city of Waco, Baylor's Mayborn Museum Complex, and National Park Service's operations. The contribution of alternative B relative to these cumulative impacts would be a small component.

Conclusion. Under alternative B, impacts on management and operations would vary depending on the managing entity. The impacts to operations at the city of Waco and Baylor University's Mayborn Museum would be moderate, long-term, and adverse. The impacts to the National Park Service's operations would be minor, short-term, and adverse. The cumulative effect of this alternative on the management and operations of the city of Waco, the Mayborn Museum, and the National Park Service would be small.

Impacts on Socioeconomic Environment

Analysis. Under this alternative, the city of Waco and Baylor University would expand visitor access to the Waco Mammoth Site. Instead of the limited operational schedule (12 scheduled events) described under alternative A, the site would be open 7 days a week. Depending on the level of marketing employed to promote the site, the park would have the potential to attract large numbers of long-distance travelers – the types of visitors who patronize hotels, restaurants, and other commercial establishments. This would provide an economic benefit for area businesses. It is projected that the construction phase ($8.1 million) would add $18.8 million to the central Texas region. Staff and operation budgets ($345,000) would have an on-going economic impact of $0.98 million. The economic impact of visitor spending would be $0.68 million. The total economic impact of this alternative would amount to a one-time impact of $20.46 million with a continuing annual impact of $1.66 million to the central Texas region. This would result in a moderate, long-term, beneficial impact on the Waco economic environment resulting from enhanced tourism and increased spending in the area generated by the daily influx of visitors to the site and the addition of new employment opportunities for managing and maintaining a new city park.

Communities in the central Texas region would benefit from enhanced educational outreach programs.

It is expected that this enhanced level of visitor access to the site would noticeably expand the range of tourism opportunities within the city and thereby beneficially impacting local community life.

Residents living in the surrounding area may experience increased traffic congestion on a daily basis. However, impacts would be minimal since access to the site would be by New Steinbeck Bend Road, a local arterial connector road that currently experiences low

volume traffic as the surrounding areas are mostly undeveloped.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the socioeconomic environment of the Waco MSA and central Texas region are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, beneficial cumulative impacts on the Waco MSA socioeconomic environment. The incremental effect of alternative B relative to these cumulative impacts would be a small component when compared to the vast array of other economic activity and community initiatives previously completed or underway.

Conclusion. Under alternative B, there would be moderate, long-term, beneficial impacts on the Waco economic environment and the communities within the central Texas region. There would be minor, long-term, adverse impacts on the residents of adjacent neighborhoods and businesses resulting from increased traffic congestion generated daily along New Steinbeck Bend Road. The cumulative effect of this alternative on the economic environment of the Waco MSA and the communities of the central Texas region would be small.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE C

Partnerships Led by the National Park Service

Impacts on the Fundamental Resources of the Waco Mammoth Site

In Situ Specimens and Geologic Context of the Discovery Site

Analysis. Under alternative C, the National Park Service would assume management responsibilities for geologic context of the discovery site. This would include monitoring the conditions of the *in situ* specimens and perhaps exploring other areas within the excavation shelter to acquire additional information about the circumstances of the site. These changes would enhance resource conditions and promote a greater understanding of the paleontological resource. As this would affect areas with high data potential, these actions would result in moderate, long-term, beneficial impacts.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the *in situ* specimens and the geological context of the discovery site are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts to the *in situ* specimens and geologic context of the discovery site. The contribution of alternative C relative to these cumulative impacts would be appreciably beneficial.

Conclusion. Under alternative C, impacts would be moderate, long-term beneficial to the *in situ* specimens and geologic context of the discovery site. The cumulative effect of this alternative on the *in situ* specimens and geologic context of the discovery site would provide an appreciable benefit.

Paleontological Collections (Museum Collections)

Analysis. Under this alternative, the paleontological collections management would be divided between the National Park Service and Baylor University with the initiation of a program of specimen preparation and cataloging called for, as in alternative B, but with the National Park Service taking the lead. It is assumed that a specimen preparation laboratory could be incorporated into the city's proposed environmental education center at the site with the National Park Service operating the lab. The collection would continue to be housed within Baylor University's Mayborn Museum Complex, except that select portions of the collection may be housed on site within the education center for the purposes of exhibiting prepared specimens and/or exhibiting the specimen preparation process to the public. Research reports, documentation of the site and excavation activities would be maintained onsite by the National Park Service. Similar to alternative B, this would benefit future researchers, as access to prepared specimens would be made possible for the first time. It would also provide a benefit for the public, as select fossils could be cast for exhibit purposes. However, under this alternative, it would provide an added benefit of integrating the specimen preparation activities into the interpretive experience at the site. These changes would result in a moderate, long-term, beneficial impact on paleontological collections of the Waco Mammoth Site under this alternative.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the Mayborn Museum's museum collections are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major,

long-term, beneficial cumulative impacts on the Mayborn Museum's central Texas museum collections. The incremental effect of alternative C relative to these cumulative impacts would be appreciably beneficial.

The effects of other past, present, and foreseeable future actions affecting the museum collections of the National Park Service's Intermountain Region are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, beneficial cumulative impacts on the museum collections of the National Park Service's Intermountain Region. Alternative C would expand the NPS collection although it deviates from the trend to centralize museum collections in the NPS Intermountain Region. The intent of this alternative is to keep the entire paleontological collection intact and in close association with the discovery site. The incremental effect of alternative C to these cumulative impacts would be a very small component.

Conclusion. Under alternative C, impacts would be moderate, long-term, and beneficial on the paleontological collections of the Waco Mammoth Site. The cumulative effect of this alternative on the Mayborn Museum's central Texas collection would be an appreciable benefit. The cumulative effect of this alternative on the museum collections of the National Park Service's Intermountain Region would be very small.

Impacts on Other Resources

Soils including Prime Farmlands

Analysis. Under this alternative, the city envisions additional park development to provide for an environmental education center and connecting trails to the Bosque River to compliment the paleontological features of the site. It is assumed under this alternative that space for NPS management staff would also be accommodated in the center. To accommodate additional park infrastructure, some localized loss of soil is anticipated, resulting in potentially minor, long-term adverse impacts to soils and potentially minor, long-term adverse impacts to some of the prime farmland contained within the study area. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5-10%) and that the majority of the site would remain undeveloped and managed as a nature preserve.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the soils and prime farmland of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, adverse cumulative impacts on the soils and prime farmland of McLennan County as these changes are readily apparent and occur throughout the county. The incremental effect of alternative C relative to these cumulative impacts would be a very small component.

Conclusion. Under alternative C, impacts would be minor, long-term, and adverse on soils and potentially minor, long-term, and adverse on the prime farmland in the study area. The cumulative effect of this alternative on the soils and prime farmland of McLennan County would be very small.

Floodplains and Wetland

Analysis. Under alternative C, there are no federal actions contemplated that would affect floodplains or wetlands. However, the city's long-range vision for accommodating water taxi service along the Bosque River and connecting to regional trailways along the Brazos River Corridor would entail a minor level of development on a portion of the study area that fronts the Bosque River. Features such as a boat dock and trails may be constructed within the floodplain and wetlands areas and would adversely impact relatively small, localized areas of these resources. This would result in negligible to minor, long-term, adverse impacts. The city

would be required to consult and coordinate with the Army Corp of Engineers to obtain permits for these activities.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the floodplains and wetlands of the Bosque River watershed within McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, adverse cumulative impacts as these changes are readily apparent and have occurred throughout watershed. The incremental effect of alternative C relative to these cumulative impacts would be a very small component.

Conclusion. Impacts from the actions under alternative C would be negligible to minor, long-term, and adverse to the floodplains and potential wetlands found within the study area. The cumulative effect of this alternative on the floodplains and wetlands of the Bosque River watershed within McLennan County would be very small.

Vegetation, Wildlife, Habitat, and Special Status Species

Analysis Under this alternative, the city envisions additional park development to provide for an environmental education center and connecting trails to the Bosque River to compliment the paleontological features of the site. There would be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the site to accommodate park development. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5-10%) and that the majority of the site would remain undeveloped and managed as a nature preserve.

There also could be on-going minor, adverse impacts on vegetation and wildlife from the increase in human activities at the site that may result in the dispersal of wildlife and the degradation of habitat.

When more detailed site planning is initiated, consultation with US Fish and Wildlife Service and the state of Texas would be needed to assess the potential for impacting special status species.

As part of the environmental education focus of this alternative, it is anticipated that resource management plans could be initiated by the city, Baylor University, and the National Park Service for the undeveloped portions of the site such as conducting inventories to determine the composition of native, non-native, and/or special status species inhabiting the study area; and developing management strategies for restoring native vegetation patterns and enhancing wildlife habitat. This would result in moderate, long-term, beneficial impacts for these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the vegetation, wildlife, habitat, and special status species of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, adverse cumulative impacts as substantial changes to vegetation communities and wildlife habitat over a large area of the county have resulted in a number of extirpated species and the designation of a number of special status species. The incremental effect of alternative C relative to these cumulative impacts would provide a small beneficial offset to the countywide loss of native vegetation and wildlife habitat by providing restoration and enhancement of these resources over a majority of the 109-acre study area.

Conclusion. Impacts would be minor to moderate, long-term, and adverse or beneficial, depending on the particular action

being taken under alternative C. There could be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the study area to accommodate park development and increased human activity. Moderate, long-term, beneficial impacts are anticipated when resource management strategies are implemented to restore native vegetation and enhance wildlife habitat throughout the study area. The cumulative effect of this alternative on the vegetation, wildlife, habitat, and special status species of McLennan County would provide a small beneficial offset.

Impacts on Visitor Experience

Analysis. Similar to alternative B, under alternative C the visitor experience opportunities at the Waco Mammoth Site would expand markedly. Instead of the limited operational schedule (12 scheduled events) described under alternative A, visitors to the site would be accommodated on a daily basis.

Under this alternative, the tripartite division of labor and responsibility for interpretation among the city of Waco, Baylor University, and the National Park Service, would mean that the National Park Service would take the lead interpreting the core paleontological site to visitors. It would own and control that portion of the study area, which would likely mean NPS designed interpretative exhibits at the core paleontological site; NPS designed interpretive and educational outreach programs and media, and trained NPS personnel to speak with visitors.

It is projected there would be moderate, long-term, beneficial impacts to the communities within the central Texas region and within the scientific community. This would be realized by enhancing onsite access and interpretation of the Waco Mammoth Site, encouraging research activities to help broaden the understanding of what occurred there, and enhancing educational opportunities for local and regional school groups.

For the area surrounding the core paleontological site, the National Park Service would look to partners to help initiate additional visitor experience opportunities there. Under the city of Waco's management lead, they would have the freedom to pursue ideas involving environmental education and recreation. Visitors would benefit from this expanded range of visitor opportunities. Change from the no-action alternative under this alternative involves the potential of increased interpretation mechanisms, educational outreach programs, and environmental educational and recreational facilities. This would provide on-going benefits to the visitor experience.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting visitor experience opportunities within the Waco area are described in the. "Impact Topics and Cumulative Effects Scenario" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts since a number of projects have greatly enhanced the range of visitor experience opportunities found within the city. Alternative C adds a unique component to this mix, available daily to the visiting public and represents a noticeable increment to the vast array of engaging visitor experience opportunities found in the Waco area.

Conclusion. Under alternative C, the impact to the visitor experience would be moderate, long-term, and beneficial. The cumulative effect of this alternative on the visitor experience opportunities within the Waco area would be an appreciable benefit.

Impacts on Management and Operations

Analysis. Under this alternative, the Waco Mammoth Site would be managed as a new unit of the national park system, in partnership with the city of Waco, Baylor University, and others.

The National Park Service would take the lead responsibility for ensuring the protection, scientific study, and visitor enjoyment of paleontological resources, enlisting the help of partners to accomplish this mission. Impacts to the National Park Service's operations would be moderate, long-term, and adverse resulting from the expanded range of management responsibilities for the National Park Service requiring congressional allocation of park funding and the assignment of additional National Park Service personnel to manage a new unit of the national park system.

The city of Waco would take the lead for initiating additional recreational, interpretive, and environmental educational opportunities on the site. This would result in an expanded range of management responsibilities for the city of Waco Parks and Recreation Department. The impacts on the city of Waco operations would be moderate, long-term, and adverse with the need to hire additional staff and allocate additional operational funding for managing new park facilities.

Similar to alternative A, Baylor University would continue to accommodate the curatorial storage of the paleontological collections within their Mayborn Museum Complex. However, under this alternative, management of the fundamental resources would be transferred to the National Park Service. Baylor University primary role under this alternative would be to collaborate with the National Park Service and the city of Waco for expanding the interpretive and educational programs highlighting the special resource. The impacts on Baylor University's Mayborn Museum Complex operations would be negligible to minor, long-term, and adverse with the transfer of their management responsibility for the fundamental resources to the National Park Service. It is anticipated that there would be a minimal change from their current investment in operations and management support for the resource as the emphasis of their effort is redirected into interpretive and educational programs.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting management and operations of the city of Waco, Baylor University's Mayborn Museum Complex, and the National Park Service are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in minor to moderate, long-term, adverse cumulative impacts on the city of Waco; Baylor University's Mayborn Museum Complex; and National Park Service's operations. The contribution of alternative C relative to these cumulative impacts would be a small component.

Conclusion. Under alternative C, impacts would range from negligible to moderately adverse and would vary depending on the managing entity. The impacts on the city of Waco's operations would be moderate, long-term, and adverse. The impacts on Baylor University's Mayborn Museum Complex operations would be negligible to minor, long-term, and adverse. The impacts to the National Park Service's operations would be moderate, long-term, and adverse. The cumulative effect of this alternative on the management and operations of the city of Waco, the Mayborn Museum, and the National Park Service would be relatively small.

Impacts on Socioeconomic Environment

Analysis. Similar to alternative B, under alternative C visitor access to the Waco Mammoth Site would be expanded. Instead of the limited operational schedule (12 scheduled events) described under alternative A, the site would be open 7 days a week. Depending on the level of marketing employed to promote the site, the park would have the potential to attract large numbers of long-distance travelers—the types of visitors who patronize hotels, restaurants, and other commercial establishments. Designation as a new unit of the national park system would enhance awareness of the site and could

potentially attract visitors from outside of the state. This would provide an economic benefit for area businesses. It is projected that the construction phase ($8.7 million) would add $20.23 million to the central Texas region. Staff and operation budgets ($645,000) would have an on-going economic impact of $1.82 million. The economic impact of visitor spending would be $0.68 million. The total economic impact of this alternative would amount to a one-time impact of $22.73 million with a continuing annual impact of $2.5 million to the central Texas region. This would result in a moderate, long-term, beneficial impact on the Waco economic environment resulting from enhanced tourism and increased spending in the area generated by the daily influx of visitors to the site and the addition of new employment opportunities for managing and maintaining a new park.

It is expected that this enhanced level of visitor access to the site would noticeably expand the range of tourism opportunities within the city and thereby beneficially impact local community life.

There would be additional long-term, beneficial impacts resulting from the intangible value of collective community pride for the citizens of Waco who have supported the notion of establishing the Waco Mammoth Site as a new unit of the national park system for the entire Nation to enjoy.

Residents living in the surrounding area may experience increased traffic congestion on a daily basis. However, impacts would be minimal since access to the site would be by New Steinbeck Bend Road, a local arterial connector road that currently experiences low volume traffic as the surrounding areas are mostly undeveloped.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the socioeconomic environment of the Waco MSA and central Texas region are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, beneficial cumulative impacts on the Waco MSA socioeconomic environment and minor, long-term, beneficial cumulative impacts on the central Texas region. The incremental effect of alternative C relative to these cumulative impacts would be a small component when compared to the vast array of other economic activity and community initiatives previously completed or underway.

Conclusion. Under alternative C, there would be moderate, long-term, beneficial impacts on the Waco economic environment and the communities within the central Texas region and within the scientific community. There would be minor, long-term, adverse impacts on the residents of adjacent neighborhoods and businesses resulting from increased traffic congestion generated daily along New Steinbeck Bend Road. The cumulative effect of this alternative on the economic environment of the Waco MSA and the communities of the central Texas region would be small.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE D

Managed as a Focused Unit of the National Park System

Impacts on the Fundamental Resources of the Waco Mammoth Site

In Situ Specimens and Geologic Context of the Discovery Site

Analysis. Under this alternative, management of the entire study area would be transferred to the National Park Service. This would include monitoring the conditions of the *in situ* specimens and perhaps exploring other areas within the excavation shelter to acquire additional information about the circumstances of the site. These changes would enhance resource conditions and promote a greater understanding of the paleontological resource. As this would affect areas with high data potential, these actions would result in moderate, long-term, beneficial impacts.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the *in situ* specimens and the geological context of the discovery site are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts to the *in situ* specimens and geologic context of the discovery site. The contribution of alternative D relative to these cumulative impacts would be appreciably beneficial.

Conclusion. Under alternative D, impacts would be moderate, long-term, and beneficial to the *in situ* specimens and geologic context of the discovery site. The cumulative effect of this alternative on the *in situ* specimens and geologic context of the discovery site would provide an appreciable benefit.

Paleontological Collections (Museum Collections)

Analysis. Under this alternative, management of the entire paleontological collections and archives would be transferred to the National Park Service. The storage of collected specimens and archives would continue to be housed within Baylor University's Mayborn Museum Complex, until the collection could be accommodated in a new collection storage facility with a specimen preparation laboratory provided onsite. The National Park Service would develop protocols and methodologies for initiating preparation and cataloging of the specimens currently housed in plaster jackets and the smaller fragments and soil samples in cardboard boxes. This would benefit future researchers as access to prepared specimens would be made possible for the first time. It would also benefit the public as select fossils could be caste for exhibit purposes and specimen preparation activities could be integrated into the interpretive experience at the site. These changes would result in a moderate, long-term, beneficial impact on paleontological collections of the Waco Mammoth Site under this alternative.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the Mayborn Museum's museum collections are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts for the Mayborn Museum's central Texas collection. The incremental effect of alternative D would contribute a very noticeable benefit to the Mayborn Museum collections as the transfer of the Waco Mammoth Site collections to an onsite facility operated by the National Park Service would free up significant collections space within the geology/paleontological collections storage room of the Mayborn Museum.

The effects of other past, present, and foreseeable future actions affecting the museum collections of the National Park

Service's Intermountain Region are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, beneficial cumulative impacts on the museum collections of the National Park Service's Intermountain Region. Alternative D would expand the NPS collection although it deviates from the trend to centralize museum collections in the NPS Intermountain Region. The intent of this alternative is to keep the entire paleontological collection intact and in close association with the discovery site. The incremental effect of alternative D to these cumulative impacts would be a very small component.

Conclusion. Under alternative D, impacts would be moderate, long-term, and beneficial on the paleontological collections of the Waco Mammoth Site. The cumulative effect of this alternative on the Mayborn Museum's central Texas collection would be an appreciable benefit. The cumulative effect of this alternative on the museum collections of the National Park Service's Intermountain Region would be very small.

Impacts on Other Resources

Soils including Prime Farmlands

Analysis. Under this alternative, it is anticipated that a minimum level of additional onsite development would be required to allow the National Park Service to effectively manage for resource protection and visitor enjoyment such as space to accommodate enhanced interpretive and educational programs, staff offices, maintenance support, paleontological collections storage, and specimen preparation. To accommodate additional park infrastructure, some localized loss of soil is anticipated, resulting in potentially minor, long-term, adverse impacts to soils and potentially minor, long-term, adverse impacts to some of the prime farmland contained within the study area. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5%) and that the majority of the site would remain undeveloped and managed as a nature preserve.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the soils and prime farmland of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, adverse cumulative impacts on the soils and prime farmland of McLennan County as these changes are readily apparent and occur throughout the county. The incremental effect of alternative D to these cumulative impacts would be a very small component.

Conclusion. Under alternative D, impacts would be minor, long-term, and adverse on soils, and potentially minor, long-term, and adverse on the prime farmland in the study area. The cumulative effect of this alternative on the soils and prime farmland of McLennan County would be very small.

Floodplains and Wetlands

Analysis Under alternative D, there are no federal actions contemplated that would affect the floodplains or potential wetland areas along the Bosque River section within the study area. Consequently, there would be no impacts to the current condition of these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the floodplains and wetlands of the Bosque River watershed are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. Alternative D would have no impacts on these resources and therefore would not contribute to the effects of these other actions. Consequently, there would be no cumulative impacts to floodplains and wetlands of the Bosque River

watershed within McLennan County under alternative this alternative.

Conclusion. There would be no impact to the floodplains and potential wetlands found within the study area from the actions under this alternative. Correspondingly, there would be no cumulative effect.

Vegetation, Wildlife, Habitat, and Special Status Species

Analysis. The National Park Service would require a minimum level of additional onsite development to effectively manage for resource protection and visitor enjoyment. There would be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the site to accommodate park development. It is anticipated that these changes would occur over a relatively small percentage of the study area (less than 5%) and that the majority of the site would remain undeveloped and managed as a nature preserve.

As development plans are prepared, consultation with US Fish and Wildlife Service and the state of Texas would be needed to assess the potential for impacting special status species.

It is also anticipated that the National Park Service would initiate resource management activities for the undeveloped portions of the site such as conducting resource inventories to determine the composition of native, nonnative, and/or special status species inhabiting the study area; and developing management strategies for restoring native vegetation patterns and enhancing wildlife habitat. This would result in moderate, long-term, beneficial impacts for these resources.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the vegetation, wildlife, habitat, and special status species of McLennan County are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, adverse cumulative impacts as substantial changes to vegetation communities and wildlife habitat over a large area of the county have resulted in a number of extirpated species and the designation of a number of special status species. The incremental effect of alternative D relative to these cumulative impacts could potentially provide a relatively small beneficial offset to the countywide loss of native vegetation and wildlife habitat by providing restoration and enhancement of these resources over a majority of the 109-acre study area.

Conclusion. Impacts would be minor to moderate, long-term, and adverse or beneficial, depending on the particular action being taken under this alternative. There would be minor, long-term, adverse impacts on vegetation, wildlife, and wildlife habitat over a localized area of the study area to accommodate park development. Moderate, long-term, beneficial impacts are anticipated when resource management strategies are implemented to restore native vegetation and enhance wildlife habitat throughout the study area. The cumulative effect of this alternative on the vegetation, wildlife, habitat, and special status species of McLennan County would be a small beneficial offset.

Impacts on Visitor Experience

Analysis. Similar to alternative B, visitor experience opportunities at the Waco Mammoth Site would expand markedly. Instead of the limited operational schedule (12 scheduled events) described under alternative A, visitors to the site would be accommodated on a daily basis.

Under this alternative, the tripartite division of labor and responsibility for interpretation among the city of Waco, Baylor University, and the National Park Service, would mean that the National Park Service would take the lead for visitor understanding and enjoyment. This would likely mean NPS designed interpretative exhibits and interpretive and

educational outreach programs and media, and trained NPS personnel to interact with visitors. Additional opportunities for visitors to observe the work of paleontologists and technicians within the specimen preparation laboratory could be provided. Such readily apparent visitor access would emphasize the core values of the paleontological resources at the site and enable visitors to realize, appreciate, and enjoy new interpretative mechanisms.

School groups of the central Texas region would benefit from the opportunity to engage in onsite educational opportunities.

Under this alternative, visitor experience opportunities within the surrounding lands would not be accommodated, as this area would be managed as a natural buffer for the protection and preservation of the core paleontological site. Consequently, there would be no impacts to the visitor experience in this area.

Change from the no-action alternative under this alternative involves the potential of increased interpretation mechanisms, educational outreach programs, and environmental educational and recreational facilities. This would provide on-going benefits to the visitor experience.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting visitor experience opportunities within the Waco area are described in the. "Impact Topics and Cumulative Effects Scenario" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in major, long-term, beneficial cumulative impacts to the overall visitor experience opportunities found within the Waco area. Alternative D adds unique component to the mix, available daily to the visiting public and represents a noticeable increment to an already vast array of engaging visitor experience opportunities found in the Waco area.

Conclusion. Under alternative D, the impact to the visitor experience would be moderate, long-term, and beneficial. The cumulative effect of this alternative on the visitor experience opportunities within the Waco area would be an appreciable benefit.

Impacts on Management and Operations

Analysis. Under this alternative, the Waco Mammoth Site would be managed as a new unit of the national park system, with the entire paleontological resource (*in situ* fossils and the collection of fossils currently housed at Baylor University) managed onsite by the National Park Service. The National Park Service would focus on a core mission of protection, scientific study, and interpretation of the fundamental paleontological resources. Impacts to the National Park Service's operations would be moderate, long-term, and adverse resulting from the expanded range of management responsibilities for the National Park Service requiring congressional allocation of park funding and the assignment of additional National Park Service personnel to manage a new unit of the national park system.

The city of Waco would transfer ownership of their land to the federal government as well as the primary responsibilities for managing and operating the Waco Mammoth Site to the National Park Service. This would reduce the need to dedicate staff and funding to operate and maintain the excavation pavilion. The city would still retain an affiliation with the site by participating in a collaborative effort with the National Park Service for developing interpretive and educational outreach programs on the special resource. It is assumed that city services such as fire, police, and emergency medical response would still be provided for the site.

Baylor University would transfer the ownership of the paleontological collection to the National Park Service, and when a collection storage facility is constructed on

site, the collection would be moved into this new facility. This change in management responsibilities would free up space in the Mayborn Museum collection room and reduce the need to dedicate museum staff for the curatorial care of the paleontological collection. Similar to the city's wishes to still retain some form of affiliation with the site, Baylor University would participate in a collaborative effort with the National Park Service for developing interpretive and educational outreach programs on the special resource.

The impacts to the operations of the city of Waco and Baylor University's Mayborn Museum Complex would be moderate, long-term, and beneficial with the transfer of management responsibilities to the National Park Service. This would free up the staff and operational expenses previously dedicated to the Waco Mammoth Site for other needs within each of their respective organizations.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting management and operations of the city of Waco, Baylor University's Mayborn Museum Complex, and the National Park Service are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in minor, long-term, adverse cumulative impacts on the city of Waco; Baylor's Mayborn Museum Complex; and National Park Service operations. The contributions of alternative D relative to the cumulative impacts on the city of Waco and Baylor University's Mayborn Museum Complex would provide a modest beneficial offset to the cumulative effects on their operations by reducing their overall management responsibilities at the Waco Mammoth Site. The contributions of alternative D relative to the cumulative impacts on the National Park Service would add a small increment.

Conclusion. Impacts would vary depending on the management entity. The impacts to the city of Waco's and Baylor University's Mayborn Museum Complex would be moderate, long-term, and beneficial while the impacts to the National Park Service operations would be moderate, long-term, and adverse. The cumulative effect of this alternative on the management and operations of the city of Waco and the Mayborn Museum would provide a small beneficial offset. The cumulative effect of this alternative on the National Park Service would be small.

Impacts on Socioeconomic Environment

Analysis. Similar to alternative B, under alternative D visitor access to the Waco Mammoth Site would be expanded. Instead of the limited operational schedule (12 scheduled events) described under alternative A, the site would be open 7 days a week. Depending on the level of marketing employed to promote the site, the park would have the potential to attract large numbers of long-distance travelers – the types of visitors who patronize hotels, restaurants, and other commercial establishments. As a new unit of the national park system, this would enhance nationwide awareness of the site and potentially attract visitors from outside of the state. This would provide and economic benefit for area businesses. It is projected that the construction phase ($2.6 million) would add $6.05 million to the central Texas region. Staff and operation budgets ($768,500) would have an on-going economic impact of $2.17 million. The economic impact of visitor spending would be $0.68 million. The total economic impact of this alternative would amount to a one-time impact of $8.9 million with a continuing annual impact of $2.85 million to the central Texas region. This would result in a moderate, long-term, beneficial impact on the Waco economic environment resulting from enhanced tourism and increased spending in the area generated by the daily influx of visitors to the site and the addition of new employment opportunities for managing and maintaining a new city park.

Communities in the central Texas region would benefit from enhanced educational outreach programs.

It is expected that this enhanced level of visitor access to the site would noticeably expand the range of tourism opportunities within the city and thereby beneficially impact local community life.

There would be additional long-term, beneficial impacts resulting from the intangible value of collective community pride for the citizens of Waco who have supported the notion of establishing the Waco Mammoth Site as a new unit of the national park system for the entire Nation to enjoy.

Residents living in the surrounding area may experience increased traffic congestion on a daily basis. However, impacts would be minimal since access to the site would be by New Steinbeck Bend Road, a local arterial connector road that currently experiences low volume traffic as the surrounding areas are mostly undeveloped.

Cumulative Effect. The effects of other past, present, and foreseeable future actions affecting the socioeconomic environment of the Waco MSA and central Texas region are described in the "Impact Topics and Cumulative Effects Scenarios" section of this chapter. The impact of these other actions in combination with the actions under this alternative would result in moderate, long-term, beneficial cumulative impacts on the Waco MSA socioeconomic environment. The incremental effect of alternative D to these cumulative impacts would be a small component when compared to the vast array of other economic activity and community initiatives previously completed or underway.

Conclusion. Under alternative D, there would be moderate, long-term, beneficial impacts on the Waco economic environment and communities within the central Texas region. There would be minor, long-term, adverse impacts on the residents of adjacent neighborhoods and businesses resulting from increased traffic congestion generated daily along New Steinbeck Bend Road. The cumulative effect of this alternative on the economic environment of the Waco MSA and the communities of the central Texas region would be small.

Chapter Seven: Public Involvement, Consultation, and Coordination

CHAPTER OVERVIEW

Solicitation of public comment on Special Resource Studies is required by NPS policy. More importantly however, public input helps the National Park Service shape and improve its preliminary ideas to better meet the mission of the Park Service, the goals of NEPA, and the interests of the American public.

This chapter describes the public involvement program employed during this project and documents the role public participation played in identifying and refining the management alternatives included in this report.

AGENCY AND PUBLIC SCOPING ACTIVITIES

Internal scoping with representatives of the city of Waco and Baylor University was conducted during July 19 –20, 2005. The primary objective was to meet with current landowners and principal players who have been actively involved in the protection and preservation of the site. This enabled the study team to gain a better understanding of site conditions, history of excavations activities, stakeholders, issues, and informational sources. Additional topics of discussions included reviewing the SRS process, the study schedule, and strategies for public involvement.

A web page was established on the National Park Service Planning, Environment, and Public Comment (PEPC) website that introduced the special resource study initiative, including information on the study process and schedule, and invited members of the public to participate in the process.

The team prepared handout materials for initial agency and public contacts including a brochure with a mail back card for listing contact information for the purpose of engaging interested members of the public.

Lyndon B. Johnson National Historical Park is the nearest NPS unit to the study area and they have graciously provided logistical support to the special resource study team as well as preparing the initial mailing list for the study.

On October 14, 2005, Congressman Chet Edwards conducted a press conference announcing the start of the special resource study; Texas State Coordinator and former Superintendent of Lyndon B. Johnson Historical Park David Vela represented the National Park Service.

On October 18, 2005, Lyndon B. Johnson Historical Park issued a press release announcing the start of the study.

On October 25, 2005, the study team met with representatives of the Texas Historical Commission, (the umbrella agency for the State Historic Preservation Office). Attending the meeting included Mark H. Denton, Director, State & Federal Review Section, Archeology Division, Dr. James Bruseth, Director, Archeology Division, and Dr. Ernest Lundelius, Professor Emeritus, University of Texas at Austin. Mr. Denton noted that an archeological investigation was previously conducted within the excavation area of the site. The archeologist did not find any signs of human interaction with the mammoth herd. The State Historic Preservation Officer is supportive of the study and the possibility of the site becoming a unit of the national park system; however, with this general level of

planning, the state does not see a need to enter into 106 consultations concerning the special resource study. They would prefer to revisit the 106 consultation during future undertakings such as additional archeological surveys at the site or during implementation activities for park development.

On October 27, 2005, Baylor University hosted a series of four public and agency scoping meetings throughout the day, providing a forum for the NPS study team to meet with the original donors, local government managers, affiliated groups, agencies, the general public, and local community leaders. It also provided the opportunity for public discussion of their visions and concerns for the resource, as well as providing the study team an opportunity to provide an overview of the study process and schedule.

October 27, 2005 public meeting in Baylor University Mayborn Museum Complex's SBC Auditorium.

The evening program almost filled Baylor University's SBC auditorium (200 seat capacity). The meetings were covered by the local newspaper and television stations. Contact cards were distributed to attendees at each session to help grow the mailing list. A total of 171 cards were collected that day.

A newsletter introducing the study process, schedule, as well as a summary of the issues identified by the public during the October public scoping meetings was distributed in March 2006. We received 48 responses from individuals providing comments. An additional 46 individuals requested to be included on the mailing list.

Common threads of concern focused on the following primary themes: provide visitor access to the site, utilize the research and educational potential of the site, and balance resource protection with these activities. A summary of the public input collected is more fully described under chapter four.

During the preparation of this plan, NPS staff coordinated informally with the U.S. Fish and Wildlife Service's Austin, Texas, field office. The U.S. Fish and Wildlife Service responded in December 2005 with a list of threatened and endangered species for McLennan County. The Texas Department of Parks and Wildlife (TPW) forwarded a list of state candidate, proposed, and listed threatened and endangered species for McLennan County in February 2006.

On April 11 –12, 2006, the study team met with representatives of Baylor University and the city of Waco to discuss the city's progress with the Save America's Treasures initiative, provide an update on the study team's progress with significance, suitability, and feasibility, review fundamental purpose framework of NPS units, develop "working" purpose statement for the Waco Mammoth Site, discuss the current Waco/Baylor management agreement, explore potential roles in management alternatives, and to provide a briefing of the study purpose and progress for a fundraising luncheon hosted by the city for the purpose of generating additional donations to match the Save America's Treasures grant from the National Park Service.

On December 7, 2006, an interim report detailing the resource evaluation and study team's initial findings for the significance, suitability, and feasibility of the Waco Mammoth Site was submitted to NPS leadership for consideration and review. A number of internal meetings and presentations were conducted between the study team

and NPS colleagues, which culminated in an approval from NPS leadership to proceed with the evaluation of the fourth criteria, which considers management options.

Drawing from the body of stakeholder and public input, the study team developed a range of management alternatives and tested their viability with current managers of the resource within the city of Waco and Baylor University and then NPS leadership. Differences among alternatives related primarily as to who would manage the area and the approach or method to which the site's purpose would be achieved. Four potential management alternatives evolved and were outlined in a newsletter that was distributed for public review and comment during September through October 2007.

A written invitation to participate in the special resource study along with copies of the scoping summary and preliminary alternatives newsletters were sent October 4, 2007, to Mr. Gary McAdams, president of the Wichita and Affiliated Tribes in Oklahoma, of which the Waco Tribe is one of the affiliated tribes. The letter was seeking to inquire if he or other members of the tribal government would like to consult about the special resource study for the Waco Mammoth Site and any possible traditional uses associated with the site. There has been no response to date.

Meetings with representatives of the city of Waco, Baylor University, and the Waco Mammoth Foundation were conducted on September 19, 2007, to discuss the management options under consideration by the National Park Service. Baylor University scheduled a media event at the Waco Mammoth Site to encourage a broader coverage of the special resource study, community initiatives for protecting the site, and to encourage public participation in the study.

Over 90 written responses were received by mail and via the NPS planning website. Almost all of the public comments indicated that the alternatives presented in the newsletter represented a reasonable range of options to further develop and analyze in the special resource study. A majority of the public responses expressed support for expanding the existing partnership between Baylor University and the city of Waco to include the National Park Service so that the strength of each organization can focus on the stewardship of this special resource.

The current mailing list includes over 400 names, consisting of members of governmental agencies, organizations, businesses, legislators, local governments, and interested citizens.

Appendixes, Selected References, Preparers and Participants

APPENDIX A: PUBLIC LAW 107-341

An Act to direct the Secretary of the Interior to study the suitability and feasibility of designating the Waco Mammoth Site Area in Waco, Texas, as a unit of the National Park System, and for other purposes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Section 1. Study and Report Regarding Waco Mammoth Site Area.

(a) Study.--The Secretary of the Interior, in consultation with the State of Texas, the city of Waco, and other appropriate organizations, shall carry out a special resource study regarding the national significance, suitability, and feasibility of designating the Waco Mammoth Site Area located in the city of Waco, Texas, as a unit of the National Park System.

(b) Study Process and Completion.--Section 8(c) of Public Law 91-383 (16 U.S.C. 1a-5(c)) shall apply to the conduct and completion of the study required by this section.

Sec. 2. Submission of Study Results.

Not later than 3 years after funds are first made available for this Act, the Secretary shall submit to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report describing the results of the study.

Approved December 16, 2002

Legislative History--H.R. 1925:

House Reports: No. 107-317 (Comm. on Resources).
Senate Reports: No. 107-264 (Comm. on Energy and Natural Resources).
Congressional Record, Vol. 148 (2002):
May 14, considered and passed House.
November 19, considered and passed Senate.

APPENDIX B: COLLECTION AND ARCHIVE ASSESSMENT OF THE WACO MAMMOTH SITE

Compiled on February 22, 2006 by Greg McDonald with the help of Anita Benedict & John Bongino

Collected Specimens

93 plaster field jackets with specimens

Currently many jackets occupy 18 4'x8' shelves on open shelving. Others are on pallets with multiple jackets on some pallets.

Estimates of preparation time:

12 jackets would require a year =	144 months
30 jackets would require 3 months =	90 months
51 jackets would require .5 months =	26 months

Total preparation time 260 months = approximately 22 years

Note: Based on field photos the bone tends to be highly fragmented and reassembly and gluing of pieces could add to estimated time for preparation. Preparation protocols also need to be established to ensure that potential information such as dermestid beetle marks and bone weathering are not lost during the preparation process.

Boxes of Mammoth Bones

- 137 total, average size 18"x13"x10"
- 11 of the boxes contain soil samples and not bone
- 20 boxes of bones have been unpacked and sorted but bones have not been reassembled

Approximately 30 to 40% of the boxes contain bones washed out from skeletons during 1978, 1981, 1984, and 1986. The museum is sorting these specimens and trying to associate them with specific skeletons. At this time specimens are not being reassembled but are bagged together. The time required for the reassembly of these bones cannot be calculated and has not been included in the estimate of required preparation time for the assemblage.

The museum is going through all boxes and placing all bones from the same individual together in the same drawer.

The museum has purchased 10 Delta Design Cabinets Model DDLX with dimensions of 58" wide, 79 "high and 32 "deep to house mammoth bones. Each cabinet will hold approximately 10 drawers with bones.

Currently the sorted and cleaned bone removed from boxes and stored in bags occupies 20 drawers in the Delta cabinets.

Staff at the Mayborn Museum is sorting through all specimens and re-associating all bones from each individual skeleton together. This will eventually allow a better assessment of space needs. Not all skeletal elements of each individual mammoth can be stored together as

skulls, jaws, major limb bones and pelvis will need to be stored on open shelving while vertebrate, ribs, and hand and foot bones will best be stored in the cabinets.

During the examination of the collection a small box with a lower third molar of a small antiliocaprid probably Capromeryx was found, thus increasing the diversity of animals known from the site. All non-mammoth bones will be stored together in one drawer.

Archives

Black 3 ring binder I
- 150 35 mm slides
- 9 5x7 color prints
- 2 8x10 black and white prints
- 109 5x7 color prints and their negatives
- 169 4x6 black and white prints

Black 3 ring binder II
- 16 slides
- 344 5x7 black and white prints plus negatives

Black 3 ring binder III
- 66 5x7 color prints plus negatives
- 23 5x7 black and white prints
- 16 3x5 color prints
- 40 5x7 black and white prints
- 48 4x6 color prints
- 31 black and white contact sheets plus negatives

Brown Binder
- 48 4x6 black and white prints from Nick Cirincione no negatives
- 12 8x10 black and white prints from Nick Cirincione no negatives

Brown Binder
- 25 8x10 black and white prints from Nick Cirincione no negatives

Brown Binder
- 54 8x10 black and white prints from Nick Cirincione no negatives

Black and white enlargements of photographs by Nick Cirincione
- 24 mounted
- 5 unmounted

Note: The prints were donated to the museum (It appears he may have retained the negatives) and are museum property and we should be able to have copyright permission to use them but it may be best to send a copyright release slip to: Nick Cirincione, PO Box 363, Hurst, TX 76053-0363

One large field map ca 4' x 4' on cardboard

3 stratigraphic cross sections – rolled
5 large scale maps with 1 meter grid system used to make composite map

Composite map of site on paper and velum (paper maps will require paper conservation)

2 photocopies of full size map

17 maps of individual specimens 1'x2'

2 rolled maps and stratigraphy cross sections

Currently all other archive records fit in 3 drawers of a standard filing cabinet.

Files Related to the Waco Mammoth Site Include:

- Equipment Purchases and excavation estimates
- Purchase of miscellaneous materials related to site excavation
- Studies of the pedology (soils) of the site
- Drafts of manuscripts of chapters in the symposium volume on the site
- Correspondence about the site with individuals
- Magazine articles and newspaper clippings about the site
- The accession file on specimens from the site
- Cooper foundation grants
- Development concept designs for the site from 1996 –2001
- Notes on the original discovery of the site
- Archeology site forms as related to the site
- Economic Impact study of site by Tom Kelly in 2001
- Student papers on developing a mission statement for the site
- Elevation data, field notes and maps
- Exhibit plans on the site for the Mayborn Museum complex
- Exhibit plans for a traveling exhibit on the site
- Field records
- Blank forms and data sheets related to the site
- Funding and grant requests
- Site history
- References pertinent to the site
- Mammoth symposium manuscripts
- Maps of the site
- Misc. files and records
- National geographic grant proposal
- Correspondence with Congressman Chet Edwards
- National park Proposal
- Press releases
- Property transfer records and deeds for
    - Doreen Plott
    - Belgium Property
    - Jon W. Spelman Inc.
    - McGlasson Purchase
- Property documents
- Release forms for volunteers

Research Files on Site

- Radiocarbon dates
- DNA study
- Dan Fisher on tusks
- Isotope analysis
- Uranium dating
- Biometrics, tooth/age study
- Bell County Archeology Society map of site
- Bruce Byers survey of the site
- Paul Heinrich – geomorphology study of site
- Diana Hallman – population biology of herd study
- Edward Hohn – taphonomy of site
- Kathryn Hoppe – isotope study of herd
- Susan Short – palynology of site
- Mammoth sculptures
- Bone conservation report by Elaine Hughes
- Correspondence with Joe Taylor
- Texas Parks and Wildlife Grants
- Tour data
- URC Grant
- Lists of past workers and volunteers at the site
- Exhibit plans for the old Strecker Museum
- Misc. articles on mammoths and elephants
- Newspaper clippings

APPENDIX C: WACO MAMMOTH SITE TRACT MAP

APPENDIX D: WARRANTY DEEDS
CITY OF WACO TRACT

MCC 9630590 5 Pgs Vol. 75 Page 204

WARRANTY DEED

THE STATE OF TEXAS §
§
COUNTY OF McLENNAN §

Date: October 4, 1996

Grantor: SAM JACK MCGLASSON, owning, occupying, and claiming other property as homestead

Grantor's Mailing Address (including county): 1 Hidden Valley Dr. Waco, McLennan County, Texas 76710

Grantee: CITY OF WACO, TEXAS, a municipal corporation

Grantee's Mailing Address (including county): P. O. Box 2570 Waco, McLennan County, Texas 76702-2570

Consideration: TEN AND NO/100THS DOLLARS ($10.00) and other good and valuable consideration

Property (including any improvements):

Being a 4.93 acre tract of land out of the John Tucker Survey Abstract No. 41 in McLennan County, Texas, and being out of that certain tract of land called 54.0669 acres described in a deed to Sam Jack McGlasson of record in Volume 1767, Page 336 of the McLennan County, Texas Deed Records, and being more particularly described in Exhibit "A"attached to this instrument and by this reference incorporated in it.

Reservations from and Exceptions to Conveyance and Warranty:

All easements and restrictions of record.

A condition of this conveyance shall be that the Grantee shall use the Property

1

for research, educational, and/or tourism purposes and Grantee shall be required to enter into an agreement with Baylor University concerning the maintenance the Property as an educational resource for the citizens of Waco, visitors and researchers.

Grantor, for the consideration and subject to the reservations from and exceptions to conveyance and warranty, grants, sells, and conveys to Grantee the property, together with all and singular the rights and appurtenances thereto in any wise belonging, to have and hold it to Grantee, Grantee's heirs, executors, administrators, successors, or assigns forever. Grantor binds Grantor and Grantor's heirs, executors, administrators, and successors to warrant and forever defend all and singular the property to Grantee and Grantee's heirs, executors, administrators, successors, and assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof, except as to the reservations from and exceptions to conveyance and warranty.

When the context requires, singular nouns and pronouns include the plural.

Sam Jack McGlasson

THE STATE OF TEXAS §
§
COUNTY OF McLENNAN §

DONALD C. LITTLETON
Notary Public
State of Texas
My Commission Expires
March 23, 1997

This instrument was acknowledged before me on this 4 day of October, 1976 by Sam Jack McGlasson.

Donald C. Littleton
Notary Public in and for the
State of Texas

z:\legal\john\parks\mcglassn.wd

EXHIBIT "A"

Field notes for a 4.93 acre tract of land out of the John Tucker Survey Abstract No. 41 in McLennan County, Texas and being out of that certain tract of land called 54.0669 acres described in a deed to Sam Jack McGlasson of record in Volume 1767, Page 336 of the McLennan County, Texas Deed Records. Said 4.39 acres being more particularly [redacted] described by metes and bounds as follows with bearing based on astronomical north by solar observations.

Commencing at a 60-D nail set in the top of a broken Texas Highway Department concrete monument found in the south line of Farm-to-Market Highway No. 3051 at a cutback with its intersection of Old Steinbeck Bend Road and marking the most northerly northeast corner of the said McGlasson tract;

Thence S 58 deg. 16 min. 46 sec. E 134.24 feet along the said cutback to a Texas Highway Department concrete monument on the occupied west line of Old Steinbeck Bend Road;

Thence N 81 deg. 37 min. 24 sec. E 18.92 feet to a point in said road marking the most easterly northeast corner of the McGlasson tract;

Thence S 32 deg. 27 min. 43 sec. E 461.67 feet along Old Steinbeck Bend Road and the east line of the McGlasson tract to a 60-D nail placed in the asphalt of said road for the northeast corner and Point of Beginning of the herein described tract;

Thence continuing along said road and east line S 32 deg. 27 min. 43 sec. E 104.02 feet and S 31 deg. 55 min. 57 sec. E 275.27 feet to a 60-D nail placed in the asphalt of said road for the southeast corner of the herein described tract;

Thence S 60 deg. 08 min. 55 sec. W at 27.37 feet passing a 1/2 inch rebar placed in concrete at 202.49 feet passing a common corner of the said McGlasson tract and that of a called 55.35 acres described in a deed to Bosque Corp. N.V. a Netherlands-Antilles Corporation of record in Volume 1394, Page 197 and being in the center of Gills Spring Branch continuing along the common line between McGlasson and Bosque Corp. N.V. for a total distance of 388.11 feet to a 1/2 inch diameter rebar placed for the southwest corner of the herein described tract;

Thence N 63 deg. 36 min. 26 sec. W 185.65 feet to a 1/2 inch diameter rebar placed;

Thence N 40 deg. 43 min. 32 sec. W 144.63 feet to a 1/2 inch diameter rebar placed;

Thence N 5 deg. 07 min. 30 sec. E 137.85 feet to a 1/2 inch diameter rebar placed;

Thence N 9 deg. 14 min. 42 sec. W 89.01 feet to a 1/2 inch diameter rebar placed at the southeast corner of an old barn;

P. O. Box 22007 - Waco, Texas 76702
8225 Central Park Drive - Waco, Texas 76712
(817) 772-9272 - Telefax (817) 776-2924

One Killeen Center - Suite 205
1711 E. Central Texas Expressway - Killeen, Texas 76541
(817) 554-5959 - Telefax (817) 554-5979

Page 2

Thence N 1 deg. 30 min. 57 sec. E 65.69 feet to a 1/2 inch diameter rebar placed at the northeast corner of said barn for the northwest corner of the herein described tract;

Thence N 83 deg. 44 min. 08 sec. E 148.61 feet to a 1/2 inch diameter rebar placed;

Thence N 86 deg. 38 min. 38 sec. E 91.00 feet to a 1/2 inch diameter rebar placed;

Thence S 84 deg. 15 min. 15 sec. E 89.13 feet to a 1/2 inch diameter rebar placed;

Thence N 74 deg. 34 min. 18 sec. E at 40.52 feet passing a 1/2 inch diameter rebar placed in concrete on the west side of the proposed 60 foot right-of-way of Old Steinbeck Bend Road, in all 71.42 feet to the Point of Beginning.

Surveyed July 24, 1996
Revised July 26, 1996

Gale Arnold, R.P.L.S. #3879

WO# 8791
Plat C-765
Disk N-35

Att: Lu Jowett
P.O. Box 2570
Waco, Tx. 76702

FN 96-8791-01
Map Chk'd by KRH, 7/25/96

FILED AND RECORDED
OFFICIAL PUBLIC RECORDS

J.A. "Andy" Harwell

11-6-96 03:35 PM 9630590
RESIDORI $13.00
J.A. "ANDY" HARWELL, County Clerk
MCLENNAN COUNTY, TEXAS

Warranty Deed Baylor University Tract (north)

AGT 20010201H

MCC 2001007485 6 PGS

WARRANTY DEED

Date: March 9th, 2001

Grantor: Elizabeth Sparks McGlasson, Individually and as Trustee of the Sam Jack McGlasson Testamentary Trust and as Executrix of the Estate of Sam Jack McGlasson, Deceased

Grantor's Mailing Address: 2612 Regency, Waco, McLennan County, Tx 76710

Grantee: Baylor University

Grantee's Mailing Address: P O Box 97000, Waco, McLennan County, Tx 76798-7000

Consideration:

Ten Dollars ($10.00) and other good and valuable consideration

Property (including any improvements):

Tract One
Being a 48.25 acre tract of land lying situate and being in the John Tucker Survey, A-41, in McLennan County, Texas and being more particularly described in the attached Exhibit "A" attached hereto and made a part hereof for all purposes

Tract Two
Being a 0.81 acre tract of land lying situate and being in the John Tucker Survey, A-41, in McLennan County, Texas and being more particularly described in the attached Exhibit "A" attached hereto and made a part hereof for all purposes

Reservations from and Exceptions to Conveyance and Warranty:

a Any visible and apparent easements on or across the subject property, the existence of which do not appear of record.

b Blanket Easement from James H. Hejtmancik to Texas Power and Light Company and Southwestern Bell Telephone Company in instrument dated June 6, 1963, recorded in Volume 929, page 491 of the Deed Records of McLennan County, Texas

c Blanket Easement from James H Hejtmancik to Texas Power and Light Company and Southwestern Bell Telephone Company in instrument dated September 28, 1967, recorded in Volume 1022, page 181 of the Deed Records of McLennan County, Texas

d Easement and Right of Way from James H Hejtmancik to Texas Power and Light Company in instrument dated March 11, 1981, recorded in Volume 1395, page 165 of the Deed Records of McLennan County, Texas.

e Any portion of subject property lying within the boundaries of a public or private roadway whether dedicated or not

Grantor, for the above stated Consideration, and subject to the above stated Reservations from and Exceptions to Conveyance and Warranty, has GRANTED, SOLD AND CONVEYED, and by these presents does GRANT, SELL AND CONVEY unto Grantee, the above stated Property, together with all and singular the rights and appurtenances thereto in any wise belonging, to have and hold it to Grantee, Grantee's heirs, executors, administrators, successors, or assigns forever Grantor binds Grantor and Grantor's heirs, executors, administrators, and successors to warrant and forever defend all and singular the property to Grantee and Grantee's heirs, executors, administrators, successors, and assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof, except as to the Reservations from and Exceptions to Conveyance and Warranty.

When the context requires, singular nouns and pronouns include the plural

Executed as of the Date first written above.

GRANTOR:

Elizabeth Sparks McGlasson

Elizabeth Sparks McGlasson, Individually and as Trustee of the Sam Jack McGlasson Testamentary Trust and as Executrix of the Estate of Sam Jack McGlasson, Deceased

THE STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF McLENNAN §

That this instrument was acknowledged before me on March 9th, 2001, by Elizabeth Sparks McGlasson, Individually and as Trustee of the Sam Jack McGlasson Testamentary Trust and as Executrix of the Estate of Sam Jack McGlasson, Deceased

Cindi A. Burson
Notary Public, State of Texas
My Commission Expires
MAY 19, 2004

Cindi Burson
Notary Public for the State of Texas

AFTER RECORDING PLEASE RETURN TO: AGT GF #200102014
AMERICAN GUARANTY TITLE, LLC ★ 200 West Highway 6 ★ Suite 270 ★ Waco, TX 76712

Prepared in the Law Offices of:
DEAVER and DEAVER ★ Attorneys at Law ★ 200 West Highway 6 ★ Suite 501 ★ Waco, TX 76712

EXHIBIT A

TRACT ONE

FIELD NOTES
48.25 acres of land
John Tucker Survey
Abstract No. 41
McLennan County
Texas

All that certain lot, tract, or parcel of land situated in the John Tucker Survey, Abstract No. 41 in McLennan County, Texas, and being part of that certain tract of land conveyed to Sam Jack McGlasson and described first in the deed filed of record in Volume 1767, Page 336, Deed Records of McLennan County, Texas, and being more particularly described by metes and bounds as follows:

BEGINNING at a 3/8" iron rod found at the southwest corner of said McGlasson tract, being at the southeast corner of that certain tract of land conveyed to Mark E. Jackson, according to the deed filed of record in Volume 482, Page 175, Official Public Records of McLennan County, Texas, and being in the northwest line of that certain tract of land conveyed to Baylor University, according to the deed filed of record in Volume 622, Page 793, Official Public Records of McLennan County, for the south corner of this tract;

THENCE along the west line of said McGlasson tract and the east line of said Jackson tract, North 11 degrees 16 minutes 48 seconds West, a distance of 105.54 feet to a 3/8" iron rod found, North 27 degrees 12 minutes 5 seconds West, a distance of 98.80 feet to a 3/8" iron rod found, and North 25 degrees 01 minutes 13 seconds West, a distance of 1306.51 feet to a 3/8" iron rod found at the most westerly northwest corner of said McGlasson tract, the northeast corner of said Jackson tract, and being in the south line of that certain tract of land conveyed to Mark E. Jackson, according to the deed filed of record in Volume 482, Page 175, Official Public Records of McLennan County, for the most westerly northwest corner of this tract;

THENCE North 58 degrees 57 minutes 10 seconds East, along the south line of said Jackson tract, the northwest line of said McGlasson tract, a distance of 775.63 feet to a ½" iron rod found at the most northerly northeast corner of said Jackson tract, being the most northerly northwest corner of said McGlasson tract, and being in the south line of Steinbeck Bend Drive (FM No. 3051), for a corner of this tract;

THENCE South 84 degrees 20 minutes 26 seconds East, along the moster easterly north line of said McGlasson tract, the south line of said Steinbeck Bend Drive, a distance of 952.08 feet to a concrete monument found at a corner of said McGlasson tract, for a corner of this tract;

THENCE South 58 degrees 17 minutes 47 seconds East, along a cutback in the south line of said Steinbeck Bend Drive, a distance of 134.23 feet to a broken concrete monument found in the southwest line of Bogey Lane, a corner of said McGlasson tract, for a corner of this tract;

Page 1 of 3

THENCE North 81 degrees 37 minutes 24 seconds East, a distance of 18.92 feet to a point in Bogey Lane, being the northeast corner of said McGlasson tract, for a corner of this tract;

THENCE South 32 degrees 27 minutes 06 seconds East, with the east line of said McGlasson tract and generally with said Bogey Lane, a distance of 461.73 feet to a 60d nail found at the northeast corner of that certain tract of land conveyed to the City of Waco, McLennan County, Texas, according to the deed filed of record in Volume 75, Page 204, Official Public Records of said McLennan County, for a corner of this tract;

THENCE along the north line of said City of Waco tract, South 74 degrees 34 minutes 55 seconds West, at a distance of 30.84 feet pass a concrete monument found, in all distance of 71.40 feet to a ½" iron rod found, North 84 degrees 13 minutes 52 seconds West, a distance of 89.14 feet to a ½ " iron rod found, South 86 degrees 39 minutes 28 seconds West, a distance of 90.96 feet to a ½" iron rod found, and South 83 degrees 45 minutes 05 seconds West, a distance of 148.63 feet to a ½" iron rod found at the northwest corner of said City of Waco tract, for a corner of this tract;

THENCE along the west and southwest line of said City of Waco tract, South 01 degrees 28 minutes 50 seconds West, a distance of 65.65 feet to a ½" iron rod found, South 09 degrees 09 minutes 11 seconds East, a distance of 89.00 feet to a ½" iron rod found, South 05 degrees 07 minutes 57 seconds West, a distance of 137.72 feet to a ½" iron rod found, South 40 degrees 40 minutes 56 seconds East, a distance of 144.54 feet to a ½" iron rod found, and South 63 degrees 34 minutes 51 seconds East, a distance of 185.64 feet to a ½" iron rod found at the southwest corner of said City of Waco tract, being in the south line of said McGlasson tract, and being in the north line of said Baylor University tract, for a corner of this tract;

THENCE South 60 degrees 11 minutes 39 seconds West, along the southeast line of said McGlasson tract, the northwest line of said Baylor University tract, a distance of 1427.63 feet to the PLACE OF BEGINNING, and containing 48.25 acres of land, more or less.

Note: The Company does not represent that the above acreage or square footage calculations are correct.

EXHIBIT A CONTINUED
PAGE 2 of 3

TRACT TWO

FIELD NOTES
0.81 acres of land
John Tucker Survey
Abstract No. 41
McLennan County
Texas

All that certain lot, tract, or parcel of land situated in the John Tucker Survey, Abstract No. 41 in McLennan County, Texas, and being part of that certain tract of land conveyed to Sam Jack McGlasson and described first in the deed filed of record in Volume 1767, Page 336, Deed Records of McLennan County, Texas, and being more particularly described by metes and bounds as follows:

BEGINNING at a 60d nail found in the east line of said McGlasson tract, being at the southeast corner of that certain tract of land conveyed to the City of Waco, McLennan County, Texas, according to the deed filed of record in Volume 75, Page 204, Official Public Records of McLennan County, Texas, and being in a west line of that certain tract of land conveyed to Baylor University, according to the deed filed of record in Volume 622, Page 793, Official Public Records of McLennan County, for the north corner of this tract,

THENCE along the northeast line of said McGlasson tract and the said west line of said Baylor University tract, South 31 degrees 55 minutes 09 seconds East, a distance of 374.43 feet to a point in the centerline of Gills Spring Branch, being a corner of said McGlasson tract and said Baylor University tract, for the southeast corner of this tract;

THENCE along a southeasterly line of said McGlasson tract, a northeasterly line of said Baylor University tract, and along the centerline of said Gills Spring Branch, the following courses and distances:

North 66 degrees 46 minutes 28 seconds West, a distance of 124 86 feet to a point.
North 29 degrees 15 minutes 28 seconds West, a distance of 64 94 feet to a point.
North 83 degrees 32 minutes 28 seconds West, a distance of 61.25 feet to a point.
North 41 degrees 10 minutes 28 seconds West, a distance of 127 64 feet to a point.
North 84 degrees 33 minutes 28 seconds West, a distance of 83.32 feet to a point, being a corner of said McGlasson tract and said Baylor University tract, and being in the south line of said City of Waco tract, for the southwest corner of this tract;

THENCE North 60 degrees 11 minutes 15 seconds East, along the south line of said City of Waco tract, at a distance of 175.82 feet pass a concrete monument found, and continuing for a total distance of 203 25 feet to the PLACE OF BEGINNING, and containing 0 81 acre of land, more or less.

Note: The Company does not represent that the above acreage or square footage calculations are correct.

EXHIBIT A CONTINUED
Page 3 of 3

FILED AND RECORDED
OFFICIAL PUBLIC RECORDS

J.A. "Andy" Harwell

2001 MAR 13 10:57 AM 2001007485
BRIDGES $17.00
J.A. "ANDY" HARWELL ,COUNTY CLERK
MCLENNAN COUNTY, TEXAS

Warranty Deed: Baylor University Tract (south)

FTC2001306

MCC 2000011398 2 pgs Vol. 622 Page 793

SPECIAL WARRANTY DEED

Date: March 30, 2000

Grantor: BOSQUE CORPORATION, N V , a Netherlands-Antilles Corporation

Grantor's Mailing Address (including county):
c/o Henry W Fielder, 510 N. Valley Mills Dr , Suite 500, Waco, McLennan County, Texas 76710

Grantee: BAYLOR UNIVERSITY

Grantee's Mailing Address (including county):
P. O. BOX 97000
Waco, Texas 76798

Consideration: TEN AND NO/100 ($10 00) DOLLARS and other good and valuable consideration

Property (including any improvements):
55 35 acres of land out of the John Tucker Survey in McLennan County, Texas, and being a part of that certain 103 51 acre tract conveyed to Mrs Minnie Wortham in Volume 464, Page 242 and Volume 567, Page 9 of the Deed Records of McLennan County, Texas, and being more particularly described by metes and bounds on the attached Exhibit "A"

Reservations from and Exceptions to Conveyance and Warranty:
THIS CONVEYANCE IS MADE AND ACCEPTED SUBJECT TO ALL RESERVATIONS, RESTRICTIONS, EASEMENTS AND MINERAL INTERESTS OF RECORD IN McLENNAN COUNTY, TEXAS, AFFECTING THE SUBJECT PROPERTY

Grantor, for the consideration and subject to the reservations from and exceptions to conveyance and warranty, grants, sells, and conveys to Grantee the property, together with all and singular the rights and appurtenances thereto in any wise belonging, to have and to hold it to Grantee, Grantee's heirs, executors, administrators, successors, or assigns forever Grantor hereby binds Grantor and Grantor's heirs, executors, administrators, successors and assigns to warrant and forever defend all and singular the property to Grantee and Grantee's heirs, executors, administrators, successors, and assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof, except as to the reservations from and exceptions to conveyance and warranty, when the claim is by, through, or under Grantor but not otherwise

When the context requires, singular nouns and pronouns include the plural

BOSQUE CORPORATION, N V

By _____
Henry W Fielder, Attorney-in-Fact and as Agent

THE STATE OF TEXAS)
)
COUNTY OF McLENNAN)

This instrument was acknowledged before me on the 13 day of April, 2000, by HENRY W FIELDER, as Attorney-In-Fact and as Agent for BOSQUE CORPORATION, N V , a Netherlands-Antilles Corporation, on behalf of said corporation

_____
Notary Public, State of Texas
Notary's name (printed)
Notary's commission expires

KRISTY CRELIA BRASIER
Notary Public
STATE OF TEXAS
My Commission Expires 02/15/2003

AFTER RECORDING RETURN TO:
First Title Co.

PREPARED IN THE LAW OFFICE OF:
SHEEHY, LOVELACE & MAYFIELD, P C
510 N Valley Mills Dr , Suite 500
Waco, Texas 76710
K:\CASES\66515-001\Baylor-Deed.wpd

Exhibit A

Fieldnotes for 55.35 acres of land out of the John Tucker Survey in McLennan County, Texas, and being a part of that certain 103.51 acre tract conveyed to Mrs. Minnie Wortham in Vol. 464, Page 242 and Vol. 567, Page 9 of the McLennan County, Texas Deed Records.

Beginning at an iron stake in the common line of the said Wortham tract with the Downing Bros., Inc. 37.3 acre tract (1138-139); said point being located N 61°28' E, 1,116.95 feet from an iron stake in the center line of Gils Camp Ground Spring Branch at its intersection with the North line of the said Wortham tract.

Thence: N 61°28' E, with the North line of the said Wortham tract, a distance of 1,738.61 feet to an iron stake.

Thence: S 83°32' E, 82.64 feet, S 40°09' E, 127.64 feet, S 82°31' E, 21.25 feet, S 28°14' E, 64.94 feet, S 65°45' E, 124.86 feet, N 31°27' W, 427 feet to an iron stake in the West line of the Vernon Koch 113.54 acres (515-308).

Thence: With the said West line of the Vernon Koch tract, S 42°43' E, 157.6 feet, S 65°29' E, 286.6 feet, S 22°03' W, 202.0 feet to an iron stake.

Thence: S 50°27' E, 210 feet to a point for angle.

Thence: With the West line of the Clinton R. Johnson 8.21 acre tract (848-381), S 06°59' W, 939.4 feet to the Southwest corner of the said Johnson tract.

Thence: The following courses and distances along the West line of the King W. Bridges 148.23 acre tract (795-252): S 15° 24' E, 69.3 feet, S 43°44' E, 55.2 feet, S 70°17' E, 73.4 feet, S 70°28' E, 82.8 feet, S 46°20' W, 119.85 feet, S 03°04' E, 10 feet, S 71°00' E, 39.9 feet, N 66°24' E, 42.75 feet, S 12°55' W, 43.7 feet, S 53°25' W, 68.4 feet, S 28°39' E, 202.4 feet, N 87°09' E, 100 feet, S 60°35' W, 111.8 feet to a point in the normal pool elevation of Lake Brazos.

Thence: Along the meanders of the normal pool elevation of Lake Brazos and the Bosque River, N 82°36' W, 112.3 feet, N 73°25' W, 304.2 feet, N 82°15' W, 194.75 feet, N 42°49' W 33.3 feet, N 32°24' E, 22.4 feet, N 05°50' E, 7 feet, N 78°47' W, 85.4 feet, S 55°21' E, 68.5 feet, S 05°50' W, 24 feet, N 86°51' W, 85.39 feet, S 80°19' W, 59.88 feet, N 61°29' W, 33.85 feet, N 12°19' W, 75.6 feet.

Thence: With the West line of the herein described tract, N 22°34' E, 60.14 feet, N 67°26' W, 1,406.69 feet, N 28°32' W, 300 feet to the place of beginning.

STATE OF TEXAS
CHARLES A. RODEN
2280
REGISTERED SURVEYOR

Compiled February 5, 1981

Charles A. Roden
Registered Public Surveyor # 2280

FILED AND RECORDED
OFFICIAL PUBLIC RECORDS

J.A. "Andy" Harwell

2000 APR 17 02:27 PM 2000011398
RESIDORI $11.00
J.A. "ANDY" HARWELL ,COUNTY CLERK
MCLENNAN COUNTY, TEXAS

APPENDIX E: CONSULTATION CORRESPONDENCE

WACO MAMMOTH FOUNDATION, INC.

P.O. Box 326 Waco, Texas 76703 (254) 750-5640

October 24, 2007

Michele D'Arcy, RLA
National Park Service
Denver Service Center
12795 West Alameda Parkway
Denver, Colorado 80225

Dear Michele,

The City of Waco together with Baylor University jointly recommends that the National Park Service choose Option C as the best management structure for the Waco Mammoth Site. This option would combine the resources of the City of Waco and Baylor University with the necessary expertise of the National Park Service to insure that the resources located at the site and in storage at Baylor University will be protected and available to visitors for education and to scientists for research into the future.

The cooperation of Baylor University and the City of Waco along with the strong support of the citizens of our community has allowed us to secure the site and plan for the first phase of improvements but we need the assistance of the National Park Service to provide the missing pieces of expertise and experience in dealing with this type of precious resource and to allow this nationally significant resource of Columbian mammoth remains to fulfill its potential to inform and educate the citizens of our nation.

We appreciate the support that the National Parks Service has demonstrated to the Waco Mammoth Site by preparing the Special Resource Study and by granting a Save America's Treasures grant to fund a portion of the first phase of improvements. We look forward to continued cooperation toward making the Waco Mammoth Site an excellent resource for understanding the history of these unique animals and the natural history of the central Texas area. As we prepare to move forward with the construction of a protective structure and other improvements at the site, we trust that the National Park Service will join us in helping the Waco Mammoth Site to fulfill its potential as a unique example of the history of the United States.

Sincerely,

Virginia DuPuy
Mayor

Dr. John M. Lilley
President, Baylor University

Jana Milliken@FWS
12/06/2005 02:33 PM
CST

To: Elizabeth Meyer/DENVER/NPS@NPS
cc:
Subject: Waco Mammoth Site Area

Hi Elizabeth,

Attached is a list of the species that occur in McLennan County, Texas. For future reference, a list of species by county can be found at http://www.fws.gov/ifw2es/EndangeredSpecies/. Individual species information is at http://www.fws.gov/endangered/.

If you have any questions, feel free to give me a call. Please reference # 21450-2006-TA-0046 in future correspondence with us regarding this project.

Thanks, Jana

McLennan.doc

Jana Milliken
Fish and Wildlife Biologist
Austin Ecological Services Office
US Fish & Wildlife Service
10711 Burnet Road, Suite 200
Austin, TX 78758
512-490-0057 ext. 243

Federally Listed as Threatened and Endangered Species of McLennan County

DISCLAIMER

This list is based on information available as of on August 11, 2005. This list is subject to change as new biological information is gathered and should not be used as the sole source for identifying species that may be impacted by a project. A list of federally listed or proposed species by county of occurrence in Texas can be found at http://ifw2es.fws.gov/EndangeredSpecies/lists/.

Migratory Species Common to many or all Counties: Species listed specifically in a county have confirmed sightings. If a species is not listed they may occur as migrants in those counties.

Least tern	(E ~)	*Sterna antillarum*
Whooping crane	(E w/CH)	*Grus americana*
Bald eagle	(T)	*Haliaeetus leucocephalus*
Piping plover	(T w/CH)	*Charadrius melodus*

McLennan County

Black-capped vireo	(E)	*Vireo atricapilla*
Golden-cheeked warbler	(E)	*Dendroica chrysoparia*
Bald eagle	(T)	*Haliaeetus leucocephalus*

INDEX

E = Species in danger of extinction throughout all or a significant portion of its range.
T = Species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
CH = Critical Habitat (in Texas unless annotated ‡)
~ = protection restricted to populations found in the "interior" of the United States. In Texas, the least tern receives full protection, except within 50 miles (80 km) of the Gulf Coast.

United States Department of the Interior
NATIONAL PARK SERVICE
DENVER SERVICE CENTER
12795 W. ALAMEDA PARKWAY
P.O. BOX 25287
DENVER, COLORADO 80225-0287

IN REPLY REFER TO:

TAKE PRIDE IN AMERICA

OCT 0 4 2007

Mr. Gary McAdams, President (telephone 405-247-2425)
Wichita and Affiliated Tribes (Wichita, Waco, Keechi, Tawakonie)
Post Office Box 729
Anadarko, OK 73005-0729

Dear Mr. McAdams:

The National Park Service has commenced a special resource study of the Waco Mammoth Site, Waco, Texas, under the aegis of Congress. The interdisciplinary study team of the Planning Division, Denver Service Center, National Park Service, is to prepare a report for Congress on the national significance, suitability, and feasibility of the site as a unit possibly to be added to the national park system. There will be other management options, such as affiliation with and technical assistance from the National Park Service as well as no National Park Service involvement. The study will evaluate and analyze the benefits and consequences of each alternative and present them as a range of management possibilities for Congress to consider.

Discovered in 1978, the Waco Mammoth Site turned out to contain the bones of a herd of mammoth elephants, now dated to about 68,000 years ago, well before the time of Paleo-Indians in the area. No cultural material appears to be associated with the site. It is important to paleontology because of the death of a relatively large number of mammoths in a single catastrophic event, possibly that of a massive mudflow. Curated at the Mayborn Museum of Baylor University, excavation has happened with reference to some of the mammoth fossil remains. Others remain in situ with partial excavations exhibited. The City of Waco owns the five acre parcel that contains the 90,000 square foot excavation site and Baylor University owns the surrounding 104 acres.

I am contacting you because the Waco Tribe is now part of the Wichita and Affiliated Tribes. As the Waco Tribe once lived in the Waco area, the tribe may have a connection to the region surrounding the Waco mammoth site. This letter is designed to alert you to the special resource study in accordance with the Code of Federal Regulations (36 CFR 800.3 (f) (2)) and to provide you with an opportunity to tell us your thoughts and concerns so that we may listen, understand, and consider your views in the study process. Please let us know by way of written correspondence if you would wish to consult on a government to government basis.

The study team has prepared two newsletters; the most recent newsletter outlines the current preliminary range of management alternatives under consideration by the study team. I have included both newsletters for your review and reference. We are currently seeking input to determine whether we have captured the full range of reasonable management possibilities, if there other management alternatives we should consider, and what the preferences are for each scenario presented.

Thank you for your consideration of this request,

Sincerely,

Michele D'Arcy, Project Manager
National Park Service
Denver Service Center
12795 W. Alameda Parkway
Denver, CO 80228

w/ atts:
Newsletter #1
Newsletter #2

United States Department of the Interior
NATIONAL PARK SERVICE
DENVER SERVICE CENTER
12795 W. ALAMEDA PARKWAY
P.O. BOX 25287
DENVER, COLORADO 80225-0287

IN REPLY REFER TO:

November 14, 2005

Mr. Lawerence Oaks, State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276, Capitol Station
Austin, Texas 78711-2276

Dear Mr. Oaks:

The National Park Service has commenced a special resource study of the Waco Mammoth Site, Waco, Texas, under the aegis of Congress. The interdisciplinary study team of the Planning Division, Denver Service Center, National Park Service, is to report back to Congress on the national significance, suitability, and feasibility of the site as a unit possibly to be added to the national park system. Other management options, such as affiliation with and technical assistance from the National Park Service as well as no National Park Service involvement, will also be considered in the study and presented as a range of possibilities.

On Tuesday, October 25, 2005, our planning team, led by Michele D'Arcy, project manager, met with Dr. Jim Bruseth, director of your Archeology Division, and Mark Denton, director of your State and Federal Review Section, at the Texas Historical Commission in Austin to explain and discuss the project. As you may know, the site of what turned out to be a herd of mammoths was discovered in 1978 and is now dated to about 68,000 years ago, well before Paleo-Indians were in the area. No cultural material appears to be associated with the site. It is important to paleontology because of the death of a relatively large number of mammoths in unstable soil due to a single catastrophic event, apparently that of a massive mudflow. Some 24 mammoth remains have been excavated and are being curated at the Mayborn Museum of Baylor University. Others remain in situ with partial excavation exhibited. The mammoth excavation site of five acres is owned by the City of Waco and the surrounding 100 acres by Baylor University.

In the future, we will keep you informed of any public meetings and send you the newsletters and draft and final reports that the study team produces. We will consult with your office about any archeological or historic sites that may be in the area. If you have any questions, please contact me at larry_van_@nps.gov or at 303-969-2255.

Yours sincerely,

SIGNED Larry Van Horn

Lawrence F. Van Horn, Ph.D., Cultural Resource Specialist

SELECTED REFERENCES

General

Agenbroad, Larry D.

1998 Pygmy (Dwarf) Mammoths of the Channel Islands of California. Mammoth Site of Hot Springs, South Dakota, Inc.

2002 When and Where Did Mammoths Roam in South Dakota? (And Adjacent States) North Dakota Minnesota Iowa Nebraska Wyoming Montana. Published by Mammoth Site, Inc. Hot Springs, South Dakota.

2004 "North American Proboscideans: Mammoths: The State of Knowledge, 2003". Quaternary International 126-128 (2005) 73-92. Published by Elsevier Ltd.

Agenbroad, Larry D., and Lisa Nelson

2002 *Mammoths Ice Age Giants.* Lerner Publications, Minneapolis, Minnesota.

Agenbroad, Larry D., and Don P. Morris

1999 Giant Island/Pygmy Mammoths: The Late Pleistocene Prehistory of Channel Islands National Park.

Associated Press

2006 "U.S. Senators Kay Bailey Hutchison and John Cornyn Want Waco Mammoth Site as Park." *The Fort Worth* (Texas) *Star-Telegram*, Saturday, September 9, 2006.

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