



Petroglyph National Monument

Visitor Use Management Plan / Environmental Assessment

NEW MEXICO

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GLOSSARY OF KEY TERMS

Administrative Road – A road within the monument used by the National Park Service for motorized administrative purposes but on which non-motorized visitor use may also be allowed. Administrative roads can include two-track roads and other old roads in the monument. A two-track road is a one-lane road that permits two-way travel but is not wide enough in most places to allow vehicles to pass one another. The two-track roads and other old roads were in existence prior to establishment of the monument.

Designated Trail – Designated trails are those non-motorized trails in the monument that have been authorized by the National Park Service through a formal planning process and which are designed, constructed, and maintained by the National Park Service in accordance with sustainable trail standards.

Formulated Trail System – This includes designated trails as well as those sections of administrative roads and utility corridors where visitor use is authorized.

Indicators – Indicators translate the goals and objectives of the monument into measurable attributes (i.e., number of visitor-created trails) that can be tracked over time to evaluate change in resource or experiential conditions.

Public Access Point – Locations where there is a constructed opening in the monument's boundary fence (not unfenced areas), providing access into the monument.

Primary Public Access Point – High-use access points near major features that typically provide core amenities such as parking areas, restroom facilities, trash receptacles, shade structures, bicycle racks, interpretive kiosks, and wayside exhibits.

Secondary Public Access Point – Secondary access points typically consist of a simple 18- to 24-inch-wide gap in the monument's boundary fence and an informational/regulations sign.

Sustainable Trail – A sustainable trail is a trail that has been designed and constructed such that it does not adversely impact natural and cultural resources and can withstand the impacts of the intended user and natural elements. A sustainable trail requires only routine maintenance and meets the needs of the intended user to a degree that they do not deviate from the established trail alignment.

Thresholds – Thresholds represent the minimum acceptable condition for each indicator and are established by considering qualitative descriptions of the monument goals and objectives, data on existing conditions, relevant research studies, staff management experiences, and scoping of public preferences.

Visitor Capacity – Visitor capacity is a component of visitor use management defined as the maximum amount and types of visitor use that an area can accommodate while sustaining desired resource conditions (i.e., goals and objectives for this plan) and visitor experiences consistent with the purpose for which the area was established.

Visitor-Created Trail – An unauthorized non-motorized trail, within the monument, created by visitors for which no formal NPS planning, design, construction, or maintenance has occurred.

Visitor Use – Refers to human presence in an area for purposes that include education, interpretation, inspiration, and physical and mental health. Visitor use goes beyond the types of activities that people engage in at parks. Visitor use also includes the amount, timing, and distribution of visitor activities and behaviors.

CHAPTER 1: PURPOSE AND NEED FOR THE PLAN

INTRODUCTION

The National Park Service (NPS), in coordination with the City of Albuquerque (city), is evaluating a range of options to formalize a trail system and manage public access within Petroglyph National Monument (monument). The monument was established on Albuquerque, New Mexico's West Mesa on June 27, 1990 "in order to preserve, for the benefit and enjoyment of present and future generations, that area...containing the nationally significant West Mesa escarpment, the Las Imagines National Archeological District, a portion of the Atrisco Land Grant, and other significant natural and cultural resources..." (Public Law 101-313). The 7,209-acre monument is jointly owned and managed by the National Park Service and the city's Open Space Division (figures 1 and 2). Monument resources include more than 20,000 petroglyphs and more than 350 documented archeological sites and ethnographic resources important to many of the pueblos and tribes of the Southwest.

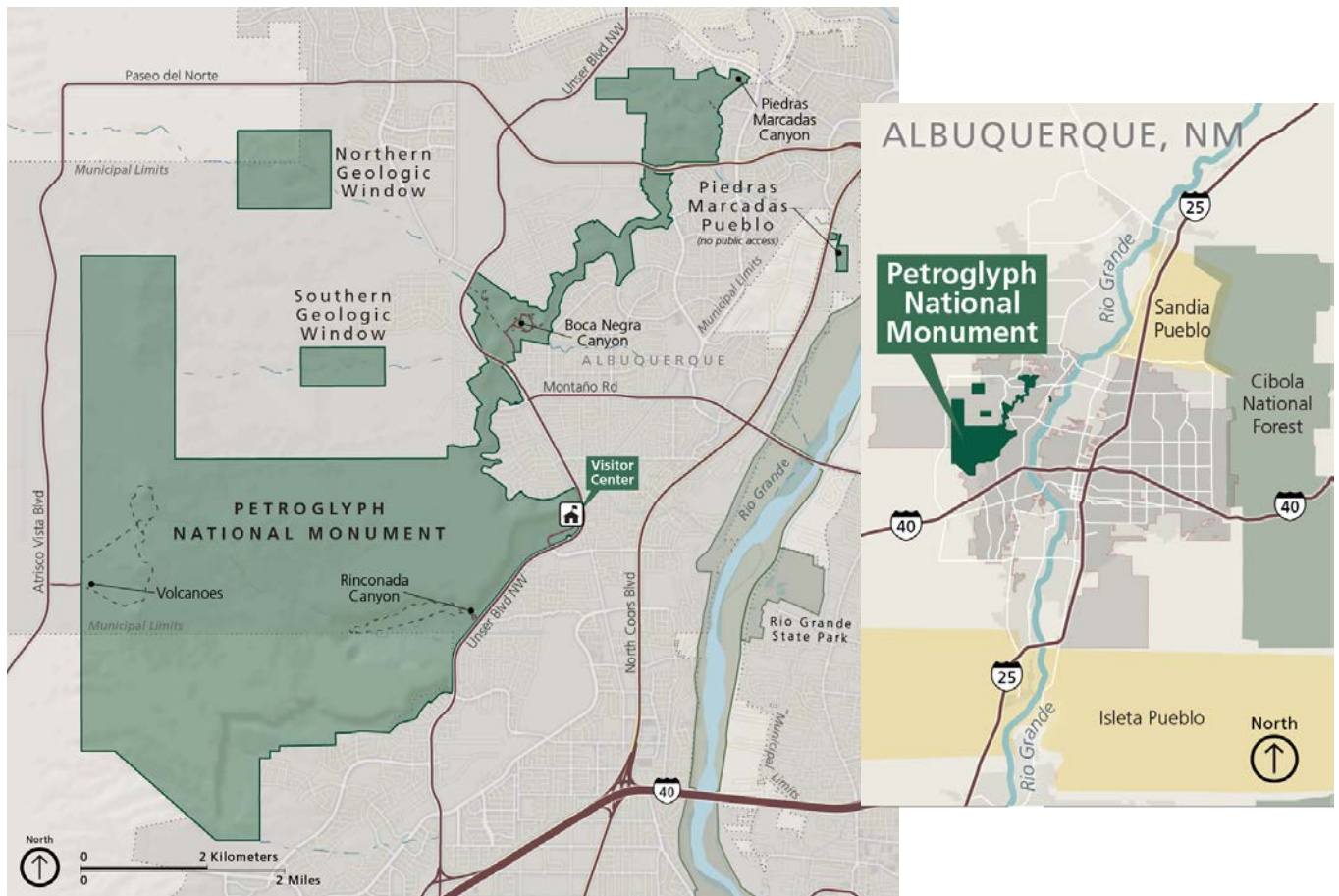


FIGURE 1. LOCATION OF PETROGLYPH NATIONAL MONUMENT

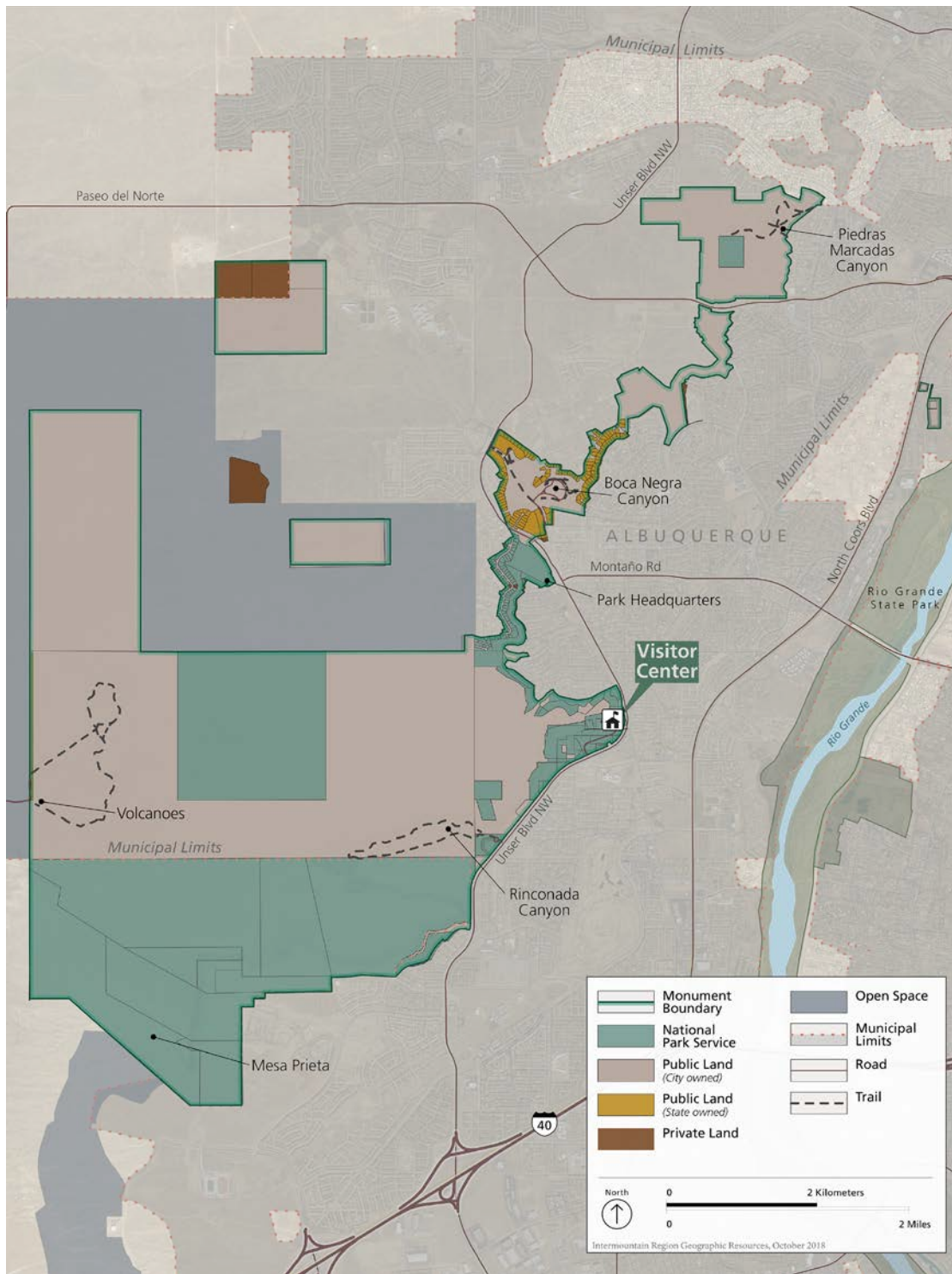


FIGURE 2. LAND OWNERSHIP MAP OF PETROGLYPH NATIONAL MONUMENT

PURPOSE AND NEED

The purpose of the Visitor Use Management Plan/Environmental Assessment (VUM Plan) is to formalize a sustainable trail system and manage public access and public use on trails within the monument. The trail network and activities will be compatible with the monument's purpose, significance, and the legislation that established the monument. Strategies will address the management and maintenance of the trail system, access points, associated infrastructure, and provide direction for visitor use management and decision-making. Cultural and traditional uses and values will be integrated into the planning and decision-making processes. The strategies associated with the trail system will also provide guidance on resolving differences among visitor groups and impacts to cultural and natural resources. It will include expectations for long-term monitoring and analysis of visitor capacity.

A sustainable trail system and visitor use management plan is needed because:

- Over the years, there has been a proliferation of visitor-created trails within the monument, which have contributed to trail widening, littering, vandalism, graffiti, soil erosion, native vegetation loss, invasive species encroachment, and damage to petroglyphs and archeological sites.
- There are a number of two-track roads, some of which are potentially historic routes within the monument that are being used as trails and have been used for administrative purposes. The duplicative nature of the routes creates confusion and resource protection issues.
- There are a number of user-created access points along the monument's boundary that should be further evaluated to determine whether they are necessary (e.g., would link to the monument's trail system, provide a 'sense of arrival,' or provide an opportunity to educate and inform visitors of this unique place).
- The monument is significant to traditionally associated pueblos and tribes, and there is concern that current use in the monument may affect tribal access and traditional uses.
- There are conflicts among various types of use (e.g., hiking, bicycling, and dog walking).
- Popular areas of the monument are overcrowded during periods of high use.
- There are opportunities that could benefit the monument and surrounding residential areas such as the establishment of trails connecting the monument to the city's trail network and open space areas.
- Facilities within the monument must be designed to conform to accessibility requirements to reduce obstacles and promote shared experiences.

PLANNING CONTEXT

This VUM Plan would amend the visitor use management aspect of the monument's 1997 general management plan (GMP) regarding formalizing a comprehensive trail system, identifying access points, and clarifying the types and amounts of visitor use on trails in different areas of the monument. The VUM Plan would also identify carrying capacities for areas of the monument.

VISITOR USE MANAGEMENT AND THE PLANNING PROCESS

Visitor use management is the proactive and adaptive process of planning for and managing characteristics of visitor use and its physical and social setting using a variety of strategies and tools to sustain goals and objectives. Visitor use management is important because NPS managers strive to

maximize opportunities and benefits for visitors while achieving and maintaining desired conditions for resources and visitor experiences in a particular area. Managing visitor access and use for visitor enjoyment and resource protection is inherently complex. It requires that managers analyze not only the number of visitors but also where they go, what they do, their impacts on resources and visitor experiences, and the underlying causes of those impacts. Managers must acknowledge the dynamic nature of visitor use, the vulnerabilities of natural and cultural resources, and the need to be responsive to changing conditions.

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

This plan uses the visitor use management framework to develop a long-term strategy for managing visitor use within the monument. The general planning process used for this plan is outlined below and is consistent with the guidance provided by the Interagency Visitor Use Management Council (IVUMC 2016).

VISITOR USE MANAGEMENT GOALS AND OBJECTIVES

The following visitor use management goals and objectives were developed to help direct the identification of the visitor use management strategies needed to achieve the desired visitor experiences for the monument, while addressing the planning issues.

Las Imágenes Visitor Center and Boca Negra Canyon

Goal. The Las Imágenes Visitor Center (visitor center) and Boca Negra Canyon are high-use areas, and interpretive and educational opportunities are abundant. The visitor center would serve as the primary destination for visitors to learn about the significance of the monument, get an orientation of the visitor services and facilities available within the monument, and receive information on other area attractions. The trail system would provide visitors close proximity to resources and guided learning in a fully developed setting, with a goal of making the areas more accessible. Visitors would independently and/or through interpretive programs experience and learn about the setting (e.g., petroglyph viewing, Mesa Top access, trail use, interpretive media). In collaboration with the city's Open Space Division, visitor access would be sustainably managed so that access and resource protection remain compatible and complementary.

Objective 1 – The Las Imágenes Visitor Center is the primary location for obtaining information about monument resources, available activities, educational and interpretive materials, and general monument information and orientation.

Objective 2 – The visitor center and Boca Negra Canyon are high use areas used for gatherings of educational groups, interpretive talks and walks, and monument programs.

Objective 3 – Provide universally accessible options for visitors and residents to connect with monument resources.

Piedras Marcadas Canyon, Rinconada Canyon, and Mesa Prieta

Goal. Other than Boca Negra Canyon, Piedras Marcadas Canyon, Rinconada Canyon, and Mesa Prieta are the primary petroglyph viewing areas. The trail system would provide visitors close proximity to these resources and the opportunity to independently experience a quiet and contemplative setting, including opportunities for solitude, natural quiet, and uninterrupted views. Information about trailhead access and use as well as connections to the monument's trail system would be made available. Visitors would be able to independently learn about the setting (e.g., petroglyph viewing, interpretive waysides or self-guided brochures). Visitor access would be sustainably managed so that access and resource protection remain compatible and complementary.

Objective 1 – Provide formalized trail opportunities for visitors and residents to include petroglyph viewing and linkages to the city's trail system.

Objective 2 – Maintain opportunities to experience solitude, natural quiet, and uninterrupted views.

Objective 3 – Provide a variety of opportunities to learn about monument resources through activities such as establishing new petroglyph viewing areas and interpretive wayside exhibits.

Objective 4 – Limit visitor impacts on resources and continue to monitor resource impacts.

Volcanoes Area and Mesa Top

Goal. The trail system would provide visitors with opportunities to appreciate the expansive southwestern landscape with views of the volcanoes, Mesa Top, Albuquerque Basin, and the Sandia Mountains. Visitors would independently and/or through interpretive media learn about the setting (e.g., cultural landscape and natural resources). Visitor access would be sustainably managed so that access and resource protection remain compatible and complementary. Views are preserved and protected on the Mesa Top and in the volcanoes area. Damaged areas continue to be restored.

Objective 1 – Provide for sustainable, long distance trail options on the Mesa Top, with connection to the overall proposed trail system and nearby city trails.

Objective 2 – Re-evaluate access to the tops of JA, Black, and Vulcan volcanoes.

Northern Geologic Window, Southern Geologic Window, and Piedras Marcadas Pueblo

Goal. These three areas are non-contiguous with the rest of the monument. General visitor use in these areas would continue to be restricted because of the physical limitations of these areas to withstand unrestricted public use and their significance to traditionally associated pueblos and tribes. Access to these locations would not be promoted (i.e., visitor maps, kiosks, etc.) in general. These would be quiet areas in contrast with the nearby urban landscape. Minimal development may occur. Signage would provide basic information such as safety and regulatory information.

Objective 1 – Promote a sense of understanding and appreciation of places special to traditionally associated pueblos and tribes, and protect the traditional associations and values of the areas.

Area North of Boca Negra Canyon and South of Paseo Del Norte

Goal. This area is a narrow strip of monument land along the escarpment located north of Boca Negra Canyon and south of Paseo del Norte. Established residential areas are present, and ongoing development is occurring. The goal for this area is to maintain a number of opportunities for sustainable access to the monument's proposed trail system and provide connections to the city's trail system.

Monument Access

Goal. Maintain a variety of opportunities for sustainable access and trail use within the monument, including formalized trail connections to the Mesa Top and along the bottom of the escarpment to link visitors and residents to the proposed trail system.

Objective 1 – Provide opportunities for visitor and residential access while ensuring connectivity to the monument's proposed trail system and linkages to city trails. This would bring locations and the number of public access points to a sustainable and manageable level.

ISSUES AND IMPACT TOPICS

As defined by the 2015 NPS NEPA handbook, "issues" or "environmental issues" can be problems, concerns, conflicts, obstacles, or benefits that would result if the proposed action or alternatives, including the no-action alternative, were implemented. The National Park Service, other agencies, tribal governments, or the public may raise issues. The public scoping phase helps identify issues. The analysis in this plan focuses on significant issues (meaning pivotal issues, or issues of critical importance). Issues were retained for a more detailed analysis in this plan if

- the environmental impacts associated with the issue are central to the proposal or of critical importance,
- a detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives,
- the environmental impacts associated with the issue are a big point of contention among the public or other agencies; or
- there are potentially significant impacts to resources associated with the issue.

Key Issues/Impact Topics Retained for Detailed Analysis

The key environmental issues are analyzed in both "Chapter 3: Affected Environment" and "Chapter 4: Environmental Consequences."

Issues/Impact Topics Considered but Dismissed from Detailed Analysis

American Indian Trust Resources. Trust resources are those natural resources reserved by or for Indian tribes through treaties, statutes, judicial decisions, and executive orders that are protected by fiduciary obligation on the part of the United States (NPS 2006). There are no Indian trust resources in the monument. The lands comprising the monument are not held in trust by the Secretary of the Interior for the benefit of American Indians because of their status as American Indians. Therefore, the impact topic of Indian trust resources was not retained for further analysis.

Environmental Justice. Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minority and low-income communities.

To fulfill Executive Order 12898 in the context of the National Environmental Policy Act (NEPA), the planning team identified minority populations and low-income populations in the vicinity of the monument. This environmental assessment demonstrates that the impacts that could result from implementation of the alternatives would be few and would not be disproportionately high with regard to human health or environmental impacts on minorities or low-income populations. For these reasons, the topic of environmental justice was not retained for further analysis.

Socioeconomics. Socioeconomics is the social science of how economic activity affects social processes. The alternatives considered would neither change local nor regional land use. Depending on the alternative selected, there could be minimal impacts to bicycle and horse-related businesses; however, this impact would be slight as there are a number of areas near the monument that provide opportunities for various uses (i.e., equestrian, bicycling, hiking, etc.) which would help mitigate effects from any selected alternative. The location of potential open and closed access points may also have a minimal impact on businesses that provide goods consumed by user groups. Implementation of the proposed action could provide a slight beneficial impact to the economy of Albuquerque because of minimal increases in potential employment opportunities, and revenues generated for local businesses and governments from these additional workers. Any increase in workforce and revenue, however, would be temporary, lasting only as long as phased project work. Because the impacts to the socioeconomic environment would be slight and would not be measurable, this topic has been dismissed from further consideration.

Other topics were considered but dismissed because they did not meet the criteria for retention and are included along with pertinent information in appendix A.

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CHAPTER 2: ALTERNATIVES

INTRODUCTION

This chapter begins with describing the no-action alternative (i.e., what would happen if current management was to continue into the future). Following the no-action alternative (alternative 1) are descriptions of the action alternatives: alternative 2 (NPS Proposed Action and Preferred Alternative) and alternative 3. A summary table of the formalized trail system and access points under each alternatives is presented at the end of chapter 2. Mitigation measures can be found in appendix D.

ALTERNATIVE 1 (NO-ACTION ALTERNATIVE)

Overview

Under alternative 1 (no action), current management actions and direction would continue into the future. That is, the National Park Service would continue with the present course of action outlined below unless or until that course is changed through a future planning and compliance process.

Visitor Use Management

Under this alternative, the visitor use management goals and objectives described in chapter 1 would continue to be used to help identify future visitor use management strategies needed to achieve resource protection and visitor experience for the monument. However, there would be no comprehensive visitor use management plan for the monument. As a result, no related indicators and thresholds, management strategies, monitoring protocols, or visitor capacities would be implemented to guide visitor use management.

Public Access Points

Public access points are defined as locations where there is a constructed opening in the monument's boundary fence (not unfenced areas), providing access into the monument. The 57 existing public access points in the monument, including primary and secondary access points, would be retained (figure 3).

Primary Public Access Points. Primary public access points are defined as high-use access points near major features. They typically provide core amenities such as parking areas, restroom facilities (not present at Piedras Marcadas Canyon), trash receptacles, shade structures, benches, bicycle racks, interpretive kiosks, and wayside exhibits.

Five primary access points would continue to exist in the monument:

- Volcanoes
- Boca Negra Canyon
- Rinconada Canyon
- Piedras Marcadas Canyon
- Las Imágenes Visitor Center

With the exception of Boca Negra Canyon, which would remain a fee parking area managed by the city's Open Space Division, these access points would continue to be managed by the monument. Amenities associated with these primary access points—and which would continue to be provided under this no action alternative—are described in further detail in chapter 3 of this document under "Visitor Access, Information, and Circulation."

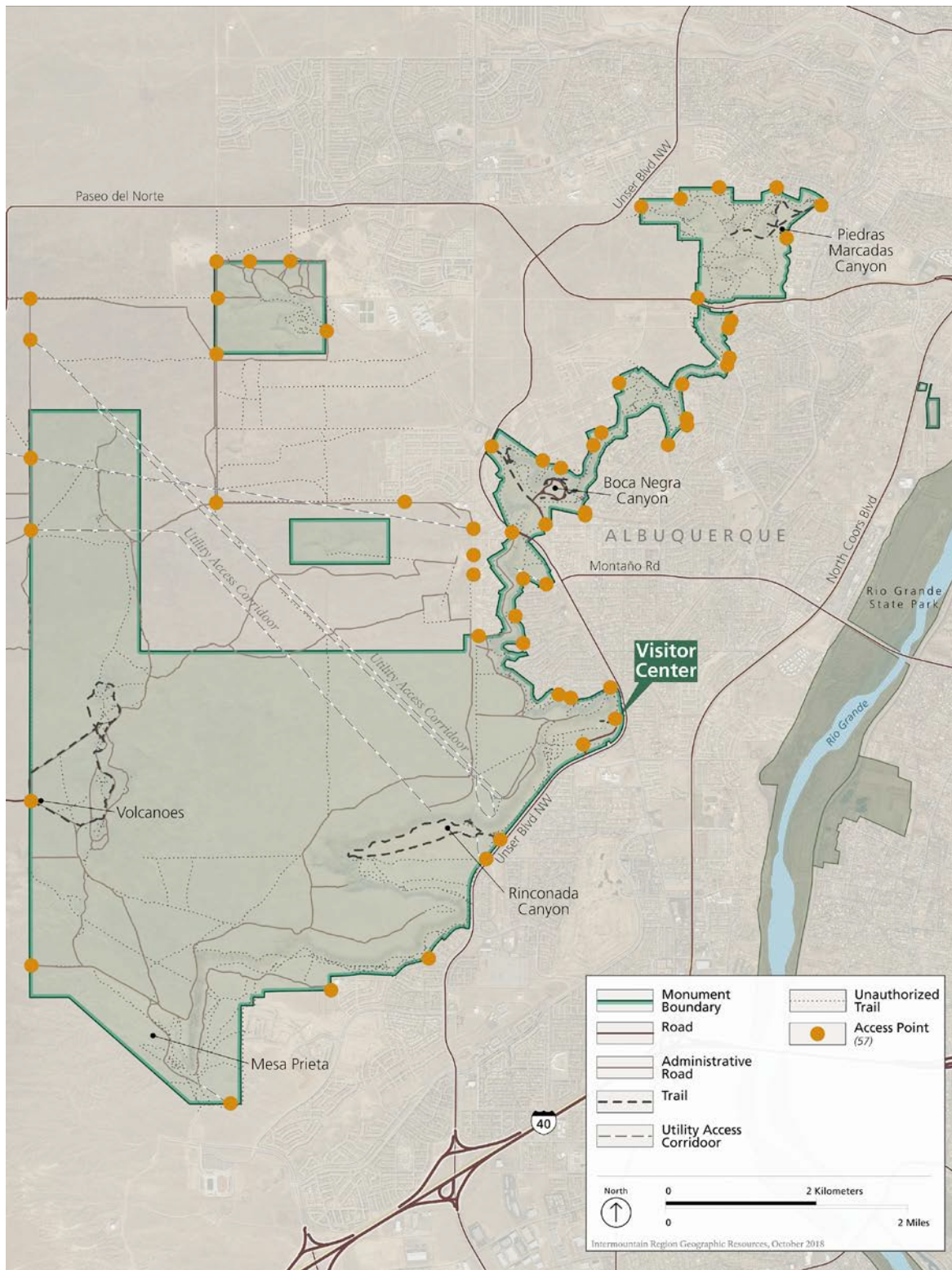


FIGURE 3. ALTERNATIVE 1 NO ACTION—TRAILS AND ACCESS POINTS

Secondary Public Access Points. Secondary access points, mostly located within adjacent residential areas, are typically little more than a gap in the monument’s boundary fence between 18 and 24 inches wide with a monument regulations sign. Some of these access points have parking along roadways that can accommodate a few cars. There would continue to be 52 identified secondary public access points in the monument. More information about amenities that would continue to be provided at these access points is found in chapter 3 of this document under “Visitor Access, Information, and Circulation.”

Closure of Public Access Points. Closure of existing public access points would be evaluated in the future on an ad hoc basis and would be subject to separate site-specific planning and compliance.

Access by Permit Only. The Northern Geologic Window, the Southern Geologic Window, and Piedras Marcadas Pueblo would be accessible by guided tours or as authorized under special use permit or research permit.

EXISTING TRAIL SYSTEM

Visitors would continue to have access to 8 miles of designated trails. In addition, although not specifically authorized, visitors would continue to use 27 miles of administrative roads and 9 miles of utility access corridors.

Designated Trails

Designated trails are those non-motorized trails in the monument that are approved, designed, constructed, and maintained by the National Park Service. There would continue to be approximately 8 miles of designated trails in the monument that would continue to be managed as shown on figure 3 and in appendix B in table B-1.

Trail width would range from 2 feet to 6 feet in most locations.

Of the total 8 miles of designated trails:

- Nearly 6.5 miles would be classified as pedestrian use only with leashed pets allowed.
- About 1.0 mile would be classified as pedestrian use only with no pets allowed.
- About 0.5 mile would be classified as multiuse for pedestrian, leashed pets allowed, and bicycle use.

Escarpment Crossings. While there are a number of visitor-created escarpment crossings and a few escarpment crossings created by utility corridors and roads, only three are designated trails. These three designated trails are within the Boca Negra Canyon area and include the Mesa Point Trail, Upper Boca Negra Canyon Trail, and the Boca Negra Canyon Multiuse Trail. These three designated escarpment trail crossings would be maintained, and road and utility corridor crossings would remain. Visitor-created escarpment crossings would be restored on an ad hoc basis after site-specific analysis.

Access to the Top of Volcanoes. Pedestrian access and leashed dog walking to the top of Black Volcano would continue to be authorized on that designated trail; there would continue to be no authorized access to the top of JA and Vulcan Volcanoes.

Trail Design and Maintenance. The National Park Service would continue to perform repairs and maintenance on designated trails as necessary using sustainable trail principles. A sustainable trail is a

trail that has been designed and constructed such that it does not adversely impact natural and cultural resources and can withstand the impacts of the intended user and natural elements. In addition, a sustainable trail requires only routine maintenance and meets the needs of the intended user to a degree that they do not deviate from the established trail alignment (NPS Natural Resource Management Reference Manual 77).

New and Emerging Trail System Uses. New and emerging uses of the monument would be evaluated using the NPS *Management Policies 2006*, Section 8.1.2 “Process for Determining Appropriate Uses” to determine compatibility with resource protection and visitor experience goals.

Administrative Roads

While not specifically authorized for visitor use, all 27 miles of administrative roads would continue to be used for non-motorized visitor use as follows:

- Pedestrian use (including hiking with dogs on leashes) on all roads
- Bicycling on Mesa Top roads and outside of petroglyph viewing areas (i.e., Rinconada Canyon, Piedras Marcadas Canyon, and Boca Negra Canyon)

These roads would generally be 10 to 20 feet in width.

Unauthorized Visitor-Created Trails and Former Roads

There would continue to be about 96 miles of unauthorized visitor-created trails and former roads crossing the monument. These former roads date prior to the establishment of the monument and are not used for vehicle access. These would continue to be used by those visitors who are aware of them for non-motorized activities such as hiking (including with leashed dogs) and bicycling. Because they are unauthorized, these trails would not be actively managed.

The National Park Service would continue to close these unauthorized visitor-created trails and former roads on a case-by-case basis, as time and funding allows. Trails and former roads to be closed would be obscured and blocked from public access to help avoid continued use. Temporary educational/closure signs may also be placed to discourage use. Once closed, trails and former roads would be reclaimed and revegetated as necessary. The extent of reclamation and revegetation efforts would depend on the specific conditions for each route. Natural recovery by native plant species is preferable to planting or seeding; however, planting or seeding would be used as necessary to prevent unacceptable erosion or resist competition from nonnative invasive species. For trails on slopes, particularly fall line trails, closure may require the addition of material to fill ruts and gullies and reestablish the original surface contour and revegetation to keep the soil from eroding. Design guidelines for trail stabilization, construction, and reclamation, along with best management practices, would be considered during planning and implementation.

For the first year or two after closure, reclamation, or revegetation of trails and former roads, monument staff would check them regularly to identify any new or unforeseen problems and take steps to remedy them. After this initial period, they should be fairly stable. Closed trails and former roads would be monitored until they are revegetated to the point that further management action is not necessary. Temporary closure signs or other materials would be removed when no longer necessary.

Utility Access Corridors

While not specifically authorized for visitor use, all 9 miles of utility access corridors would continue to be used for non-motorized visitor use as follows:

- Pedestrian use (including hiking with dogs on leashes) on all corridors
- Bicycling use on all corridors, except those in petroglyph viewing areas

These utility access corridors would generally 10 to 20 feet in width.

Visitor Educational and Interpretive Opportunities

Monument staff would continue to offer various educational and interpretive programs at the Las Imágenes Visitor Center and at other locations within and outside of the monument. There would be opportunities for ranger-led hikes, guided tours, and self-guided discovery. Opportunities for contemplation and solitude, petroglyph viewing, photography, hiking, bird watching, picnicking, walking leashed pets, study of geological and volcanic processes, wildlife viewing, and other activities would be available. (See chapter 3 of this document under “Opportunities for Visitors to Learn About Important Resources and Stories” for more details.)

Accessibility

Guidelines in the Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA), which include standards for outdoor developed areas issued by the United States Access Board (US Access Board 2014), would be followed when updating facilities, programs, and services provided by the National Park Service and its partners to the greatest extent feasible.

Partnerships

The National Park Service would continue to work cooperatively with the city’s Open Space Division in the administration and management of the monument as directed in the monument’s enabling legislation and in accordance with a Cooperative Management Agreement between the city and the National Park Service. The Cooperative Management Agreement establishes and defines the role of each party and specific responsibilities for the management of the monument. The National Park Service would continue to work with the city and other neighboring land agencies to maintain and improve on providing a range of trail opportunities and connectivity such as maintaining shared parking facilities, constructing and maintaining trails, and securing access points across neighboring lands, where appropriate.

Volunteer Efforts

Volunteers and youth groups would continue to provide a valuable service to the monument by partaking in trail-related work activities, monitoring trail conditions, providing information to visitors, and protecting resources. Currently, the monument uses both group and individual volunteers. Volunteers could be asked to perform basic tasks to help improve the monument trail system as well as educate the visiting public.

ALTERNATIVE 2 (PREFERRED ALTERNATIVE)

Overview

Alternative 2 (NPS Preferred Alternative) would enhance the protection of the monument's natural and cultural resources by providing a more expansive formalized trail system that links local residents and visitors to areas of interest within the monument and provides additional opportunities to learn about and understand important monument resources and stories. This alternative focuses visitor use on walking and hiking, with limited multiuse opportunities (bicycling and hiking together), within the monument to provide for connectivity with existing city trails. This alternative would promote resource conservation and tribal access and traditional uses.

Although this action alternative would address visitor use management within the monument, it does not guarantee that funding and staffing needed to implement the plan will be forthcoming. The implementation of the approved plan will depend on future funding and could be affected by factors such as changes in NPS staffing, visitor use patterns, and unanticipated environmental changes. In addition, unforeseen changes or development on adjacent lands could warrant consideration of adaptive management actions; this plan intends to be flexible to adapt to these changes (i.e., installation of additional monument boundary fencing and associated access). Full implementation could be many years in the future. Once the plan has been approved, more detailed planning and environmental compliance may be needed before certain components of the selected alternative can be carried out (e.g., active restoration or rehabilitation of closed routes, stabilization of trails, trail reroutes, etc.).

Visitor Use Management

As under alternative 1 (no action) the visitor use management goals and objectives described in chapter 1 would continue to be used to help identify future visitor use management strategies needed to achieve resource protection and visitor experience for the monument. In addition, under alternative 2, a comprehensive visitor use management plan would be implemented to maximize opportunities and benefits for visitors while achieving and maintaining goals and objectives for resources and visitor experiences. As part of the plan, the following indicators and thresholds, management strategies, monitoring protocols, and visitor capacities would be implemented to guide visitor use management.

Indicators and Thresholds. Indicators translate goals and objectives of the monument's VUM Plan into measurable attributes (i.e., number of visitor-created trails) that can be tracked over time to evaluate change in resource or experiential conditions. These are a critical component of the VUM framework (IVUMC 2016). The interdisciplinary planning team considered potential issues and developed related indicators that would help identify when a level of impact becomes cause for concern and when management action may be needed. The planning team also reviewed the experiences of other park units with similar issues to identify meaningful indicators. The indicators described below were considered the most critical, given the importance and vulnerability of the resource or visitor experience affected by types of visitor use.

Thresholds represent the minimum acceptable condition for each indicator and were established by considering qualitative descriptions of the goals and objectives, data on existing conditions, relevant research studies, staff management experiences, and scoping of public preferences. Although defined as "minimally acceptable," thresholds still represent acceptable conditions. In addition, establishing thresholds does not imply that no action would be taken prior to reaching the threshold.

Thresholds identify when conditions approach unacceptable levels and accordingly serve as a “line in the sand,” letting managers and the public know that corrective action must be taken to keep conditions acceptable, ultimately allowing goals and objectives to be met and tracked over time.

Indicators, thresholds, associated management strategies, and mitigation measures would be implemented because of this planning effort and are described below. The planning team arrived at the following six indicator topics that would translate the goals and objectives into measurable attributes that could be tracked over time (tables 1a – 1f):

- Damage to petroglyphs, archeological sites, and ethnographic resources
- Solitude and natural quiet within Mesa Prieta and the inner canyons of Rinconada and Piedras Marcadas
- Quality of the visitor experience
- Visitor-created trails
- Trail conditions
- Unauthorized resource-related activity

Visitor use management is an iterative process in which management decisions are continuously informed and improved. Indicators are monitored, and adjustments are made as appropriate. As monitoring of conditions continue, managers may decide to modify or add indicators if better methods are found to measure important changes in resource and experiential conditions. Monitoring indicators helps monument staff determine the most effective way to manage visitor use to attain desired visitor experiences and resource conditions. Management strategies identified in tables 1a through 1f are either already included in this action alternative because they are needed now or would be implemented in the future if warranted because conditions were approaching threshold levels.

Table 1a. Indicators and Thresholds for Resource or Experiential Conditions—Damage to Petroglyphs, Archeological Sites, and Ethnographic Resources

MONITORING STRATEGY		DAMAGE TO PETROGLYPHS, ARCHEOLOGICAL SITES, AND ETHNOGRAPHIC RESOURCES	
Indicator		Number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of site erosion or compaction) adjacent to the trail system or disruption of tribal access or traditional uses.	
Threshold		No more than five documented incidents of damage to petroglyphs and archeological sites impacted by visitor activity adjacent to the trail system in a given year or disruption of tribal access or traditional uses.	
Rationale for Indicator and Threshold		Damage to petroglyphs and archeological sites can occur through both intentional and unintentional means. Both can cause impacts that influence the integrity of these resources. Continued and increasing visitor use and the resulting deterioration of trail conditions coupled with increased erosion could cause adverse impacts to petroglyphs and archeological sites. The indicator selected would be sensitive to capture activity around the volcanoes, which would potentially be open for hiking and access. The volcanoes, escarpment, and geological windows are areas of cultural sensitivity and traditional use. Given that these traditional uses can be disrupted, this indicator would capture social impacts to cultural experiences. The monument’s archeological resources, petroglyphs, and historical sites are nonrenewable resources, and, as a result, thresholds are set low.	
Monitoring		Continue to record incidents of vandalism or theft. Review incident reports on a yearly basis. Strongly advertise that visitors report and help monitor any harmful activities, theft, or damage to archeological sites. Conduct condition assessments on at least 10% of archeological sites a year. Request reports from traditionally associated pueblos and tribes on any disruptions to their activities. A monitoring protocol would be developed to include mechanisms and standard procedures for monitoring.	

MONITORING STRATEGY	DAMAGE TO PETROGLYPHS, ARCHEOLOGICAL SITES, AND ETHNOGRAPHIC RESOURCES
Management Strategies and Mitigation Measures	<ul style="list-style-type: none"> ▪ Continue monitoring and have a higher frequency of condition assessments completed in sensitive areas with high visitor use (as recorded by trail counters). ▪ Conduct archeological condition assessments and implement recommendations for monitoring and stabilization of sites. ▪ Establish a site steward program. ▪ Consult with cultural resource subject matter experts to conduct damage analyses. ▪ Educate visitors and the community on the sensitivity of resources and the need to protect prehistoric and historic sites, including messaging through signage. ▪ Educate groups that are accessing areas with sensitive cultural resources on appropriate behaviors. ▪ Increase ranger presence or patrol, enforcement, and documentation. ▪ Consider rerouting trails to avoid impacts to sensitive cultural resources. ▪ Create physical barriers to separate visitors from sensitive resources. ▪ Consider area closures only after a range of management strategies have been implemented and not effective. ▪ Increase volunteers with the Trail Watch program. ▪ Consider installing viewscopes in certain areas along trails to enhance viewing of petroglyphs and other features located off the trail. ▪ Establish more regular communication with tribal representatives to protect areas important for traditional use and practices.

Table 1b. Indicators and Thresholds for Resource or Experiential Conditions—Natural Soundscapes

MONITORING STRATEGY	NATURAL SOUNDSCAPES
Indicator	Increase in sound level above natural ambient at locations in Rinconada Canyon, Piedras Marcadas Canyon, and Mesa Prieta. The metric used at each site is a comparison between a median ANS-weighted sound pressure level (ANSI-S3 2014) and a previously measured median natural ambient (Rapoza et al. 2014) with the same weighting. Only daytime hours (6 a.m. – 6 p.m.) would be compared.
Threshold	Median daily sound levels (L_{50}) will not exceed natural ambient by more than 3 decibels (dB) for 90% of the daytime hours (6 a.m. – 6 p.m.) measured during a 30-day monitoring period in winter and summer. In other words, for a 30-day monitoring period, only 3 days can exceed natural daytime ambient by 3 dB.
Rationale for Indicator and Threshold	<p>Rinconada Canyon, Piedras Marcadas Canyon, and Mesa Prieta are areas in the monument for visitors to experience solitude and natural quiet. These sites are removed from the nearby city or other developed areas.</p> <p>A common measurement of an acoustic environment is sound pressure level (SPL). SPL is a logarithmic measure of pressure relative to a reference value and referred to as decibels or dB. ANS-weighted sound pressure level ($L_{A,NS}$) is a mathematical adjustment to better align it with the sensitivity of human hearing and filtered to exclude sound energy above 1 kHz octave band. The metric can therefore be used to characterize sound levels with respect to anthropogenic noise and be used to better relate to functional effects (particularly those related to relative intensity, or loudness) of human hearing.</p> <p>National parks such as Zion, as well as the NPS Natural Sounds and Night Skies Division (NSNSD), rely on various metrics that capture different dimensions of the acoustic environment. One indicator of a change in the acoustic quality for local conditions is an increase in sound pressure level over natural ambient. Natural ambient is composed of the natural sound conditions in a park that exist in the absence of any anthropogenic noise (e.g., mechanical, electrical, and other non-natural sounds). Different from these previous examples, the indicator used in this situation incorporates a new weighting function more appropriate for protected areas (ANSI 2014).</p> <p>The addition of noise to natural ambient reduces the ability of a listener to hear sounds, known as a reduction in listening area. This ‘reduction of listening area’ for humans and animals alike occurs most</p>

MONITORING STRATEGY	NATURAL SOUNDSCAPES
	<p>dramatically at the same frequency range of the noise but also reduces other frequency ranges as well through upward spread of masking. For example, transportation noise generally ranges from 100 – 800 (Hz) and therefore is extremely effective at masking natural sounds and human conversation in this range but has a lesser impact on higher frequency sounds, such as bird songs, that generally range from 1,000 – 10,000 (Hz). However, when conducting a masking analysis, it is impossible to determine the degree of masking from A-weighted sound levels (ANSI 2005). Therefore, as a general rule, an increase of 3 dB over baseline conditions (in this case natural ambient) to reduce listening area by 50% is considered. For example, if the natural ambient is 30 dB and transportation noise raises the ambient to 33 dB (a 3 dB increase), the listening area for humans (and many birds and mammals) is reduced by 50%. Increasing the ambient an additional 3 dB (to 36 dB) would reduce the listening area by half again, to 25% of the initial area.</p>
Monitoring	<p>The Acoustical Monitoring Report for Petroglyph National Monument (Rapoza et al. 2014) reports data from monitoring in the summer of 2010 and winter of 2012. Two sites were monitored: Rinconada and Volcano Vista (see table 5 of the Rapoza report for latitude and longitude). The results from this study included both existing ambient and natural ambient segmented by summer and winter (see table 7 in the Rapoza report).</p> <p>The results from this study suggest that noise is increasing the natural ambient of the sites. Results from the study revealed that the existing daytime ambient sound level at Rinconada in the summer of 2010 was 33 dBA and natural ambient was 30 dBA (n = 29 days). Daytime winter conditions (2012) at Rinconada were 31 dBA for existing and 28 dBA for natural ambient (n = 34). Daytime conditions at Volcano Vista were slightly more influenced by noise with summer (2010) existing conditions at 31 dBA and natural ambient at 26 dBA. Daytime winter conditions at Volcano Vista were 31 dBA for existing ambient and 27 dBA for natural ambient. It is important to note that these results are the medians over the whole 30-day period and not daily medians suggested for measuring thresholds. Further, these medians are A-weighted rather than ANS-weighted, as suggested for future monitoring and threshold establishment.</p> <p>The existing daytime noise sources at Rinconada Canyon in the summer of 2010 were fixed-wing aircraft and helicopter (15%), other aircraft (39%), and other human (1%). At Rinconada Canyon in the winter of 2012, the noise sources were fixed-wing aircraft and helicopter (27%), other aircraft (20%), and other human (6%). The results at Volcano Vista for daytime levels were similar in summer of 2010 with values of fixed-wing aircraft and helicopter (31%), other aircraft (18%), and other human (4%). The winter of 2012 had slightly improved results: fixed-wing aircraft and helicopter (28%), other aircraft (12%), and other human (2%).</p> <p>The park is interested in the acoustic environment at Rinconada Canyon, Piedras Marcadas Canyon, and Mesa Prieta. The existing conditions stated above only provide conditions at Rinconada Canyon and not at Piedras Marcadas Canyon and Mesa Prieta; therefore, baseline conditions at these sites need to be measured.</p> <p>Future monitoring of conditions should follow the methods, procedures, and analysis outlined in the Rapoza et al. (2014) report with some modifications for daily medians and ANS frequency weighting. Monitoring should be conducted at each site for a minimum of 30 days at the same locations at all three sites. Monitoring should be conducted once a year (either winter or summer) every five years.</p>
Management Strategies and Mitigation Measures	<ul style="list-style-type: none"> Consider identifying and designating a portion of Mesa Prieta, and the inner canyons of Rinconada and Piedras Marcadas or specific area of the canyons as "Quiet Zone/Area." These areas could be identified on maps, through signage, or interpretation. Visitors would be encouraged to be quiet enough to hear natural sounds in these areas. This would include encouraging visitors to be respectful of others by not shouting, yelling, having loud conversations, or producing other excessive noise. Provide interpretation and education about prehistoric and historic eras, natural soundscapes, and acoustic environments. Provide guided walks or interpretive programs with listening exercises. Provide information in monument newsletters or on websites about the importance of the natural soundscape Continue to minimize noise generated by monument management activities by minimizing NPS administrative uses of noise producing equipment.

MONITORING STRATEGY	NATURAL SOUNDSCAPES
	<ul style="list-style-type: none"> Continue to collaborate with adjacent property owners and local, state, and federal agencies as well as organizations on the following: <ul style="list-style-type: none"> Work with adjacent landowners, developers, inholders, Bernalillo County, and the City of Albuquerque to mitigate impacts of sources of noise originating from those lands. Continue working with staff from Double Eagle II Airport to reduce noise that may impact the monument. Work with the Federal Aviation Administration's Flight Standards District Office at the local level to limit increases in overflight noise. If air tour noise becomes a problem, work with NSNSD to submit a request to withdraw from exemption and begin work with the FAA and NSNSD to develop an air management agreement in accordance with Public Law 106-181.

Table 1c. Indicators and Thresholds for Resource or Experiential Conditions—Quality of Visitor Experience

MONITORING STRATEGY	QUALITY OF VISITOR EXPERIENCE
Indicators	<p>Indicator (1): Number of reasonable visitor complaints related to trail experiences within the monument.</p> <p>Indicator (2): Percent of visitors satisfied with the monument's facilities, trailheads, trail system, the Las Imágenes Visitor Center, and interpretative programs.</p>
Thresholds	<p>Threshold (1): No more than 20 reasonable complaints related to trail experiences within the monument each year.</p> <p>Threshold (2): 90% of visitors responding to the annual visitor satisfaction survey are satisfied within the categories of monument facilities and interpretive programs.</p>
Rationale for Indicators and Thresholds	<p>The rationale for these indicators and thresholds is that together they represent the quality of the visitor experience. The number of visitor complaints related to monument experiences is inclusive of the number of complaints related to off-leash pet encounters. Pets off-leash is a common visitor complaint and can be disruptive to the visitor experience.</p>
Monitoring	<p>Monument trailhead and trail counter data would be used to monitor the number of people accessing the monument through primary and secondary access locations. Visitors' complaints, regarding monument trails, would be logged, reviewed, and considered. Criteria would be developed to define reasonable complaints. A monitoring protocol would be developed to include mechanisms and standard procedures for monitoring. The annual visitor satisfaction survey would be used to monitor visitor satisfaction. Trail Watch volunteers would also be engaged to provide feedback to the monument's management team. Monument staff would also monitor foot traffic through secondary access points via trail counter data to better understand visitor and residential access and identify high use areas.</p>
Management Strategies and Mitigation Measures	<ul style="list-style-type: none"> Incorporate frontcountry 'Leave No Trace' messaging into media and communications. Install or improve trailhead visitor facilities (i.e., shade structures, benches, information kiosks), where appropriate. Provide dog waste pick-up bag stations at trail access locations to encourage clean-up of pet waste. Provide educational materials at trailheads. Implement cyclic maintenance activities such as routine clearing of brush along trails, maintaining post and cable and other delineating trail structures, and minor trail repairs. Communicate and coordinate with adjacent residents and communities. Conduct regular patrols of high use trails/areas, and clean-up items not properly disposed of.

Table 1d. Indicators and Thresholds for Resource or Experiential Conditions—Visitor-Created Trails

MONITORING STRATEGY		VISITOR-CREATED TRAILS
Indicator		Number of new visitor-created trails leaving the formalized trail system.
Threshold		No additional visitor-created trails annually in excess of 50 lineal feet.
Rationale for Indicator and Threshold		The indicator helps to determine the frequency of the visitor-created trails used and whether some are more widely used than others. The threshold is based on the sensitivity of a resource, amount of use, and tolerance of impact.
Monitoring		Evaluate the presence of new visitor-created trails leaving the formalized trail system. A monitoring protocol would be developed to include mechanisms and standard procedures for monitoring.
Management Strategies and Mitigation Measures		<ul style="list-style-type: none"> ▪ Evaluate visitor-created trails to determine appropriate management action. ▪ Minimize the number of visitor-created trails that are culturally and ecologically harmful. ▪ Formalize visitor-created trails as designated trails, as appropriate. ▪ Close and rehabilitate unacceptable routes using signage and brushing visible portions of visitor-created trails. ▪ Educate visitors about sensitive resources and staying on trails, and promote trail stewardship. ▪ Educate and work with neighborhood associations and residents to better communicate trail information. ▪ Improve trail identification and signage, and regularly maintain designated trails. ▪ Provide waysides and kiosks with information about the trail system. ▪ Use site management/design such as constructing boardwalks, adding viewscopes, rails, borders, and post and cable to improve delineation of designated trails and discourage off-trail travel. ▪ Consolidate duplicative access points. ▪ Expand the Trail Watch program and increase the number of Trail Watch volunteers.

Table 1e. Indicators and Thresholds for Resource or Experiential Conditions—Trail Conditions

MONITORING STRATEGY		TRAIL CONDITIONS
Indicators		<p>Indicator (1): Percent change in trail width.</p> <p>Indicator (2): Percent change in trail depth.</p>
Thresholds		<p>Threshold (1): No more than 25% increase in width.</p> <p>Threshold (2): No more than 25% increase in depth.</p>
Rationale for Indicators and Thresholds		With the establishment of a comprehensive formalized trail system, these indicators would ensure the trail conditions remain consistent over time. These indicators also account for soil compaction from trampling and expansion from soil moisture. Each can be indicative of high use on particular trails or that the trail design is not effective. Each indicator was also selected based on their ease of measurement, cost-effectiveness, and ability to provide useful data and results any time of day or year.
Monitoring		Establish baseline conditions using point sampling for trail width and depth. A monitoring protocol will be developed to include mechanisms and standard procedures for monitoring.
Management Strategies and Mitigation Measures		<p>Strategies to manage trail widening:</p> <ul style="list-style-type: none"> ▪ Establish trail borders with rocks, logs, post and cable, or fencing to narrow trail width. ▪ Encourage and educate trail users to stay toward the center of the trail. ▪ Notify trail users of areas of muddiness, erosion, and excessive rockiness to contain the lateral spread of traffic in affected areas. Messaging strategies would be developed and might include posted signs at trailheads and the visitor center, and/or alerts on the monument's website.

MONITORING STRATEGY	TRAIL CONDITIONS
	<ul style="list-style-type: none"> ▪ Many of the trails would follow existing administrative roads. Travel by monument staff on administrative roads after a heavy rain would be discouraged to minimize widening and deepening of roads/trails. ▪ Strategies to manage excessive soil loss: ▪ Incorporate sustainable trail (re)design. ▪ Consider minor reroutes. ▪ Harden treads through the application of gravel or rockwork. ▪ Install boardwalks. ▪ Install sand ladders or rock steps when grades are steep. ▪ Incorporate periodic grade reversals within steeper treads that may carry water. ▪ Incorporate water bars, swales, and outsloped treads. ▪ Construct drainage control structures, if needed. ▪ Install jute fabric or other erosion control mechanisms. ▪ Consider mulch, seeding, and revegetation. ▪ Establish temporary trail closures for resource protection or safety.

Table 1f. Indicators and Thresholds for Resource or Experiential Conditions—Unauthorized Resource-Related Activity

MONITORING STRATEGY	UNAUTHORIZED RESOURCE-RELATED ACTIVITY
Indicator	Number of incidents of unauthorized resource-related activity (i.e., off-road driving, dumping, vandalism, off-leash pets, etc.).
Threshold	No more than six recorded incidents of unauthorized resource-related activities a month.
Rationale for Indicator and Threshold	<p>Unauthorized resource-related activities may become a primary safety concern for visitors and monument staff, and protection of the monument's resources.</p> <p>This threshold is based on the following recommendation. The law enforcement data for the number of resource-related incidents in 2016 was about 100 with a monthly average of about eight incidents. The threshold would be set at six recorded resource-related incidents of unauthorized activity a month so the monument can strive to decrease unauthorized activities.</p>
Monitoring	The monument's law enforcement rangers document incidents. A monitoring protocol would be developed to include mechanisms and standard procedures for monitoring.
Management Strategies and Mitigation Measures	<ul style="list-style-type: none"> ▪ As the threshold is approached (four to five incidents a month), conduct assessments of areas to determine primary causes of unauthorized activities. ▪ Increase law enforcement patrols oriented towards education. ▪ Maintain the integrity of the monument's boundary fence. ▪ Install boundary fencing as appropriate. ▪ Install additional signage delineating property lines. ▪ Consider area closures only after a range of management strategies have been implemented and not effective. ▪ Train Trail Watch volunteers to assist with recording incidents and disseminating information about low-impact trail use and appropriate visitor behavior.

Visitor Capacity at Key Areas.

Overview—Visitor capacity is a component of visitor use management defined as the maximum amount and types of visitor use that an area can accommodate while sustaining desired resource conditions (i.e., goals and objectives for this plan) and visitor experiences, consistent with the purpose for which the area was established. Visitor capacity would be used to inform and implement the management strategies selected as part of this VUM Plan and are common to both action alternatives.

By establishing and implementing visitor capacities, the National Park Service can help ensure that resources are protected and that visitors have the opportunity for a range of high-quality experiences. The monument has no prior identification of visitor capacity. Through this planning effort, the monument has an important opportunity to proactively identify capacity and, therefore, safeguard the highly valued experiences and resources throughout the park unit. The following section outlines the considerations and process used to identify visitor capacity.

General Process for Identifying Visitor Capacities.

Visitor capacities were identified using best practices and examples from other plans and projects across the National Park Service. The approach for identifying visitor capacities is based on the Interagency Visitor Use Management Council's Visitor Use Management Framework (IVUMC 2016) and associated publications and is consistent with the literature and best practices on this topic. Based on these best practices, the planning team describes the process for identifying capacity with the following steps: 1) determine the analysis area, 2) review existing direction and knowledge, 3) identify the limiting attribute, and 4) identify visitor capacity.

Guideline 1. Determine the Analysis Area —

Petroglyph National Monument Context. The amount, timing, and distribution of visitor use at the monument influence both resource conditions and visitor experiences. Currently, there is high demand for outdoor activities and moderate levels of use within the monument, particularly between the months of March and October on a largely nonformalized trail system. Visitors arrive in a variety of ways including by personal vehicle, alternative transportation, bicycles, and walking through neighborhood access locations. The levels and patterns of visitor use can create conflict among the types of visitor use and experience and may cause adverse impacts to cultural and natural resources. These impacts influence the ability of the National Park Service to maintain and achieve goals and objectives. Appropriate management strategies can be selected and implemented to maintain and achieve goals and objectives and visitor experiences consistent with the purposes for which the monument was established.

Analysis Areas. To determine the analysis area, the monument staff and planning team considered the most meaningful geographic areas to understand the relationship between existing and potential visitor use patterns as well as goals and objectives for the VUM Plan. Key areas were selected as destinations where high levels of use are currently or projected to cause impacts to natural and cultural resources and visitor experiences and are related directly to goals and objectives. For these key areas, a detailed analysis has been conducted to identify visitor capacity. The visitor capacities would be used to implement management strategies for these sites as part of the VUM Plan. Eight key areas were identified and are listed below. Three other areas, the Southern Geologic Window, the Piedras Marcadas Pueblo, and the narrow area of the monument north of Boca Negra Canyon and south of Paseo del Norte, are outside of the key areas and are also discussed (appendix C).

Key areas include:

- Las Imágenes Visitor Center
- Boca Negra Canyon
- Piedras Marcadas Canyon
- Rinconada Canyon
- Mesa Prieta
- Volcanoes
- Mesa Top
- Northern Geologic Window

For each location, an overview of the analysis area is included in “Chapter 3: Affected Environment” in the Visitor Use and Experience section.

Guideline 2. Review Existing Direction and Knowledge—

During this guideline, the planning team reviewed goals and objectives, indicators and thresholds, and paid particular attention to conditions and values that must be protected and are most related to visitor use levels. Goals and objectives of key areas can be found in “Chapter 1: Visitor Use Management Goals and Objectives.” Analysis of the key areas, including relevant indicators and thresholds, visitor use issues, and current use levels is described in more detail in appendix C.

In addition, the action alternatives were assessed for the primary differences related to the amounts, timing, distribution and types of use. The primary differences for visitor use issues between the two alternatives includes a comprehensive multiuse (hiking, dog walking, and bicycling) trail in alternative 3; while alternative 2 primarily provides for pedestrian visitor use experiences (hiking and dog walking). Given the purpose and need for the plan, the differences in the alternatives do not suggest the need to look at different capacities. Therefore the visitor capacity was established based on consideration of the elements in both action alternatives, and the goals and objectives established for the VUM Plan based on the monument’s fundamental resources and values specific to the cultural and natural resources.

Guideline 3. Identify the Limiting Attribute—

Guideline 3 requires the identification of the physical, biological, cultural, social (visitor experience), or managerial attribute(s) that most constrains the analysis area’s ability to accommodate visitor use. The limiting or constraining attribute(s) may vary across the analysis area and is described under each key area under the heading “Limiting Attribute and Relevant Indicators” (appendix C). This is an important guideline given that a key area could experience a variety of challenges regarding visitor use issues, however there will be only one that is the most limiting or sensitive for determining the amount of use that the analysis area can accommodate which could be related to the physical, biological, cultural, social (visitor experience), or managerial attribute.

Guideline 4. Identify Visitor Capacity—

To identify the appropriate amount of use at key areas, outputs from previous guidelines were reviewed to understand current conditions compared to goals and objectives for the area. Visitation data that is collected monthly by monument staff to track levels of visitor use throughout the monument and by area was used as a data source. The National Park Service also collects monthly data including counts of fees, parking availability, trail counts, and other data sources. The monument has employed the use of passive infrared trail counters at several locations throughout the park. This data can be reported in a variety of aggregates such as daily, weekly, monthly, or annually. Where necessary, approximations have been made. For example, a person-per-vehicle

(PPV) multiplier has been used to estimate the average number of people who come to a site by private vehicle. While some vehicles may include more or less people than the multiplier used, it represents an average. The monument's PPV multiplier is a factor of 2.5. If a site does not include delineated parking spaces, estimates have been made assuming vehicles will park perpendicular to the edge of the parking area.

Additionally, third party sourced data from StravaMetro was also used to identify visitor capacity. StravaMetro is a social media application that allows users, to track their activities and share with their friends and network by uploading rides, runs, and walks. StravaMetro capitalizes on the millions of uploads, anonymizes and aggregates the data, for use in transportation and recreation planning to improve infrastructure for bicyclists and pedestrians. StravaMetro data enables deep analysis of cyclist and pedestrian activity including popular or avoided routes, peak commute times, intersection wait times, and origin/destination zones. StravaMetro processes this data for compatibility with geographic information system (GIS) environments. For the purposes of identifying visitor capacity at the monument, the following types of StravaMetro data was used: number of trips, trips per unique user (or individual), and number of unique users. The monument staff and interdisciplinary team considered StravaMetro data to represent only about 1% of monument users. The StravaMetro data was aggregated and considered.

The table below summarizes the identified visitor capacity for analysis areas at Petroglyph National Monument (table 2). For all the details and rationale for each identified visitor capacity, please see appendix C.

Table 2. Identified Visitor Capacity for Analysis Areas

Analysis Area	Identified Visitor Capacity
Las Imágenes Visitor Center	225 People At One Time (PAOT)
Boca Negra Canyon	180 PAOT
Piedras Marcadas Canyon	600 People In One Day (PIOD)
Rinconada Canyon	600 PIOD
Mesa Prieta	240 PIOD
Volcanoes	325 PIOD
Mesa Top	300 PIOD

Public Access Points

Under alternative 2, the number of public access points in the monument would be reduced from 57 to 30.

Primary Access Points. The five access points described under alternative 1 (no action), would continue to exist. In addition, one new primary access point would be established at the southernmost tip of the monument near the Mesa Prieta area and would include a parking area, shade shelter, kiosk, trash and recycling, dog waste bags, and potentially a comfort station.

Secondary Access Points. Secondary access points would be reduced from 52 to 24. These include 12 below the escarpment and 12 above the escarpment on the Mesa Top (figure 4). From every secondary access point, there would be a designated trail leading to the monument's formalized trail system, either below or above the escarpment.

Closure of Public Access Points. Of the 52 existing secondary access points, 27 would be closed and restored, similar to rehabilitation of visitor-created trails. One access point would be designated as a primary access point as mentioned above.

Access by Permit Only. Actions would be the same as described under alternative 1 (no action).

Formalized Trail System

The proposed 39-mile formalized trail system would be comprised of the 8 miles of existing designated trails, 20.5 miles of visitor created trails and former roads that would be converted to designated trails, 9 miles of the administrative roads, and 1.5 miles of the utility access corridors that would be specifically authorized for non-motorized visitor use. It would include new short connector trails, escarpment crossings, and short reroutes. The remaining 18 miles of administrative roads and 7.5 miles of utility access corridors would not be open for visitor use and would not be maintained as part of the formalized trail system.

Designated Trails. Under alternative 2, the 8 miles of designated trails listed in appendix B in table B-1 under alternative 1 (no action) would remain; however, the type of use is different for the Rinconada Canyon Trail and in the Volcanoes area (appendix B). In addition, approximately 31 miles of proposed trails would be added to the formalized trail system as shown in appendix B in tables B-2 and B-3.

As under alternative 1 (no action), trail width would range from 2 feet to 6 feet in most locations.

Of this total 39-mile formalized trail system (figure 4):

- Nearly 34.5 miles would be classified as pedestrian use only with leashed pets allowed.
- About 2.5 miles would be classified as pedestrian use only with no pets allowed.
- About 2 miles would be classified as multiuse for pedestrian and bicycle use.

Escarpment Crossings. In addition to the three designated escarpment crossing trails identified under alternative 1 (no action), there would be an additional 10 designated escarpment crossing trails. From north to south of the monument, these include three in Piedras Marcadas Canyon, two between the area south of Paseo del Norte and north of Boca Negra Canyon, three in the Santa Fe Village area, one near the visitor center, and one in the Mesa Prieta area (see figure 4 and table B-3 in appendix B).

Access to the Top of the Volcanoes. Pedestrian access would continue to be authorized to the top of Black Volcano on that designated trail. In addition, access to the top of JA Volcano would be formalized with a designated trail. There would continue to be no authorized access to the top of Vulcan Volcano. There would be no dogs allowed to the tops of Black and JA Volcanoes.

Trail Design and Maintenance. The trail system under this action alternative would be designed and managed using sustainable trail principles as described under alternative 1 (no action).

Although a number of visitor-created trails and old roads have been selected for integration into the monument trail system as noted above, no determination has been made about specific improvements needed to ensure trail sustainability. In general, however, the following types of actions would be taken:

- Stabilizing existing trails as needed.
- Implementing minor trail reroutes to improve poor design and mitigate resource concerns.
- Employing specialized construction methods (e.g., steps, check dams) to improve stability and durability of the trail and reduce erosion in locations where rerouting is undesirable or impractical.

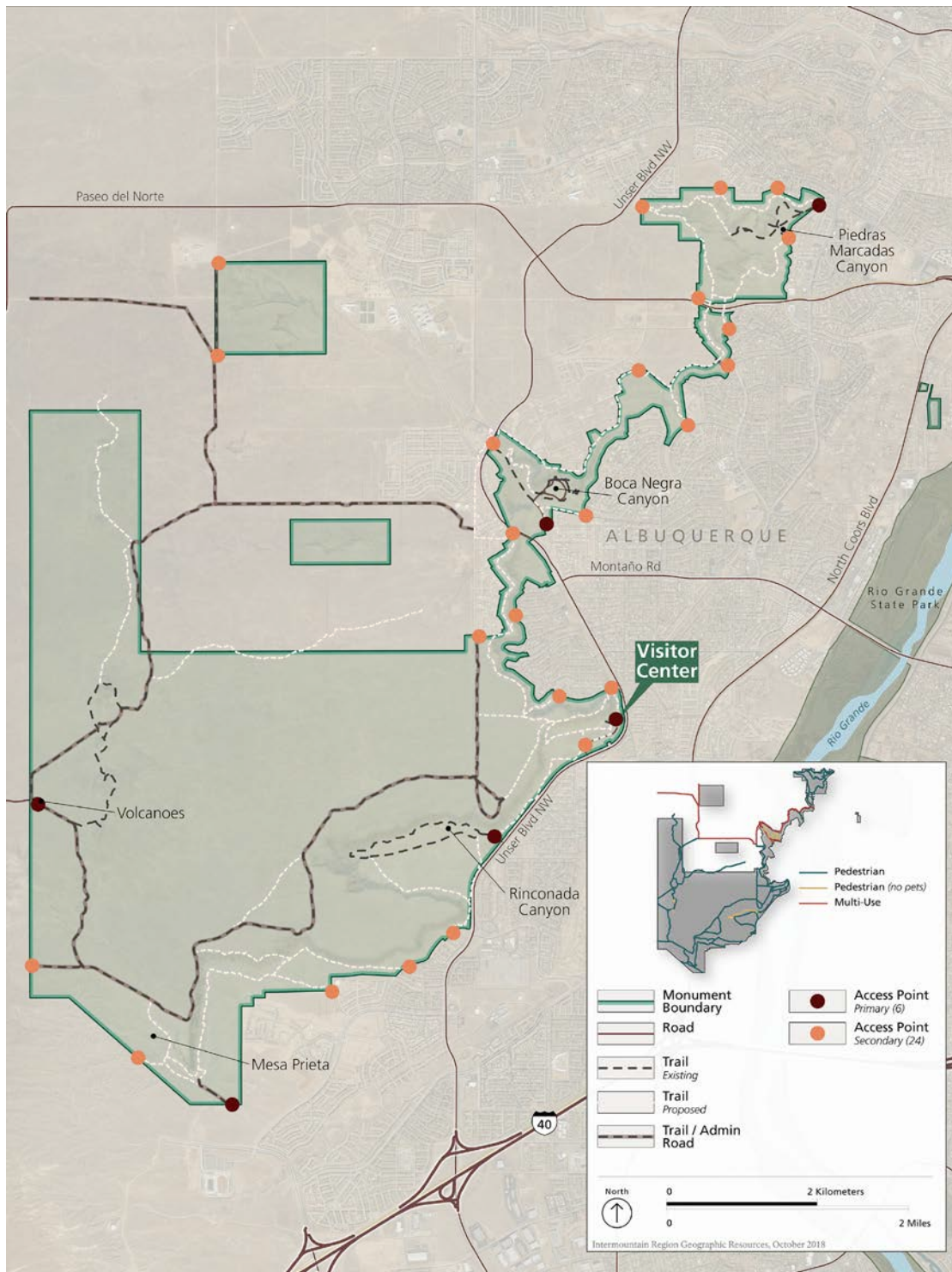


FIGURE 4. MAP OF ALTERNATIVE 2 FORMALIZED TRAIL SYSTEM AND ACCESS POINTS

All new trail construction (including connector trails, escarpment crossings, and reroutes) would be completed using sustainable design principles. Examples of sustainable practices include side hill alignments, cross slope alignment (generally perpendicular to the slope or fall line), relatively gentle trail grades, short dips in the trail called grade reversals that drain water, and an outsloped tread that angles slightly toward the outside edge. Soil and rock material from within the monument or from approved sources outside of the monument would be used as fill in repairing trails and administrative roads.

For the first year or two after stabilization, rerouting, or construction of trails, monument staff would check the trails regularly to identify any new or unforeseen problems and take steps to remedy them. After this initial period, the trails should be fairly stable. Maintenance crews would then transition into a cyclic maintenance program for trail system upkeep.

Administrative Roads. About 9 miles of the existing 27 miles of roads in the monument would be authorized for administrative motorized use and would be maintained and used by NPS law enforcement, facilities management, and resource management staff on an occasional basis. These 9 miles of administrative roads make up about a quarter of the formalized trail system. The remaining 18 miles of roads would be closed to visitor use and used only when it is determined necessary to conduct specific project work, for safety and security purposes, or other approved requests; some may be restored after evaluation.

All 9 miles would be authorized for non-motorized visitor use as follows:

- Pedestrian use (including hiking with dogs on leashes).

About 1 of the 9 miles of primary administrative road would be authorized to non-motorized visitor use as follows:

- Bicycling would continue to be allowed on the north-south road along the western edge of the Northern Geologic Window to maintain access to the Paseo de la Mesa multiuse trail on city land.

As under alternative 1 (no action), these roads would generally be up to 20 feet in width.

Utility Access Corridors—The existing 9 miles of utility access corridors would remain. Four short segments of utility access corridors would become part of the formalized trail system. These include 1) a short corridor just south of Paseo del Norte (multiuse); a short corridor in Rinconada Canyon (pedestrian use with leashed pets authorized); a short corridor at the southern end of the monument (pedestrian use with leashed pets authorized); and, a short corridor on the Mesa Top above Rinconada Canyon (pedestrian use with leashed pets authorized). Combined, these short corridors equal about 1.5 miles of utility access corridors that would be part of the formalized trail system. The remaining 7.5 miles of existing utility access corridors would not be used for pedestrian use.

Unauthorized Visitor-Created Trails and Former Roads. There would be about 93.5 miles of unauthorized visitor-created trails and former roads crossing the monument that would not be part of the 39 miles comprising the proposed formalized trail system, primary administrative roads, and utility access corridors. These routes would continue to be unsustainable, redundant, and/or poorly aligned. Because of these conditions, these trails and former roads would be closed and reclaimed and potentially revegetated in the same manner described under alternative 1 (no action).

New and Emerging Trail System Uses. New and emerging trail system uses would be treated as described under alternative 1 (no action).

Visitor Educational and Interpretive Opportunities

The educational and interpretive programs identified under alternative 1 (no action) would continue to be implemented. In addition, adequate and effective directional information and education of visitors would be implemented to ensure a safe and enjoyable experience and reduce adverse resource impacts. For example, information on kiosks, trail signs identifying routes and distances, brochures, or other media would be used to provide information and orientation to visitors and to communicate a clear rationale for trail closures and the importance of remaining on designated trails. Both monument staff and volunteers would be involved in this effort to inform and educate visitors. Monument staff would maintain their presence within the monument to help remind the public of the rules regarding to staying on the trail, not touching the petroglyphs, etc. In a future endeavor, the National Park Service would develop a comprehensive interpretive plan to specifically address a broader education effort for the monument.

Accessibility, Partnerships, Volunteer Efforts

Actions would be the same as described under alternative 1 (no action)

ALTERNATIVE 3

Overview

As with alternative 2, alternative 3 would provide diverse visitor experiences and monument access while ensuring the consideration and protection of the cultural and natural resources within the monument. However, relative to alternative 2, this would be accomplished by designating additional trails as multiuse throughout the monument.

As described under alternative 2, although this action alternative would address visitor use management within the monument, it does not guarantee that funding and staffing needed to implement the plan will be forthcoming, and implementation would depend on a number of factors.

Visitor Use Management

Actions taken would be the same as described under alternative 2.

Visitor Educational and Interpretive Opportunities. Actions taken would be the same as described under alternative 2.

Public Access Points

Actions taken would be the same as described under alternative 2.

Access By Permit Only. Actions would be the same as described under alternative 2.

Formalized Trail System

Similar to alternative 2, the proposed 39-mile trail system would be comprised of the 8 miles of existing designated trails, all 9 miles of primary administrative roads, about 1.5 of the existing 9 miles of utility access corridors, and about 20.5 miles of a combination of visitor-created trails and old roads. It would include new short connector trails, escarpment crossings, and short reroutes.

Designated Trails. Under alternative 3, the 8 miles of designated trails described under alternative 2 would remain, however the type of use is different in the Volcanoes area (see appendix B, table B-4).

Approximately 31 miles of proposed trails identified under alternative 2 (see appendix B, table B-3) would be added to the formalized trail system. Of these proposed trails, the type of use for the escarpment crossings is the same as described in alternative 2; however, the type of use for the Mesa Top Trails and Below Escarpment Trails is different from alternative 2 and is described in table B-5 in appendix B.

Of the 39 miles of formalized trails (figure 5):

- Nearly 22 miles would be classified as pedestrian use only with leashed pets allowed.
- About 2.5 miles would be classified as pedestrian use only with no pets allowed.
- About 14.5 miles would be classified as multiuse for pedestrian and bicycle use.

Escarpment crossings. Actions would be the same as described under alternative 2.

Access to the Top of the Volcanoes. Actions related to access to the top of the volcanoes would be the same as described under alternative 2.

Trail Design and Maintenance. Actions would be the same as described under alternative 2.

New and Emerging Trail Use. Actions taken would be the same as described under alternative 2.

Unauthorized Visitor-Created Trails and Old Roads. Actions taken would be the same as described under alternative 2.

Administrative Roads

Actions would be the same as under alternative 2, except use would change as described subsequently.

All 9 miles would be authorized for non-motorized visitor use as follows:

- Pedestrian use (including hiking with dogs on leashes).
- Bicycling

As under alternative 2, these roads would generally be up to 20 feet in width.

Utility Access Corridors

Actions would be the same as under alternative 2, except a short corridor at the southern end of the monument would be authorized as a multiuse formalized trail system. Combined, these short corridors equal about 1.5 miles of utility access corridors that would be part of the formalized trail system.

Accessibility

Actions taken would be the same as described under alternative 2.

Partnerships

Actions taken would be the same as described under alternative 2.

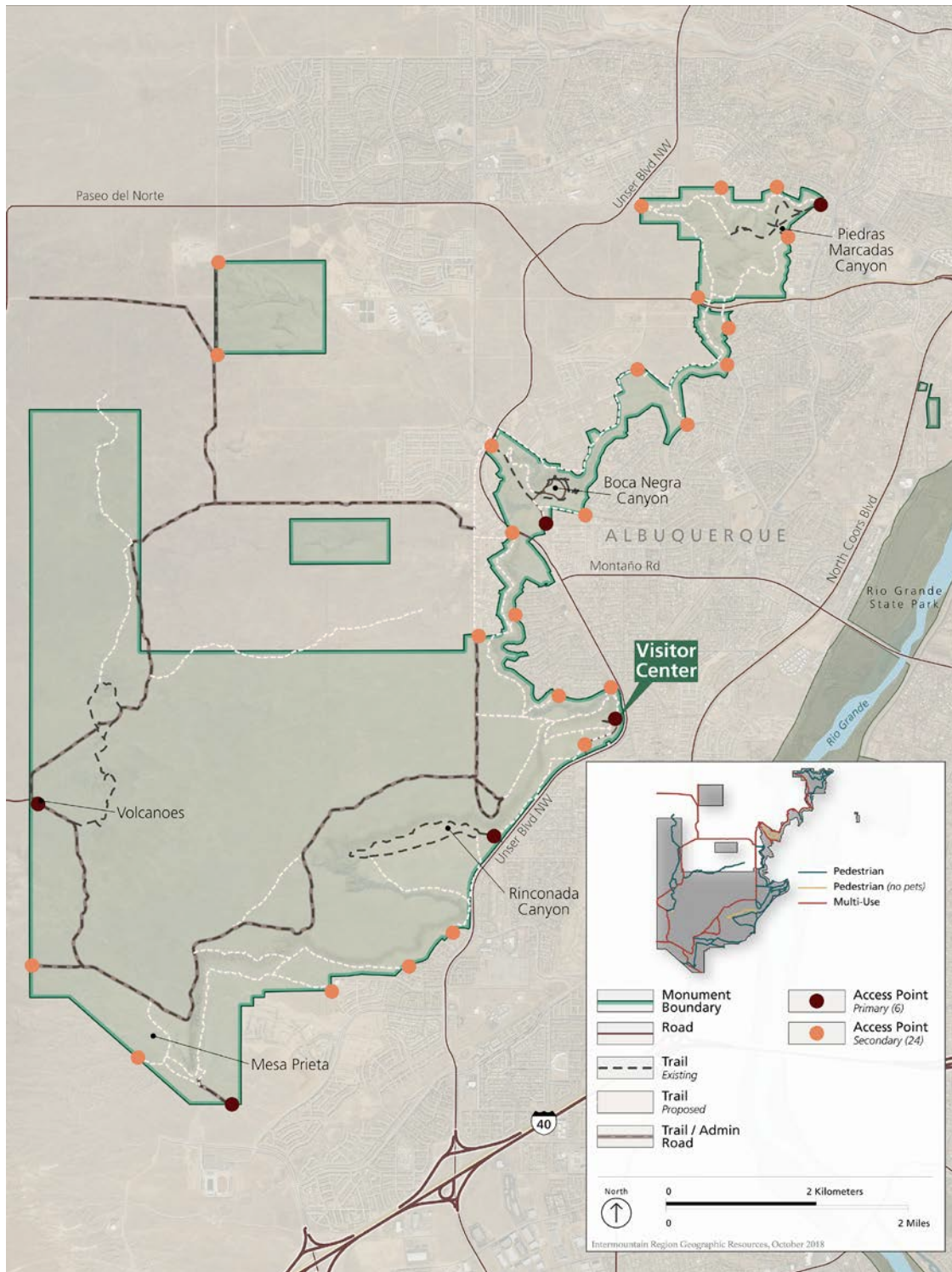


FIGURE 5. MAP OF ALTERNATIVE 3 FORMALIZED TRAIL SYSTEM AND ACCESS POINTS

Volunteer Efforts

Actions taken would be the same as described under alternative 2.

Comparison of Alternatives

See the following table (table 3) for a summary of the formalized trail system miles and access points under each alternative.

Table 3. Formalized Trail System Miles and Access Points Under Each Alternative

Trail System	Alternative 1 (No Action)	Alternative 2 (Preferred Alternative)	Alternative 3
Designated Trails (miles)	8	28.5	28.5
Administrative Roads (miles)	*27	**9	**9
Utility Corridors (trail miles)	*9	**1.5	**1.5
Total Formalized Trail System Mileage	8	39	39
Access Points	57	30 (6 Primary/ 24 Secondary)	30 (6 Primary/ 24 Secondary)

*Though the administrative roads and utility corridors are part of the existing trail system under the no-action alternative, visitor use has not been formally authorized on them.

** This trail mileage of administrative roads and utility corridors would become part of the formalized trail system under alternatives 2 and 3.

Actions Considered But Dismissed

Three actions were considered but dismissed “due to too great of an environmental impact” as stated in the NPS *NEPA Handbook* 4.3A. They are discussed in the following sections.

Use of Horses in the Monument. Horses have been allowed on the Mesa Top of the monument along existing roads and corridors. While use of horses on the Mesa Top has been permissible, there has been very little clarity on which roads/trails can be used and the creation of visitor-created trails has added confusion. In the past 5 to 10 years, horse use within the monument has been extremely sparse to nonexistent. The potential impacts from horse use on monument resources such as erosion and soil compaction have been considered, especially should horses be inadvertently or advertently taken off-trail. Several studies report that even low levels of horse use result in more severe impacts to soils, vegetation, and trails than from hikers or other users because of greater weight per unit area of a horse and rider compared to a person (Pickering et al. 2009). Erosional impact from horseback riding to archeological resources would therefore be expected to be greater than hikers or bicyclists.

Also considered was the increase of residential neighborhoods, schools, and sporting areas adjacent to the monument and the prediction of increased use of trails upon establishment of a formalized trail system. It was also considered that the probability of visitor conflict among the types of uses may increase. In addition, trails would need to be designed to support multiple uses, which typically equates to wider trails that could impact monument resources. Finally, through ongoing consultation with traditionally associated pueblos and tribes, limiting use to primarily pedestrian use only would respect the sacredness and cultural associations that pueblos and tribes have with the area. In considering these factors, horse use would be prohibited in the monument and would be redirected to other more appropriate areas.

In-Monument Trail Connecting Secondary Access Points near Lava Bluff in the Mesa Prieta Area. It was originally considered to have an in-monument connection near Lava Bluff in the Mesa Prieta area of the monument. After further consideration and consultation with the NPS Geologic Resources Division, it was determined that the best course of action at this time is to not allow action in the approximate 0.5 mile section of the monument until such time as erosional processes and gully formation, originating outside the monument's boundary, can be remediated. Allowing access and use in this area could further exacerbate the impacts to monument resources in this narrow portion below the escarpment. Funding would be pursued to evaluate options to correct erosion in this area. Upon completion of a corrective action, providing a trail through this area may be considered. For these reasons, this option was considered but dismissed from further evaluation at this time. A nearby sidewalk outside of the monument's boundary can be accessed by visitors to connect from each secondary access point in this area in the interim.

Access to the Top of Vulcan Volcano. The existing Volcanoes Loop Trail consists of two connected loop trails, the Black Volcano Loop Trail (2 miles) and the Vulcan Volcano Loop Trail (1 mile). The Black Volcano Loop Trail goes by JA Volcano and Black Volcano. Access to the top of Black Volcano is currently authorized. Access to the top of JA Volcano is being evaluated as part of this plan. Providing access to the top of Vulcan Volcano was considered during this planning process then dismissed for the following reasons. The Vulcan Loop Trail travels through the saddle of the Vulcan Volcano and already provides great views of the surrounding landscape and opportunities to intimately view the geology of the volcano. The steep-faced, loose cinder material on the top portion of this volcano does not allow for a sustainable trail design that would be resistant to erosion. For these reasons, providing access to the top of Vulcan Volcano has been dismissed from further consideration.

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CHAPTER 3: AFFECTED ENVIRONMENT

This chapter provides a summary of the resources associated with the alternatives and the environmental consequences of the alternatives. It is organized by impact and resource topics that were derived from internal park and external public scoping and is limited to those topics where there is the potential for significant impacts on the resources or because the impacts associated with the issue are central to the proposal. It focuses on the natural and cultural resources and visitor use and experience that may be affected by actions proposed in the alternatives.

ETHNOGRAPHIC RESOURCES (INCLUDING CULTURAL LANDSCAPE)

The NPS Director's Order 28, Cultural Resource Management, defines ethnographic resources 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. A cultural landscape is defined as a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values. The term cultural landscape is used in this document to collectively describe ethnographic resources within the monument. Ethnographic resources in the monument are known to exist based on ethnographic studies and consultation with representatives from the tribes and pueblos. These consultations with contemporary communities reveal a pattern of overlapping associations with the monument's natural and cultural resources. These resources are considered sacred to traditionally associated people and serve as a direct connection to their ancestors.

With the far-ranging movement of people over time, all 21 contemporary Pueblo communities trace cultural-historical associations with the 17-mile basalt escarpment. These communities include the 17 Rio Grande Pueblos (Cochiti, Isleta, Jemez, Nambe, Picuris, Pojoaque, Sandia, San Felipe, San Ildefonso, Ohkay Owingeh, Santa Ana, Santa Clara, Santo Domingo [Kewa Pueblo], Taos, Tesuque, Ysleta del Sur, and Zia) and the four Western Pueblos (Acoma, Hopi, Laguna, and Zuni). This feature defines the eastern edge of a volcanic mesa referred to locally in their landscape constructions as the West Mesa. Several ethnographic sources have specifically identified active pilgrimage by individuals from these pueblo communities to the present (Anschuetz et al. 2002). Navajo oral histories indicate that ancestral Navajo became familiar with the Middle Rio Grande Valley during the period between AD 1300 and 1600. The West Mesa figures in their Beautyway ceremonial repertoire. Mescalero Apache and Jicarilla Apache ancestors also established connections with the West Mesa environs during the same general time span (Anschuetz et al. 2002).

Descendants of early Spanish settlers, some of whom recall their indio mexicano heritage through their identification as both Atrisqueños and Nuevomexicanos, the Atrisco Land Rights Council, individual family histories, or some combination of the above also have established connections to the landscape (Anschuetz et al. 2002).

Because of the openness of the terrain on the West Mesa, scarring and erosion caused by visitor-created trails and access points are highly visible and detract from the viewsheds to and from the West Mesa and the Rio Grande valley. Viewsheds are critical elements of the larger cultural landscape. The natural features of spiritual significance to the traditionally associated pueblos and tribes include the volcanoes, escarpment, and petroglyphs. These are all experiencing the effects of neighborhood encroachment and increased visitation. The lack of designated trails and appropriate

signage has caused a proliferation of visitor-created trails across these ethnographic resources. Non-sanctioned activities such as vandalism, graffiti, and dumping garbage have also physically impacted the integrity of these resources. Some tribes have expressed concerns about allowing visitors to have access to the tops of the volcanoes, which they consider to be sacred.

The petroglyphs are viewed by pueblo communities as shrines, a living reminder of a connection between the past and present, and the natural and supernatural realms. Many of the petroglyph images are recognizable as animals, people, brands and crosses; others are more complex. These significant ethnographic resources are inseparable from the greater cultural landscape, including the five volcanic cones within the monument, and from the spirits of the native peoples and early Spanish settlers who created them (Brandi et al. 1999). The volcano shafts, caves, and the escarpment formed by the lava flows in the monument are the objects of rituals and pilgrimages (Anscheutz et al. 2002).

Given the nonformalized nature of the trail system, both intentional and unintentional damage to the petroglyphs is occurring in the monument. They are vulnerable to unintentional destruction caused by touching, rubbing, or highlighting with chalk or other materials. The individual images are vulnerable to oils from human hands that erode the patina of the rock. Intentional vandalism on monument lands includes removing the rocks and/or chiseling, spray painting, scratching, and shooting guns, which deface the rocks and/or the patina of the rocks, including those without petroglyphs. Removing significant associated features, such as nearby plants and other rocks or boulders, may adversely affect the qualities that give the petroglyphs spiritual meaning for the Pueblo people (NPS 1994 GMP). These resources are sacred to traditionally associated people, serve as a direct connection to their ancestors, and are irreplaceable once they are damaged or destroyed.

ARCHEOLOGICAL RESOURCES

Petroglyph National Monument was established in 1990 to preserve and protect the petroglyphs and other significant archeological sites within its boundaries. The monument protects approximately 350 archeological sites and the Las Imágenes Archeological District, which includes more than 20,000 petroglyphs etched by native peoples and early Spanish settlers.

The recorded archeological resources represent human use of the West Mesa landscape within the monument since at least 10,000 BP. Archeological investigations of these sites indicate mostly short-term uses, including lithic procurement, lithic tool manufacture and maintenance, plant gathering and processing, hunting, horticulture and/or agricultural activities, and livestock herding (Brandi et al. 1999). However, an exception is the Piedras Marcadas Pueblo, a large, multi-storied habitation site that appears to have been inhabited for approximately 300 years from the late 13th century to the late 16th century. Petroglyph images in the monument have been made over the last 2,000 to 3,000 years and were created by Archaic Period hunter-gathers, Ancestral Puebloan people, and Spanish sheepherders who used the area historically (Schaafsma 1987).

Historic road alignments recently identified in the monument are small segments of the longer circulation networks that existed as transportation routes. These routes connected the ancestral and contemporary Pueblo villages to the petroglyphs and other natural and archaeological resources, as vernacular ranching roads connecting ranches and grazing lands with communities and markets, and as utilitarian military roads facilitating the use of the West Mesa as a precision bombing range during World War II.

An archeological sample survey, performed in 1986 for planning purposes, recorded 10,423 petroglyphs along the 17-mile basalt escarpment that defines the eastern edge of a volcanic mesa referred to locally as the West Mesa (Brandt et al. 1999). The Schmader and Hays 1986 survey led to the listing of the Las Imágenes (Albuquerque West Mesa Escarpment) Archeological District in the National Register of Historic Places in 1986. It also documented the prehistoric and historic utilization of the volcanic West Mesa escarpment and recorded 10,423 Rio Grande style petroglyphs with the majority dating from AD 1300 to 1700. An intensive inventory of the petroglyphs began in 1997 and continued to 2004. More than 20,000 petroglyphs were identified.

Archeological sites in proximity to trails can be damaged by off-trail pedestrian trampling, off-trail bicycle use, vandalism, rock stacking, leaving memorials/offerings, and collecting artifacts. Records indicate that approximately 110 of the 350 recorded archeological sites are being impacted by trails or former roads that cross through them. In addition to the impacts to petroglyphs described in the previous section, sites have been mainly impacted by erosion, compaction of soils, illegal dumping, and removal of rocks and other artifacts. Trails also intercept overland surface run-off associated with rain events, channelizing the run-off. This can incise trails, exacerbate soil erosion and sedimentation, and threaten archeological resources (KellerLynn 2017; Gellis 1994). These conditions were described in a comprehensive archeological resource inventory covering 95% of the lands in the monument, which occurred from 1992–1994 and is referred to as the National Archeological Survey Initiative. The remaining five percent of lands have been severely impacted by vehicular traffic, refuse dumping, and road and right-of-way blading (Brandt et al. 1999).

SOILS

Soils in the monument are generally very susceptible to wind and water erosion, especially on steep slopes. Many trails below the escarpment such as those in Rinconada Canyon and Piedras Marcadas Canyon are in aeolian sands. Aeolian sand is soft, unstable, and easily eroded by water and wind. Areas with a lot of aeolian sands tend to have a more open and spread-out pattern of vegetation, which can make trail routes unclear and result in numerous visitor-created trails developing. Many petroglyphs are located in areas where the ground surface is almost completely covered in aeolian sands.

There are currently numerous visitor-created trails through aeolian sands in Rinconada Canyon and Piedras Marcadas Canyon, which experience high levels of visitor use associated with petroglyph viewing. Visitor-created trails through aeolian sands also exist below the escarpment in “the narrows” between Piedras Marcadas and Boca Negra canyons. Numerous visitor-created trails also originate from adjacent neighborhoods from multiple access points that currently exist.

A map and list of soils types and characteristics can be found in appendix E (figure E-1).

Erosion caused by visitor-created trails within the sandy sediments on slopes at the base of the escarpment is especially problematic and difficult to manage (SRI Report 2010). Many of the monuments’ petroglyphs are located within the slope of the escarpment and access to them needs careful planning because of the high potential for erosion in these areas. Visitor-created paths often cut across topography to create what is termed, “fall line trails” (e.g., trails that lead straight up a slope; see figure 6). Trails can thus intercept overland flow associated with rain events, channelizing run-off, which can incise trails, exacerbate soil erosion and sedimentation, and threaten archeological resources (KellerLynn 2017; Gellis 1994). Rilling and gully formation can progress rapidly during heavy rain events, with uphill and down-slope impacts, potentially undercutting boulders and redepositing sediment into lower-lying areas that can bury monument resources.

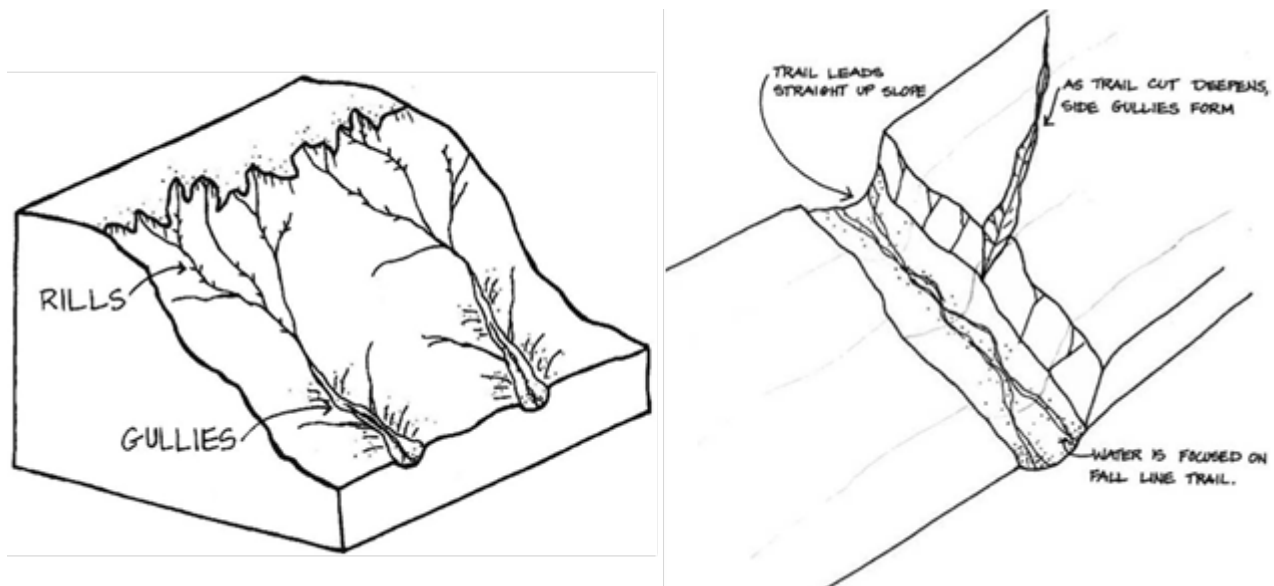


FIGURE 6. EROSION AND FALL LINE TRAILS

Planned trails also need to be conscientiously routed to reduce erosion potential and lessen impacts to archeological sites.

Several existing trails within the monument above the escarpment, including old ranch or military roads, cross natural drainages. Water in the drainages often gets diverted from its natural course flowing onto and down trails, resulting in erosion and soil loss along the trails. Another common condition in the monument is deeply incised trails. These typically are the former roads, but this condition can occur on any fall line trail. Over time, through compaction and erosion, the trail bed deepens. At some point, the sides become unstable and begin to erode into the trail, causing it to widen. As the trail deepens and widens, it becomes susceptible to gully erosion.

VISITOR USE AND EXPERIENCE

Overview of Visitor Use and Experience

The visitor experience at Petroglyph National Monument is unique within the region as an urban park experience. By working collaboratively with the city's Open Space Division, the monument provides opportunities for solitude and multiple low-impact forms of recreation (NPS 2017). Visitor experiences are one of the monument's "Other Important Resources and Values" identified in the monument's 2017 foundation document.

The monument was established on June 27, 1990, and since then visitation has been steadily increasing. Annual visitation has almost doubled in the 28 years since the monument was established. Increasing from the initial 68,065 the first year visitors were counted in 1992, the visitor count in 2016 was 124,177 (figure 7). However, unlike other national park units, the monument's visitation does not follow a standard bell curve that is typical of many national parks in which visitation greatly increases during the summer months (Ziesler 2017). Instead, visitation is relatively steady throughout the year, with the exception of the month of October in which there is a spike each year due to Albuquerque's Annual International Balloon Fiesta. Figure 8 illustrates the monument's monthly visitation from 2010 through 2017.

Visitor Access, Information, and Circulation

Petroglyph National Monument differs from many national parks in that it has a multitude of access points and is bordered by residential areas. Entrances into the monument are categorized as primary public access points and secondary public access points. Primary access points are locations in which general monument visitors are directed and may have basic trailhead facilities (i.e., parking, shade shelters, benches, orientation kiosk, etc.). Secondary access points include gates for administrative roads and utility access and openings in the monument's boundary fence for pedestrian access by adjacent residential neighbors.

The primary mode of access to the monument for out-of-town visitors is by driving a personal vehicle; local residents usually walk into the monument. The city's transit system, ABQ Ride, also has three commuter routes that serve the monument through bus stops within roughly a block of the monument's boundary. These stops are generally sparse, consisting of either just a sign or a sign and an unsheltered bench. Additionally, the bus schedule is more typical of a morning and afternoon commute than providing regular access to the monument. Visitor access and circulation management is difficult given the obvious presence of visitor-created trails allowing visitors to seek shortcuts, take a less congested route to their intended destinations, or avoid trails in poor condition.

Primary Public Access Points. Primary public access points are high-use access points near major features. These include the Las Imágenes Visitor Center and the entrances at Boca Negra Canyon, Rinconada Canyon, Piedras Marcadas Canyon, and the Volcanoes area. These primary public access points are identified on the map of the monument distributed to visitors, which lists the amenities of each area. Visitors are directed to these locations because of the cultural resources, natural resources, and visitor experiences that can be enjoyed in these unique areas.

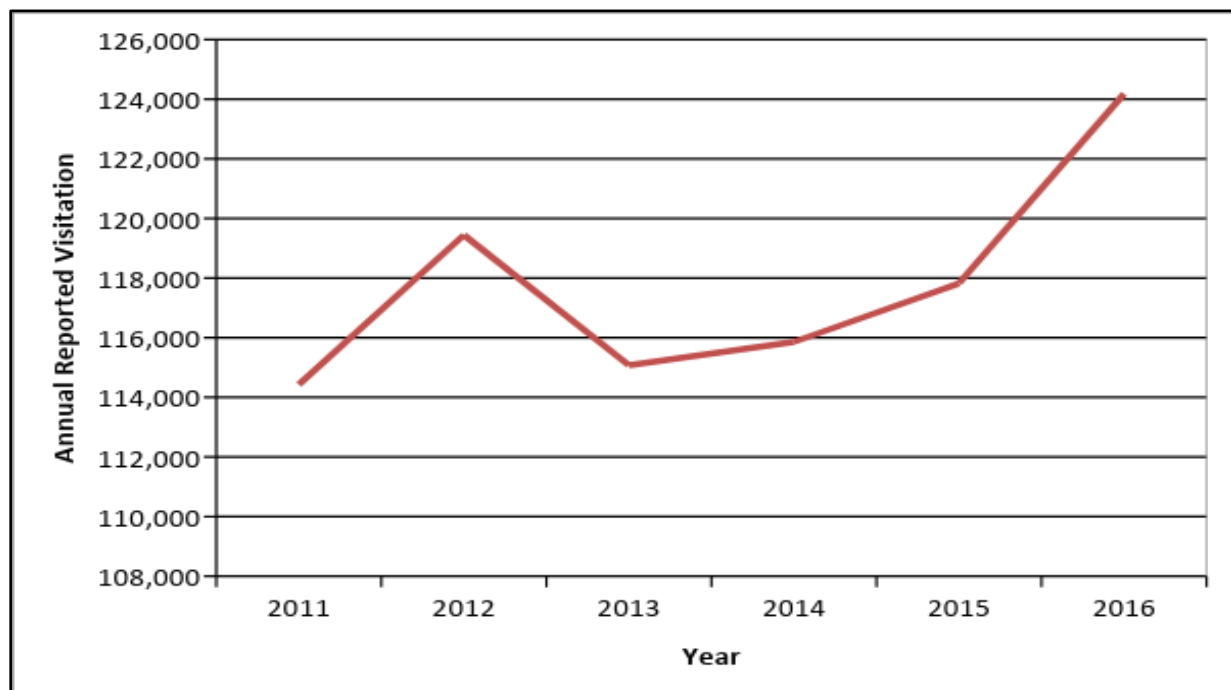


FIGURE 7. ANNUAL VISITATION TO PETROGLYPH NATIONAL MONUMENT (2011-2016)

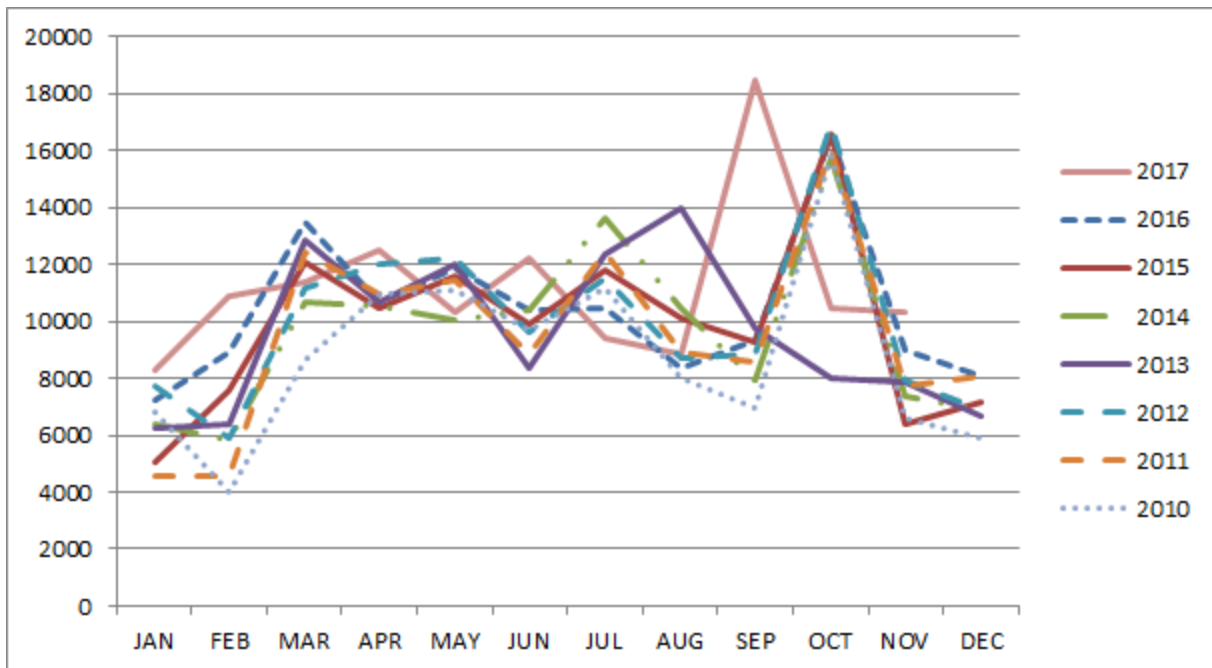


FIGURE 8. MONTHLY VISITATION TO PETROGLYPH NATIONAL MONUMENT (2010–2017)

Las Imágenes Visitor Center—The visitor center is the most visited area of the monument and serves as the primary point of contact to learn about the significance of the monument, obtain information on visitor services and facilities in the monument, and watch an orientation film about the monument. There is currently no formalized trail that departs from the visitor center area.

Boca Negra Canyon—Aside from the Las Imágenes Visitor Center, Boca Negra Canyon is the most visited area of the monument. Ongoing residential development in the area will likely increase visitor use to this part of the monument. Comprising 70 of the monument’s 7,209 acres, hundreds of petroglyphs can be viewed here. There is a small entrance station and the City of Albuquerque collects a parking fee in this area (\$1 parking on weekdays; \$2 on weekends). The entrance station and three trails are enclosed by fencing; this area is open from 8:30 a.m. to 4:30 p.m. and no pets are allowed. There are accessible parking spaces and an accessible platform with viewscope on a patio near the restroom. Three designated trails offer a diverse view of the cultural and natural landscape within this area. Trails in this area were built more than 40 years ago and do not meet federal accessibility standards. Outside of the fenced area, a paved, multiuse trail follows the original alignment of Atrisco Drive and provides access from the base of the escarpment to the Mesa Top. The natural-surfaced Upper Boca Negra Canyon Trail also provides access to the Mesa Top from the base of the escarpment.

Rinconada Canyon—At Rinconada Canyon, visitors can walk into the canyon along the approximate 2-mile-loop trail and see prehistoric and historic petroglyphs, wildlife, and listen to natural sounds. This trail does not meet federal accessibility standards. Several visitor-created trails have been closed in this area for restoration of native vegetation.

Piedras Marcadas Canyon—There is a 1.5-mile round-trip trail that is delineated by trail markers and offers visitors a chance to see up to 400 petroglyphs and experience natural sounds in the inner canyon. The primary access for Piedras Marcadas Canyon is near the intersection of Golf Course Road and Jill Patricia Road.

Volcanoes Area—In the Volcanoes area, visitors can be in close proximity to three distinct volcanoes that are conveniently connected by a series of loop trails that are up to 3 miles in length. A trail provides access to the top of Black Volcano; access to the tops of the other two volcanoes is currently prohibited. The map of the Volcanoes area names and illustrates the different trails, labels each of the volcanoes, and draws attention to the opportunities for creating loop hikes, which improve circulation through the site. Monument staff has closed visitor-created trails and increased signage in this area to begin restoration of areas disturbed by visitor-created trails.

Secondary Public Access Points. Secondary public access points are defined as having some, but not all, of the core amenities of the primary public access points and can include neighborhood access. Secondary access points may also include utility corridors and/or administrative roads. Many of these have metal gates to allow access by the utility company and monument staff. Secondary access points are typically a little more than a gap in the monument's boundary fence between 18 to 24 inches wide, with a monument regulations sign. Some of these access points have parking that can accommodate a few cars or parking along a street. The trails leading from these entrances are designed for a small number of users to gain access to major trails. These access points are typically used by local residents who are familiar with the area. Secondary public access points are not generally publicized and would not be included on the official monument trail maps. The only information at these locations is a sign informing visitors of prohibited activities and other regulations such as pet rules.

A recent assessment by monument staff revealed 52 secondary public access points including private and neighborhood access points with varying levels of use and sustainability. Private access points often originate from neighborhoods or individual's backyards; they are visitor-created and are not maintained or authorized by the monument.

Wayfinding and Signage. In general, wayfinding and other signage are limited throughout the monument. The limited, ineffective, and/or absent wayfinding and signage as well as the lack of a well-marked trail system often causes visitors to take less-efficient routes or could cause confusion on the part of the visitors as to which route would take them to their destination, making it more difficult to access and circulate throughout the monument. Most out-of-town visitors access the monument from points that have official NPS signage, such as at the primary access points, but more signage would help to inform visitors of which trails are officially designated by the monument and which activities are allowed on those trails. The large and complex network of visitor-created trails perpetuates the potential for visitors to get lost within the monument, which poses a safety risk—especially when there is a high heat index. Rescue operations are at a disadvantage because of the number of potential routes the visitors may have taken.

Diversity of Visitor Experience and Opportunities

Petroglyph National Monument offers a variety of day-use areas with relatively short, easy to moderately strenuous trails that take visitors into canyons and near volcanoes to view the natural and cultural resources that are protected here. The following activities may take place within the monument: hiking, dog walking, and bicycling. Opportunities to learn about and understand

important monument resources and stories are also a part of the diverse range of visitor experiences available at the monument.

Visitor conflicts often result of a host of challenges, including crowding, competition for experiences (i.e., lack of opportunity for temporal and spatial visitor experience dispersion), incompatible activities occurring in the same area, variance in desired experience types or motivation, and others. At the monument, the user groups with the greatest potential for conflict are bicyclists and dog walkers. Current conditions at the monument do not always allow visitors to achieve their desired experiences (i.e., solitude, spending time with family, etc.) often because of incompatible activities occurring in the same area. Conflicts often arise as participants in one activity may object to the sheer presence or behavior of another type of activity or participant (Manning 2011).

Conflicts also occur because of inappropriate uses for designated areas. Visitors encountering conflicts with other visitors are likely to find other areas to achieve their goals leading to the potential for displacement of user groups. Crowded conditions at sites can create the potential for visitor conflicts.

Hiking. Hiking is the primary activity within the monument. The network of routes, including designated and visitor-created trails, provides visitors with a variety of options in length, level of challenge, and setting in which to hike. It is well documented, both within the monument and throughout social science data, that visitors inevitably choose the easiest route when hiking. This sometimes takes them off established trails if those trails are in poor condition (i.e., muddy, full of loose rocks that are difficult to walk upon, etc.), resulting in the widening of trails or the creation of redundant, parallel trails.

Leashed Dog Walking. Dog walking is a popular activity within the monument, especially by local residents. Dogs must be kept on a leash no longer than six feet long and dog walkers are required to clean up after their dogs. Dogs are not allowed in certain areas (i.e., Boca Negra Canyon or inside the visitor center), but otherwise are able to use most trails.

Bicycling. Bicycling has been allowed on the Mesa Top roads/trails and outside petroglyph viewing areas, as indicated by signage. Trail identification and signage for bicycle use has been minimal, and the creation of visitor-created trails has further added to confusion about which trails are open to bicycles.

Opportunities for Visitors to Learn About and Understand Important Resources and Stories

The monument provides a variety of opportunities for visitors to learn about and understand its important resources and stories. Opportunities include audio walking tours, guest speakers, cultural demonstrations, and educational programs using parks as classrooms such as guided programs, traveling trunks, and providing curriculum materials. Specifically, visitors are able to see hundreds of petroglyphs in the context of the landscape and develop connections to them through personal experience, interpretive exhibits, and educational programs. Some of the distinct geologic features of the monument such as the volcanoes, canyons, and escarpment would also be easily reachable, and visitors could learn about and be inspired by the natural environment. In addition, the monument offers a unique natural soundscape. Piedras Marcadas Canyon, Rinconada Canyon, and Mesa Prieta in particular are areas where visitors have the opportunity to escape from the sights and sounds of the city and experience natural quiet.

One opportunity available for visitors to learn about the monument is through an audio tour using individual cellular devices. The audio narration is given by a park ranger on various aspects of the monument from geology to the unique human history of the area. When visiting the monument, visitors can listen to these narrations at any of the designated trails and at the Las Imágenes Visitor Center. Signage for information about the “Park Ranger Audio Tour” is provided at the various locations.

Educational programs are scheduled throughout the year and focus on a variety of topics relating to the cultural and natural resources of the monument and the surrounding area. Teachers and students visit the monument to join a park ranger on one of several guided programs. Boca Negra Canyon, Rinconada Canyon, Piedras Marcadas Canyon, and the Volcanoes area are all available for educational field experiences. Educational programs are free and are coordinated through the monument’s Interpretation Division.

Quality of the Visitor Experience

Visitor satisfaction with the overall quality of monument facilities, visitor services, and outdoor opportunities has consistently ranked in the mid-to-high 90th percentile. The percentage of monument visitors satisfied with this indicator was 98% in 2017 (Pacific Consulting Group 2017). Monument facilities that were rated by monument visitors include the Las Imágenes Visitor Center, restrooms throughout the monument, picnic areas, exhibits, and the walkways/trails/roads.

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CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter analyzes the environmental impacts of implementing the alternatives considered in this environmental assessment on ethnographic resources (including cultural landscapes), archeological resources, soils, and visitor use and experience. This analysis is the basis for comparing the beneficial and adverse effects of implementing the alternatives.

This chapter begins with a discussion of the cumulative impacts scenario. Following this section, the impact analysis is presented. Each of the alternatives, including the no-action alternative (continuation of current management), is analyzed for adverse or beneficial changes that would occur to the existing conditions of each impact topic as presented in “Chapter 3: Affected Environment.” After describing the impacts of the alternative, the cumulative effects of each impact topic are discussed and a conclusion is stated.

CUMULATIVE IMPACTS SCENARIO

The Council of Environmental Quality (CEQ) regulations require assessment of cumulative impacts in the decision-making process for federal projects. A cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7).

Cumulative impacts are considered for all alternatives, including the no-action alternative. They were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions that would also result in beneficial or adverse impacts to that resource. It is necessary to identify other ongoing or reasonably foreseeable future projects and plans at the monument and, if applicable, the surrounding region. The following projects, plans, and actions were identified for the purpose of conducting the cumulative effects analysis and listed from past to future for actions within the monument and on surrounding lands.

NPS Actions, Plans and Projects Inside the Monument

Past, present, and future actions and projects inside the monument, independent of this plan, are discussed in the following sections.

Past Actions to Improve Visitor Facilities and Accessibility. Several upgrades were made to visitor facilities throughout the monument from 2005 to 2014. This included relocation of the Volcanoes parking area, improvements to the visitor center and Rinconada Canyon parking areas, development of a small parking area near the visitor center entrance gate, and construction of accessible trails at the visitor center and on the Mesa Top above Boca Negra Canyon and south of Paseo del Norte.

Monument Fire Management Plan. The monument's 2005 Fire Management Plan calls for the continued total suppression of wildfire because of the close proximity of residential areas of the City of Albuquerque to the monument. Site-specific mechanical fuel reduction projects also would continue to be periodically undertaken as part of the fire management program as needed. Monument staff regularly removes hazardous fuels along the monument's boundary.

Ongoing and Future Trail Maintenance. Maintenance, repairs, and improvements to trails and signage in the monument are ongoing. Work to sign and close off trails for resource or safety concerns occurs as needed. Larger restoration projects such as at the Volcanoes area (2015) and Rinconada Canyon (2015) have been undertaken to help improve resource conditions and wayfinding. In 2018, the first section of the Volcanoes trail will be improved and shade structures replaced.

Past and Future Installation of Fencing along the Monument's Boundary. Much of the monument's boundary has been fenced to better identify the monument and deter unauthorized access. A few sections are likely to be fenced in the future, including an area on the Mesa Top between Boca Negra Canyon and Piedras Marcadas Canyon, the Southern Geologic Window, and the northern boundary of the Atrisco portion of the monument. With the installation of additional fencing, monument access points would need to be reconsidered to allow for utility right-of-way access and the need for other potential public access points. For example, should additional fencing be installed on the northern boundary of the Atrisco portion of the monument, which borders City of Albuquerque open space lands, an estimated five public access points and six gates for utility right-of-way access may be established.

Future Improvements to Visitor Facilities. The 2011 *Las Imagenes Visitor Center Area Improvements Environmental Assessment* calls for improvements to accessibility in the visitor center. A future project to improve the accessibility of the visitor center parking area is anticipated to address grades and access to the visitor center.

Other Actions, Plans and Projects Outside the Monument

Local Land Use Plans. The monument is an integral part of the "West Side" of Albuquerque and is adjacent to the city's open space lands, housing developments, schools, sporting complexes, commercial and light industrial developments. A number of land use and facility plans for adjacent lands include recommendations for future trail linkages with areas adjacent to the monument. The 2015 *Bikeways and Trails Facilities Plan* for the City of Albuquerque, provides a vision of bikeways and trails that connect throughout the city to support active transportation and recreation, and includes areas near the monument.

Albuquerque Metropolitan Arroyo Flood Control (AMAFCA) Potential Projects. Initial discussions with the AMAFCA, regarding projects adjacent to the monument, include potential flood control developments near the Northern Geologic Window and Piedras Marcadas Canyon. Monument staff would continue to coordinate with AMAFCA representatives and explore monument access opportunities.

ETHNOGRAPHIC RESOURCES (INCLUDING CULTURAL LANDSCAPE)

Alternative 1 (No-Action Alternative)

Under this alternative, no new trails would be added to the existing 140-mile network of routes, which consists of 27 miles of administrative roads, 9 miles of utility access corridors, 8 miles of designated trails, and 96 miles of former roads and visitor-created trails. With the exception of the 8 miles of designated trails, the vast majority of the network of routes consists of visitor-created trails, most of which are not currently maintained. Because of the openness of the terrain on the West Mesa, the existing 96 miles of visitor-created trails and former roads and 57 access points are highly visible because of erosion and compaction of soils. Left in place, they would continue to detract from

the viewsheds to and from the West Mesa and the Rio Grande valley, which are critical elements of the cultural landscape. The restoration of visitor-created pedestrian trails would occur on a case-by-case basis, but there would be no comprehensive plan that would identify whether to retain and improve these visitor-created trails and escarpment crossings or rehabilitate and restore the trails and crossings.

Dog walking would continue to be prohibited on trails in the Boca Negra Canyon area but would be allowed elsewhere in the monument. Dog waste, digging, and litter deposits along the escarpment would continue to detract from the physical condition of the cultural landscape.

Based on consultations with traditionally associated pueblos and tribes, bicycle use within the monument would continue to disturb the inherent peaceful, sacred qualities of the volcanoes and their setting and would disrespect the cultural associations that the pueblos and tribes have with the area.

The Black Volcano Loop Trail goes by JA Volcano and Black Volcano. Under this alternative, visitors may continue to access the top of Black Volcano and pets are currently allowed, and the associated adverse impacts, including erosion and visual scarring of the volcano, would likely continue. Access to the tops of JA and Vulcan volcanoes is not allowed and sections of post and cable and signage have been installed as part of restoration project work in the area. Regardless, visitors continue to seek access to the tops of these two volcanoes, which has led to the creation of numerous visitor-created trails resulting in visual scars, moved rocks, and an increase in the potential for erosion. Monument law enforcement rangers would continue to issue warnings and citations and prosecute those who disobey the closure as they are caught. Based on consultations with traditionally associated pueblos and tribes, some pueblos and tribes prefer that access to the tops of all three volcanoes be prohibited.

In addition, both intentional and unintentional damage to the petroglyphs as described in chapter 3, is also likely to increase due to the continued proliferation of visitor-created trails and lack of formalized access points to petroglyph viewing areas, making it difficult for park staff to monitor and mitigate visitor impacts. The continued removal of important associated features such as nearby plants and other rocks or boulders would continue to adversely impact the qualities that give the petroglyphs spiritual meaning for the Pueblo people.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect ethnographic resources. A past project that relocated an existing parking lot farther away from the volcanoes removed an artificial, visually intrusive element on the cultural landscape. Past restoration work and wayfinding improvements in the Volcanoes area and Rinconada Canyon further improved the physical condition of the landscape in those areas by reducing the scarring and erosion resulting from visitor-created trails. A fencing project was completed around the Northern Geologic Window that formalized a portion of the boundary and resulted in a decrease of illegal activities that impact the cultural landscape in that location, including paintballing, riding ATVs, golfing, dumping garbage, and target shooting. The planned installation of additional monument boundary fencing would reduce informal access from neighborhoods and to a limited extent decrease scarring and erosion along the escarpment. Additional monument boundary fencing also would provide further protection to the cultural landscape. General trail maintenance would also continue although the beneficial impacts of these actions would be specific and localized, depending upon the areas that were targeted. Ongoing residential development immediately surrounding the monument would likely result in additional visitor-created access points and trails and the associated scarring and erosion caused by these

activities, which would adversely impact the overall condition of the escarpment and Mesa Top. The proliferation of informal access points from neighborhoods along the escarpment to the petroglyphs would continue although it would be somewhat mitigated with additional boundary fencing.

Collectively, these present and reasonably foreseeable future actions have had and would continue to have localized beneficial impacts to eroded areas mainly along the escarpment that would be fenced or subject to trail repair, but monument-wide, there would be long-term adverse impacts on ethnographic resources because of the proliferation of visitor-created trails and the lack of a formalized system. The incremental impact of the no-action alternative combined with other past, present, and reasonably foreseeable future impacts as described above would contribute slightly to but not substantially change the impacts to ethnographic resources that are already occurring. Ongoing and continued traditional uses by tribal members would ensure continuity of cultural traditions into the future.

Conclusion. The no-action alternative would result in the continued physical deterioration of the volcanoes and the escarpment, mainly because of the erosion and scarring associated with visitor-created trails. These impacts, both to the physical condition of the landscape and to viewsheds on the Western Mesa, are long term, adverse and monument-wide. Under this alternative, continued access to the top of Black Volcano would adversely impact a feature of spiritual significance to culturally associated tribal and Puebloan people. Short term, localized improvements to the physical condition of individual ethnographic resources because of individual trail closures would occur, but overall, this alternative would result in adverse visual effects associated with the lack of a formalized trail system. The continued proliferation of access points to the petroglyphs would continue to put these resources at risk of both intentional and unintentional damage by visitors. These impacts, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, adverse impacts to individual ethnographic resources, including the volcanoes, the escarpment, and the petroglyphs, as well as to the cultural landscape as a whole.

Alternative 2 (NPS Preferred Alternative)

Under alternative 2, a total of about 39 miles of trails consisting of 34.5 miles of pedestrian use trails (leashed pets allowed), 2.5 miles of pedestrian use only trails (no pets allowed), and 2 miles of multiuse trail would be formalized. Visitors would be appropriately guided to a formalized trail system with formalized access, and information and circulation throughout the monument would be improved. Erosion and scarring of the landscape would be considerably lessened by the closure of approximately 93.5 miles of visitor-created trails and former roads. Alternative 2 would identify six primary access points and 24 secondary access points. The closure, restoration, or rehabilitation of approximately 27 informal access points would provide beneficial, direct impacts to soils and vegetation that have been damaged by visitor-created trails, thereby improving the condition of the escarpment. These impacts would not be immediate, as it is expected that fragile high desert soils may take decades to stabilize and revegetate. The viewsheds from the Rio Grande valley to the West Mesa would also be gradually improved because of the large reduction in the number of access points and the associated visual impacts.

Dog walking would continue to be prohibited on trails in the Boca Negra Canyon area, on a portion of the Rinconada Canyon trail, and on the trails leading to the tops of Black and JA volcanoes, reducing the potential for dog waste, digging, and litter deposits along the escarpment that detract from the cultural landscape.

Based on consultations with traditionally associated pueblos and tribes, because bicycle use would be confined to 2 miles of designated multiuse trails not within the Volcanoes area, the presence of bicyclists within the monument would be less intrusive to the inherent peaceful, sacred qualities of the volcanoes and their setting and would be more respectful of the traditional associations that the pueblos and tribes have with the area.

Under this alternative, sustainable trail design would be used when formalizing the escarpment crossings. This could entail constructing steps or using other trail features (i.e., concrete, logs, etc.) to provide sustainability and to be visually compatible with the surrounding landscape. In addition to improving the physical condition of the escarpment in these locations, these actions would provide beneficial impacts to the viewshed of the West Mesa from the valley.

The Black Volcano Loop Trail goes by JA Volcano and Black Volcano. Under this alternative, one well-marked trail would lead to the top of each of these two volcanoes. The trails would incorporate sustainable design and may include the addition of new trail features. Pets would not be allowed on these two spur trails. There would be sensitivity when choosing the materials, colors, and patterns to help mitigate any adverse visual effects on ethnographic resources and cultural landscapes. This action would mitigate erosion issues and ground disturbance from numerous unauthorized trails that have been created over the years as visitors sought to gain access to the top of the small volcanoes. Land disturbed by visitor-created trails would be rehabilitated. These actions are anticipated generally to have beneficial effects on ethnographic resources and the cultural landscapes in this area. However, as noted previously, some of the traditionally associated tribes and pueblos prefer that access to the tops of all volcanoes be prohibited, so these features would continue to be adversely impacted from their perspective.

Under alternative 2, monument management would potentially reroute trails and examine potential temporary closures. Other management strategies would include increasing ranger patrols in prioritized high visitor use areas. The monument staff would monitor the condition and the number of cultural features and sites impacted by visitor activity (rocks moved and/or newly recorded modern graffiti present) adjacent to the trail system and at the petroglyph viewing areas. Through the use of enhanced interpretive signage, the monument would educate visitors to learn about appropriate visitor behavior and cultural sensitivity. Increasing trail watch volunteers would provide the opportunity for the local community to engage with and help to protect important monument resources. The monument would continue to consult with traditionally associated tribes and pueblos on ensuring access for tribal members and implementing appropriate monitoring and treatment strategies for the protection of these nonrenewable ethnographic resources.

Collectively, these management strategies and mitigation measures under alternative 2 would have a long-term beneficial impact on the physical condition and the integrity of individual ethnographic resources, including the escarpment, volcanoes, and petroglyphs. Viewsheds along the escarpment and in the Volcanoes area would also be improved with the rehabilitation of areas disturbed by visitor-created trails. Ongoing and continued traditional uses by tribal members would ensure continuity of cultural traditions into the future.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect ethnographic resources. These projects are fully described under alternative 1.

The incremental impact of alternative 2, with the implementation of a formalized trail system and additional management processes, when combined with other past, present, and reasonably foreseeable future impacts as described above, is beneficial and would contribute substantially by mitigating many of the ongoing adverse impacts to ethnographic resources and the cultural landscape associated with a nonformalized trail system.

Conclusion. The closure of 93.5 visitor-created trails and former roads and rehabilitation of 27 informal access points would greatly reduce the physical damage to the escarpment. Sustainable trail design techniques would ensure visual compatibility of the remaining formalized trails with the surrounding landscape. The associated viewsheds from the valley to the West Mesa would also be improved. Limiting bicycle use would reduce erosion and soil compaction in the Volcanoes area and on the Mesa Top, and reduce the potential creation of unauthorized bike paths elsewhere in the monument. The implementation of new management strategies, including monitoring, rerouting or closure of individual trails, and increased visitor education, would greatly reduce the potential for damage to landscape features. These actions would generally result in long-term, localized, and also monument-wide beneficial impacts to ethnographic resources. However, based on consultation with the traditionally affiliated tribes and pueblos, continued visitor access to the top Black and JA Volcanoes would be a localized, adverse impact to these ethnographic resources.

These affects, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, beneficial impacts to individual ethnographic resources, including the volcanoes and petroglyphs, and to the cultural landscape as a whole.

Alternative 3

Impacts would be the same as described under alternative 2, except that bicycle use would be authorized on 14.5 miles of formalized multiuse trails, 12.5 miles of which are within close proximity to the Volcanoes area. Based on consultations with traditionally associated pueblos and tribes, the presence of bicyclists would continue to intrude on the inherent peaceful, sacred qualities of the volcanoes and their setting and therefore, would be less respectful of the traditional associations that the pueblos and tribes have with the area.

In addition, with the exception of bicycle use in the vicinity of the volcanoes, which would be an adverse impact, the management strategies and mitigation measures under alternative 3 would generally have a long-term beneficial impact on the physical condition and the integrity of individual ethnographic resources, including the escarpment and petroglyphs. Viewsheds along the escarpment and in the Volcanoes area would also be improved with the restoration of visitor-created trails. Ongoing and continued traditional uses by tribal members would ensure continuity of cultural traditions into the future.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect ethnographic resources. These projects are fully described under alternative 1.

The incremental impact of alternative 3, with the implementation of a formalized trail system and additional management processes, when combined with other past, present, and reasonably foreseeable future impacts as described above, is beneficial and would contribute substantially by

mitigating many of the ongoing adverse impacts to ethnographic resources and cultural landscapes associated with a nonformalized trail system.

Conclusion. The closure of 93.5 visitor-created trails and rehabilitation of 27 formal access points would greatly reduce the physical damage to the escarpment. Sustainable trail design techniques would ensure visual compatibility of the remaining formalized trails with the surrounding landscape. The associated viewshed from the valley to the West Mesa would also be improved. The implementation of new management strategies, including monitoring, rerouting or closure of individual trails, and increased visitor education, would greatly reduce the potential for damage to landscape features. These actions would generally result in long term, localized, and monument-wide beneficial impacts to ethnographic resources. Alternative 3 would result in monument-wide beneficial impacts to ethnographic resources and cultural landscapes. However, the adverse impact associated with bicycle use in the volcanoes area would continue because of the presence of bicyclists continuing to intrude on the inherent peaceful, sacred qualities of the volcanoes and their setting and would be less respectful of the traditional associations that the pueblos and tribes have with the area. These affects, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, beneficial impacts to individual ethnographic resources including the petroglyphs and to the cultural landscape as a whole.

ARCHEOLOGICAL RESOURCES

Alternative 1 (No-Action Alternative)

Under this alternative, although no new trails would be added to the existing 140-mile network of routes, the recorded archeological sites in proximity to these trails would continue to be damaged by trampling, vandalism, rock stacking, and collecting artifacts. In addition to the adverse impacts to petroglyphs outlined in the previous section, an estimated 110 sites are located within 10 feet of existing routes (e.g., designated trail, visitor-created trails, administrative roads, utility corridors) and this number would likely increase because of the proliferation of additional informal trails. Use levels for hiking, dog walking, and bicycling would be expected to continue in the same proportion, although the actual numbers for each are expected to rise commensurate with the increase in visitation, causing additional direct, adverse impacts to the physical condition and the integrity of archeological resources. Although minor damage to sites may be mitigated to some extent by rerouting a trail segment and using stabilization techniques, destruction of individual features by erosion, compaction, or looting may result in the loss of integrity of the site and limit or destroy its potential for informational value. These adverse impacts are localized, permanent, and not reversible.

Continued, unauthorized pedestrian and bicycle use could increase the incidences of erosion and soil compaction associated with this activity on sites throughout the monument, especially if off-trail activity occurs. The monument would continue to consult with traditionally associated tribes and pueblos on implementing appropriate monitoring and treatment strategies for the protection of archeological resources.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect archeological resources. Past restoration work and wayfinding improvements in the Volcanoes area and Rinconada Canyon reduced the adverse impacts to sites resulting from visitor-created trails. A fencing project was completed around the Northern Geologic Window that formalized a portion of the boundary and resulted in a decrease of illegal activities in that location, including paintballing, riding ATVs,

dumping garbage, and target shooting, all of which adversely impact the condition of archeological sites. The planned installation of additional monument boundary fencing would reduce informal access from neighborhoods and to a limited extent decrease the potential for adverse impacts to sites along the escarpment. General trail maintenance would also continue, although the beneficial impacts of these actions would be specific and localized, depending upon the areas that were targeted. Ongoing residential development outside the monument boundary would likely result in additional visitor-created access points and trails, and the associated compaction and erosion caused by these activities would adversely impact the sites along the southwest boundary of the monument. The proliferation of informal access points from neighborhoods along the escarpment to the petroglyphs would continue, although it would be somewhat mitigated with additional boundary fencing.

Implementation of fire suppression activities associated with the fire management plan could result in adverse effects on archeological resources if activities must be taken immediately to protect life and property and there is not time for an archeological monitor. However, referencing past archeological surveys to determine locations of archeological resources can minimize potential impacts. Ongoing removal of hazardous fuels helps to prevent fire from potentially entering the monument and harming archeological resources.

Collectively, these present and reasonably foreseeable future actions have had and would continue to have localized beneficial impacts to eroded areas mainly along the escarpment that would be fenced or subject to trail repair. Monument-wide, however, there would be long-term adverse impacts on archeological resources because of the proliferation of visitor-created trails and the lack of a formalized trail system. The incremental impact of the no-action alternative combined with other past, present, and reasonably foreseeable future impacts as described above would contribute measurably to the impacts to archeological resources that are already occurring.

Conclusion. Although minor damage to archeological sites may be mitigated to some extent by rerouting a trail segment and using stabilization techniques, destruction of individual features by erosion, compaction, or looting may result in the loss of integrity of the site and limit or destroy its potential for informational value. These effects are localized, but largely irreversible and permanent. Continued, unauthorized pedestrian and bicycle use could increase the incidences of erosion and soil compaction associated with this activity on sites throughout the monument, especially if off-trail activity occurs. The fencing and individual trail repairs at selected areas under the no-action alternative would result in localized beneficial impacts to archeological resources in those locations, but overall, the impacts of this alternative would be adverse because a nonformalized trail system would continue to contribute to the deterioration of the condition of sites in proximity of these alignments. When considered with other past, present, and reasonably foreseeable future projects, alternative 1 would have long-term, monument-wide, adverse impacts to archeological resources.

Alternative 2 (NPS Preferred Alternative)

Under alternative 2, a formalized trail system would be established, and closure of unsustainable visitor-created trails would be completed. This would result in a total of about 39 miles of formalized trails. There are about 65 known archeological sites within a 10-foot buffer of the proposed trail system under this alternative. Alternative 2 would identify six primary access points and 24 secondary access points. The closure, restoration, or rehabilitation of approximately 27 informal access points would provide beneficial, direct impacts to sites in those areas along the escarpment by stabilizing sites that are particularly vulnerable to erosion and compaction caused by visitor-created trails.

Limiting pedestrian and bicycle use in the monument to the formalized trail system would have a beneficial effect on archeological resources because it would reduce the potential for new erosion and soil compaction associated with this activity.

Under this alternative, a number of management actions would be taken to reduce impacts to archeological resources. Documentation of archeological sites in high visitor use areas would be prioritized to establish a baseline to aid in future monitoring of the integrity and condition of these sites. Damage to petroglyphs and sites would be monitored and the number of these documented incidents would not be allowed to exceed five a year before mitigation measures were taken, including an increased ranger presence and possible trail closure. Using enhanced interpretation signage, the monument would educate visitors about appropriate visitor behavior and cultural sensitivity. Increasing trail watch volunteers would provide the opportunity for the local community to engage with and help to protect important monument resources. The monument would continue to consult with traditionally associated tribes and pueblos on implementing appropriate monitoring and treatment strategies for the protection of archeological resources. Collectively, these management strategies and mitigation measures would have a beneficial impact on the physical condition and the integrity of archeological resources.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect archeological resources. These projects are fully described under alternative 1.

The incremental impact of alternative 2 combined with other past, present, and reasonably foreseeable future impacts as described above would substantially reduce the potential for impacts to archeological resources because of the reduction in the number of sites that would be impacted by creating a formalized trail system and mitigating existing impacts to archeological resources through sustainable trail design and consideration of effects on archeological resources.

Conclusion. The reduction of visitor-created trails, and the closure, restoration, or rehabilitation of approximately 27 informal access points would provide beneficial, direct impacts to sites in those areas along the escarpment by stabilizing those that are particularly vulnerable to erosion and compaction caused by visitor-created trails. Management actions, including documentation and monitoring of petroglyphs and sites, would result in a measurable, long-term, beneficial impact to archeological resources monument-wide. Enhanced interpretation signage, and increasing ranger presence and trail watch volunteers would be an additional measure of site protection. Collectively, these management strategies and mitigation measures would have a long term, monument-wide beneficial impact on the physical condition and the integrity of archeological resources. However, the beneficial impacts of limiting visitor use to the formalized trail system are measurable and monument-wide. These effects, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, beneficial impacts to archeological resources.

Alternative 3

Under alternative 3, impacts would be the same as described for alternative 2.

Cumulative Impacts. Cumulative impacts under alternative 3 would be the same as alternative 2.

Conclusion. Impacts under alternative 3 would be the same as described for alternative 2.

SOILS

Alternative 1 (No-Action Alternative)

Under the no-action alternative, the current configuration and use of the approximately 140-mile network of routes throughout the monument would continue. Exposure of soil because of various uses along the existing road/trail network and at access points has led to various impacts that would continue under the no-action alternative (see *Affected Environment*). Over time, the adverse effects to soils would likely increase because of the compounding nature of soil erosion and compaction processes. These effects would be long-term and occur along a good portion of the 140-mile network of routes throughout the park.

While some of these ongoing effects would occur on segments of existing formal trails, administrative roads, and utility corridors, the vast majority of these ongoing effects would likely occur along the 96 miles of visitor-created trails. These unofficial trails (some of which are former roads) have widths that range anywhere from 2 feet to 20 feet, which often translates to equal or greater widths of associated soil erosion, compaction, and downhill sedimentation along their lengths. Most of the visitor-created trails are not sustainable, particularly given the type and amount of visitor use that occurs on them. Thus, poor trail locations, alignments, grades, and drainage greatly contribute to the intensity and extent of the soil and geologic resource-related impacts. In addition, the creation of visitor-created trails coupled with unclear signage on which uses are allowed on formal trails would continue to cause confusion on what types of uses are permitted on which trails. This often results in user types (and higher user volume) on trails that may not be able to sustainably accommodate the use types and levels without causing excessive soil compaction, erosion, and loss of soils.

The rate of soil erosion would likely increase on visitor-created trails and on some formal trails in areas of high use and areas of unstable soils and/or slopes under the no-action alternative, particularly on steep trails located on the escarpment and volcanic cones, where trails cross arroyos, and where trails traverse areas with exposed sandy soils/sediments at the surface. Most visitor-created trails on the volcanoes are poorly-routed fall line trails. Hiking and bicycle use would likely continue to loosen gravel and small rocks, thereby displacing soils and increasing the rate of erosion on and along these existing visitor-created trails. Concentration of runoff down fall line trails on the escarpment and resulting gully erosion would likely continue to expand (i.e., widening and deepening of trails). On escarpment-face visitor-created trails, boulders may be undercut and tumble down the escarpment. Intermittent water flow in some arroyos would continue to be diverted by the grade of existing trail crossings. Water would continue to be diverted from its original course and run along the trails for some distance before establishing a new downhill course, resulting in continual erosion problems.

The surface organic layer of soils along the route corridors would continue to be removed and soils would be compacted, inhibiting water infiltration and leading to increases in water runoff and erosion. Erosion typically would continue and intensify when trails erode below the surrounding soil level, which further concentrates water and increases its erosive force. Ruts and uneven trail surfaces caused by erosion may lead some trail users to circumvent these sections of trail and cause trail widening or creation of parallel trails (Wimpey and Marion 2011; Hammitt and Cole 1998).

Soil impacts in the monument would continue to largely be distributed linearly along trail corridors. However, some trail sections would continue to experience greater degrees of impacts. The type and severity of resource impacts would be influenced by environmental attributes such as soil and

vegetation types, topography, and use-related factors such as behavior of users, amount of use, and type of use (Hammit and Cole 1998; Leung and Marion 2000; Monz et al. 2010). Soils in the monument vary in their runoff potential and susceptibility to wind or water erosion. Soils with moderate to high potential for erosion, such as loamy fine sand and steeper slopes, would be more prone to be adversely impacted by trail use. Furthermore, visitor-created trails, unlike well-designed designated trails, are rarely sustainable under heavy use, and resource degradation can become severe (Marion 2008). Relative to the total acreage of the monument, the area of soil disturbances along the monument's 140 miles of total routes (which range from 2-20 feet in width) is only a small proportion of the total monument area. However, the trails and the associated soil impacts meander across much of the monument's landscape and through many erosive landforms (arroyos, escarpments, etc.). Thus, the spatial extent of soil erosion, loss, and compaction, as well as widespread disruption of native soil structure is the most notable attribute of soil impacts from the no-action alternative.

In addition to the impacts from existing visitor-created and formal trails, given NPS staff observations of past and ongoing visitor trail use trends, new unofficial trails would likely be created over time by visitors in multiple areas of the monument under the no-action alternative. The relatively sparse, low-growing vegetation within the monument does not inhibit off-trail use, and visitor-created trails would likely continue to expand and proliferate. These likely expansions would increase the spatial extent of soil impacts throughout the monument. In particular, visitor-created trail expansion could be anticipated through sandy soils in Rinconada and Piedras Marcadas canyons and below the escarpment in "the narrows" between Piedras Marcadas and Boca Negra canyons. Sandy soils would not be as subject to compaction, but continued and increasing use and proliferation of visitor-created trails that disturb these soils and stabilizing vegetation would continue to exacerbate loss of soils because of wind scouring and water erosion.

In addition, numerous visitor-created trails originating from adjacent neighborhoods from multiple access points would remain open under the no-action alternative until ad hoc, site-specific evaluation is completed. Based on NPS observations of past and ongoing trends in access trail creation and external land development, the number and extent of these types of trails would likely increase over time in areas adjacent to external development, particularly where new developments are planned. Mesa Prieta is not currently highly used by visitors, but as development south of the monument continues, the volume of users and associated impacts in this area is likely to increase.

Overall, the no-action alternative would continue to result in the considerable, long-term deterioration of route corridors and result in the loss and degradation, compaction, and erosion of soils along and adjacent to visitor-created trails and former roads throughout the monument and heavily-used, unsustainable segments of formal trails on slopes and escarpments.

Cumulative Impacts. Several past projects within the monument have altered soils, such as relocation of the Volcanoes parking area, improvements to the Rinconada Canyon parking area, development of a small parking near the visitor center entrance gate, and construction of accessible trails. However, most of the past construction-related activities occurred within previously disturbed areas and did not create long-term or ongoing adverse impacts to soils. Improvements to the condition of walkways and continuing trail maintenance efforts have reduced some existing erosion problems and reduced localized disturbance to soils from visitor trampling. The monument's fire management plan, which calls for total fire suppression, would benefit soil resources by reducing the loss of soil stabilizing vegetation and avoiding the establishment of hydrophobic soil characteristics such as increased runoff and erosion rates. However, fire is an important natural disturbance that

helps to recycle soil nutrients and encourages new vegetative growth, so fire management actions overall would have both adverse and beneficial impacts on soils.

Several plans for connector trails from lands outside of the monument are likely to increase access and support increased use of the visitor-created trail network within the monument. Although the National Park Service would continue to perform designated trail maintenance based on staffing and funding availability, most of the trail network is composed of visitor-created trails and former roads that were never formally designed or constructed and are not maintained. Increased access and use from adjacent lands would contribute to continuing and worsening trail conditions and the compaction, erosion, and loss and alteration of soils along trails throughout the monument.

Although some of the past, present, and future actions independent of this plan would reduce localized impacts to soils, overall impacts from these actions in conjunction with the adverse effects associated with the no-action alternative would result in long-term adverse cumulative impacts to soils within the monument. The no-action alternative would represent a substantial component of the overall adverse cumulative impacts.

Conclusion. The no-action alternative would result in the continued, and in some cases increasing, deterioration of trail conditions and localized soil impacts such as compaction, reduced water infiltration, erosion, sedimentation, and disturbed soil structure. Water erosion, trail widening, and visitor-created trails would likely increase over time, especially along fall line trails prevalent on the escarpment and volcanic cones, through sandy soils, at arroyo crossings, and near adjacent neighborhoods. Overall, these impacts to soils from the continuation of current management direction would be long-term and along the majority of trails monument-wide. The effects would be concentrated along route corridors, most notably along much of the 96 miles of visitor-created trails, former roads, and along unsustainable trail segments on slopes and the escarpment. Although the linear nature of these trail-induced impacts would result in a disturbance area that is relatively small compared to the total monument size, the widespread, meandering nature of the 140 miles of routes makes these adverse effects considerable on a landscape scale. The impacts from past, present, and reasonably foreseeable future projects within the monument and surrounding areas when combined with the adverse effects associated with the no-action alternative would result in adverse cumulative impacts to soils.

Alternative 2 (NPS Preferred Alternative)

Under alternative 2, there would be 39 miles of formalized trail within the monument (which includes all 9 miles of primary administrative roads, about 1.5 of the 9 miles of utility access corridors, about 20.5 miles of a combination of visitor-created trails and former roads, and 8 miles of existing designated trails). About 93.5 miles of existing routes (which consists of visitor-created trails and former roads not included in the primary administrative roads) would be closed.

Passive restoration to natural desert conditions would be allowed to occur on most of these 93.5 miles of closed routes (i.e., allowing nature to run its course with vegetation restoration and soil stabilization occurring over time once regular visitor use/disturbance is removed). Also, active restoration may occur in other areas that necessitate it, such as in severely eroded areas and high use areas (soil scarification, native seeding, temporary erosion control measures, etc.). The area of restoration provided by these closures would range from about 2 to 20 feet width over the 93.5 miles of routes. Although the soil structure along these routes has been notably disturbed from years of visitor use, and some surface soils have been lost due to erosion, the soils along most of the closed routes are recoverable and the soil structure and function can be restored over time if visitor

disturbance is eliminated from these routes and native vegetation cover returns. However, it should be noted that due to the arid climate conditions of this region, the soil types, and the local topography, passive vegetation restoration and soil stabilization along many of the the closed routes may take several years. The rate of recovery would be very correlated to precipitation and temperature trends in the coming years.

As noted in the *Affected Environment*, a major issue with the existing network of visitor-created trails and former roads is erosion, particularly on the volcanoes and escarpment where many existing trails follow fall line alignments. Under alternative 2, existing routes would either be reclaimed (as described above) or rerouted to provide a more gradual climb and a more sustainable trail with less erosive potential (and part of the formalized trail network). Proposed trail design would incorporate more sustainable practices, such as side hill alignments, a cross slope alignment generally perpendicular to the slope (fall line), moderate trail grades, grade reversals, and out-sloped treads that drain water. These features would minimize erosion by containing trail users on the durable trail tread and allowing water to flow down slope in a minimally-erosive manner. In locations where rerouting is undesirable or impractical, specialized construction methods (e.g., steps, check dams) would be employed to improve stability and durability of the trail and reduce erosion.

Areas classified with erosion-susceptible soils and where underlying sandy sediments can be exposed to wind and water action are less suitable for sustainable trail construction. Trails through these areas would be provided as necessary to allow visitors to access petroglyph-viewing locations. However, best management practices for trail construction and maintenance would be applied to minimize erosion potential in these areas. There is currently a high concentration of visitor-created trails below the escarpment through areas characterized with thin soils that are prone to erosion if underlying sediment is exposed through disturbances. Studies show that improving and maintaining visitor-created trails to more clearly identify the designated trail and providing educational messages can reduce use of multiple unnecessary routes (Marion 2008; Marion and Reid 2007). Special construction methods (e.g., stabilized crusher fines, boardwalks, crib ladder stairways) and deterrents to off-trail hiking, such as educational and restoration signs, would be employed under this alternative to address resource protection concerns and reduce soil-related impacts such as erosion and compaction. These methods would help inform or dissuade visitors from roaming off-trail by helping them recognize the difference between formal and visitor-created trails and understand the potential resource impacts of going off-trail. The use of clearly defined and designed trails and informational/educational signs would properly direct visitors and allow for the restoration of visitor-created trails. Over time, this would reduce the area and intensity of direct soil erosion and compaction under this alternative and reduce visitor-caused soil disturbances that indirectly lead to increases in soil loss from wind and water erosion.

Similarly, secondary access points would be reduced, and formally designated trailheads and signs directing visitors into the monument would be provided under alternative 2. This is expected to limit the proliferation of user-created trails emanating from adjacent neighborhoods. The existing duplicative access trails leading into the monument would be reclaimed further reducing the extent of soil impacts.

Limiting bicycle use to 2 miles of multiuse trails specifically designed for such use, including the multiuse trails within Boca Negra Canyon and the Mesa Top above the canyon, along the western edge of the Northern Geologic Window, and a short escarpment crossing near Calle Nortena, would minimize potential soil impacts by avoiding areas that would require steep uphill or downhill grades or quick changes of speed or direction that cause wheels to lock, slide, and shear soils in the trail tread.

Trail stabilization and trail construction projects would adversely impact soils along portions of the proposed 39 miles of formalized trails and at access points (where stabilization is needed). However, there would be only small, localized amounts of new disturbance and the effects would be short term, likely lasting no more than one construction season. Proposed trail routes would take advantage of previously disturbed areas by primarily using existing impacted trail and road segments where possible, and construction activities would use best management practices to minimize the footprint of impacts. Despite these localized, short-term, adverse effects of the construction work, the resulting long-term effect of trail stabilization and sustainability would be beneficial to soils along the 39-mile formalized trail system.

In addition, trail use on the formalized trail network would continue to contribute to soil compaction and erosion, and the use of formalized trails may increase under alternative 2 because of the closure and rehabilitation of much of the visitor-created trails and former roads. However, the implementation of a visitor use management framework with indicators for monitoring formal trail conditions and new visitor-created trails would allow monument managers to identify conditions that are indicative of a need to implement management strategies and mitigation measures. As part of this alternative, these visitor use management activities would help to reduce trail widening, soil loss, and the formation of unsustainable visitor-created trails that contribute to soil compaction and erosion, thus resulting in a long-term beneficial impact to soil resources.

Cumulative Impacts. As described under alternative 1, various past improvement projects and fire management activities within the monument have altered soils in a few localized areas. The provision of clearly formalized trails under alternative 2 would correct existing erosion problems and reduce localized disturbance to soils from visitor trampling. Several plans for connector trails from lands outside of the monument would increase access and support increased use of the trail network within the monument. However, under this alternative, this increased use would be directed along an improved formalized trail system designed to minimize impacts.

Although some of the cumulative actions would result in localized, adverse impacts to soil resources, overall impacts from these actions in conjunction with the overall beneficial effects associated with alternative 2 would result in beneficial effects to soils within the monument. Actions proposed in alternative 2 would represent a substantial component of the overall beneficial cumulative impacts to soils.

Conclusion. Alternative 2 would result in some localized, short-term soil compaction and erosion impacts along trails and at access points during trail construction or stabilization work. However, the passive and active restoration of a majority of existing visitor-created trails and former roads (93.5 miles) coupled with improved sustainability and signage of trails retained as designated under this alternative would notably reduce the extent of ground impacts and eliminate many areas of localized soil erosion, compaction, and gully formation. Although complete vegetation restoration and soil stabilization along closed routes may take several years and is dependent on climate conditions among other factors, these actions would allow for a gradual recovery of soil structure and function across much of the monument over time. In addition, improved control and monitoring of monument access points and prevention of new visitor-created trail development would help minimize or prevent new soil impacts from developing in the future. Collectively, this alternative would result in a considerable, long-term beneficial effect to soils and soil structure across the monument over time. The impacts from past, present, and reasonably foreseeable future projects within the monument and surrounding areas when combined with the overall beneficial effects associated with alternative 2 would result in a beneficial cumulative effects to soils.

Alternative 3

The impacts of alternative 3 on soil resources would be very similar to those described in alternative 2 with the exception of the allowed uses on some trails.

Alternative 3 would designate 14.5 miles of multiuse trail, primarily on the Mesa Top and in the Volcanoes area. Bicycle use can contribute to soil impacts by shearing and compacting the soil that makes up the trail tread. However, by limiting bicycle use to stabilized Mesa Top roads/trails that have gentle gradients and do not require rapid changes in speed or direction, alternative 3 would greatly reduce the number of trail miles susceptible to soil impacts that may result from bicycle use under current conditions.

Cumulative Impacts. As noted under the analysis of alternatives 1 and 2, various past improvement projects and fire management activities within the monument have altered soils in a few localized areas. However, the impacts from these past, present, and future actions in conjunction with the overall beneficial effects associated with alternative 3 would result in long-term, beneficial effects on soils within the monument. Alternative 3 would substantially contribute to the overall beneficial cumulative impacts.

Conclusion. Alternative 3 would mostly result in the same impacts as described under alternative 2.

VISITOR USE AND EXPERIENCE

Alternative 1 (No-Action Alternative)

Under the no-action alternative, there would be no comprehensive formalized trail system. The continuation of current management would continue to adversely impact visitor access, information, and circulation, the diversity of visitor experiences, and the quality of the visitor experience.

Visitor Access, Information, and Circulation. Lack of a well-marked trail system may cause visitors to take visitor-created trails, which may result in visitor confusion and disorientation in determining which trail would take them to where they want to go, thereby causing adverse impacts to the visitors' ability to access and circulate safely and efficiently throughout the monument. For visitors who use the trails accessing the monument, the overall adverse impacts would continue until action is taken to improve visitors' ability to circulate more easily throughout the monument. There is potential risk to visitor safety for those who are unfamiliar with the monument who may get lost from taking visitor-created trails because under the no-action alternative there is no comprehensive plan to improve visitor access, information, and circulation.

Access

- *Primary Public Access*—Under the no-action alternative, the five primary access points would remain open and visitors would continue to be directed to the 8 miles of existing designated trails.
- *Secondary Public Access*—Secondary access points would remain open and visitors would continue to circulate unconstrained on visitor-created trails and former roads. The continuation of primary and secondary access points would result in beneficial impacts for visitor opportunities to access a variety of areas in the monument leading to a diverse range of outdoor activities. Retaining all of the secondary access points would likely result in adverse impacts and added confusion to wayfinding, given the proliferation of visitor-created trails and access points throughout the monument.

Wayfinding and Signage—The lack of wayfinding and signage would continue to cause confusion for visitor access, information, and circulation. Ineffective and/or absent wayfinding and signage would likely result in an adverse experience for some visitors as they struggle to navigate throughout the monument.

Because of the openness of the landscape, the visitor-created trails and access points are highly visible and detract from the sense of a well-managed and protected environment. Without improved wayfinding and signage, the monument is likely to see a proliferation of visitor-created trails and access points. Existing informal access points and visitor-created trails leading from informal access points can adversely affect the visitor's experience because of the lack of clear directional guidance and messaging which reduces the risk of visitor's becoming disoriented or getting lost.

Diversity of Visitor Experiences and Opportunities. Use levels for hiking, dog walking, bicycling, scenic viewing, education study, and other uses would be expected to continue in the same proportion, although the actual numbers for each are anticipated to rise because of the aforementioned increase in visitation. Crowding on trails would continue to be a problem under the continuation of current management as a result of visitor conflicts. This is likely to occur in popular areas where multiple user groups compete for similar experiences. This could cause adverse impacts to the overall visitor experience. Crowding on trails could become a problem, particularly in popular areas, causing adverse impacts to the overall visitor experience. Under the no-action alternative, the overall range of diverse visitor experiences would remain consistent and potentially increase. The range of diverse visitor experiences could increase as visitation continues to grow and emerging types of visitor uses become more popular. The adverse impacts would occur during potential user conflicts with the likelihood of displacing visitors to other areas if they are unable to achieve their visitation goals. User conflicts would also cause adverse impacts to the natural soundscape and would have an adverse effect on visitor experience, particularly for those who are seeking solitude. All visitors would be adversely affected by a continued degradation of the soundscape resulting from sources originating outside of the park such as air traffic. Beneficial impacts such as access to a variety of visitor experiences would continue. Access to a variety of visitor experiences provides visitors' with a wide range of motivations for opportunities to achieve their desired visitor experiences.

Hiking—Hiking would continue to be a primary activity within the monument. The designated trails and current configuration of routes within the monument would continue to provide visitors a variety of options for length, level of challenges, and natural quiet experiences contributing to beneficial impacts to the diverse range of visitor experiences. Given the inevitability of visitors to hike the easiest route, the visitor-created trails could be expanded by visitors' over time, by high use. Under the no-action alternative, beneficial impacts would occur to the diversity of visitor experiences especially for hiking. Beneficial impacts include access to a range of hiking experiences from varied trail length and difficulty providing visitors with a wide range of motivations for recreation to achieve their desired visitor experience. Trail widening has been observed throughout the monument, particularly in connection with visitor-created trails. Trail widening is more problematic after precipitation events. The quality of the hiking experience could be adversely impacted, as the experience can become less intimate and more of a distraction from the fundamental resources and values visitors' intend to experience.

Leashed Dog Walking—Dog walking would continue to be a primary activity within the monument. Failure by some visitors to follow dog leash rules would likely continue perpetuating adverse impacts to the visitor experience. The presence of dog feces, for instance, would continue to degrade the

quality of the visitor experience in areas where it has not been disposed of properly, and dogs off-leash could create user-conflicts between dog walkers and hikers without dogs.

Bicycling—Bicycling would continue to be a primary activity within the monument allowed on Mesa Top roads/trails and outside of petroglyph viewing areas. Under the no-action alternative, bicycling could contribute to the creation of visitor-created trails throughout the monument as well as the potential for user conflict in the absence of the separation of types of use. This alternative would benefit visitors seeking bicycle experiences, while other displaced visitors would be adversely impacted. Benefits include continued access to a wide range of bicycle experiences from easy to moderately challenging through trail selection.

Opportunities for Visitors to Learn About and Understand Important Resources and Stories.

The monument would continue to provide a variety of opportunities for visitors to learn about and understand the important resources and stories of the area. Visitor experiences would benefit as the diversity of available opportunities to learn about the monument resources continues under the no-action alternative. The National Park Service would continue to offer multiple and diverse interpretive/educational programs and wayside exhibits as described in the affected environment. As a result, visitors would continue to have enough opportunities to learn about monument resources to meet demand, and visitor satisfaction with these opportunities, as determined by annual surveys, would likely remain high.

Quality of the Visitor Experience.

Monument Facilities—The 8 miles of designated trails would continue to be available and provide access to the main destinations.

Visitor Services—Visitor services would continue to be provided and visitor satisfaction with those services is likely to remain high. This would result in beneficial impacts to the quality of the visitor experience.

Cumulative Impacts. Past, present, and reasonably foreseeable future projects within the monument and surrounding areas have the potential to affect visitor use and experience. Past actions to improve visitor facilities and accessibility have enhanced visitor experience and contributed to better ABA-accessibility at those sites. Ongoing and future trail maintenance would temporarily, during construction only, adversely impact visitor experience but would result in long-term beneficial effects. Past and future installation of fencing along the Monument's boundary, especially near the Northern Geologic Window, have resulted in a decrease of prohibited and illegal activities—the effects of which degrade the quality of visitor experiences and the ability of visitors to understand and appreciate resources. Further fencing along the monument boundary is likely to have the same effect on visitor use and experience. The Local Land Use Plans would consider options to enhance visitor use and experiences in that area, which would have beneficial effects. In addition, continued coordination with the Albuquerque Metropolitan Arroyo and Flood Control Authority on potential projects adjacent to the monument could improve access opportunities, resulting in beneficial effects.

Past, present, and reasonably foreseeable future actions include development immediately adjacent to the monument (Local Land Use Plans), which will directly impact visitor use and experience by affecting monument access and number of visitors to the monument. In the absence of a comprehensive formalized trail system, the development would likely result in additional visitor conflicts and visitor-created access points and trails throughout the monument. The situation for visitor use management is already difficult to manage because of the creation of informal access

points and the proliferation of visitor-created trails. Visitor use and experience would continue to be adversely affected by activities that continue to create disruptions in the scenic landscape, which further perpetuate challenges with wayfinding and signage not to mention the proliferation of visitor-caused damage to important monument resources. The effects of other past, present, and reasonably foreseeable future actions by others, in combination with the effects of the NPS action alternatives, would result in minor, adverse, cumulative effects. The incremental contribution of the no action alternative would be slightly adverse and cumulative impacts would continue to be minor and slightly adverse.

Conclusion. The no-action alternative would contribute beneficial and adverse effects to visitor use and experience. Specifically the lack of a well-marked trail system and lack of wayfinding and signage will continue to cause confusion for visitors resulting in adverse effects to visitor use and experience. The quality of the visitor experience will be continue to degrade where visitor conflict exists. However, beneficial impacts include access to a range of hiking experiences from varied trail length and difficulty providing visitors with a wide range of motivations for recreation to achieve their desired visitor experience. Overall, under alternative 1, the adverse impacts to visitor use and experience would outweigh the beneficial impacts of a continuation of current management.

Alternative 2 (NPS Preferred Alternative)

Under alternative 2, visitation at the monument would likely continue to gradually increase as it has been over recent years. Increasing numbers of visitors would be appropriately guided to a formalized trail system with formalized access, information, and circulation throughout the monument, resulting in beneficial effects to wayfinding and the overall quality of visitor experience. However, the diversity of visitor experience would be somewhat more limited than in the no-action alternative, as bicycling would be restricted to two miles of multiuse trails. Despite any adverse impacts to the diversity of visitor experiences, the quality of the visitor experience would be greatly enhanced as a result of improvements such as the restoration and rehabilitation of petroglyph viewing areas, unsustainable trail corridors, and visitor-created trails.

Visitor Access, Information, and Circulation. The changes proposed in alternative 2 would result in beneficial impacts to visitor access, information, and circulation. Formalizing visitor access points would give visitors a ‘sense of arrival,’ and providing information about the formalized trail system, such as maps and signage, as well as improving circulation by incorporating roads and visitor-created trails where appropriate, would help to create a sustainable trail system. All users would be advised to stay on the formalized trails.

Designating the trail system would also potentially decrease the number of occurrences of visitor-caused damage to petroglyphs, archeological sites, and ethnographic resources. Under alternative 2, monument strategies may include rerouting trails and examining potential temporary closures and increasing ranger presence/patrol in prioritized high visitor use areas. Should there be an increase in visitor-caused damage to important monument resources, area closures would likely adversely impact visitor access and circulation.

Access

- *Primary Public Access.* Under alternative 2, there would six primary public access points with core amenities within the monument at the Volcanoes area, Mesa Prieta (southern tip of the monument), Rinconada Canyon, Boca Negra Canyon, Piedras Marcadas Canyon, and the Las Imágenes Visitor Center. These primary access points would provide entrance to the

established trail system, allowing visitors to more easily circulate throughout the monument and access a diverse range of visitor experiences including the petroglyph viewing areas.

- **Secondary Public Access.** Under alternative 2, 24 secondary access points would be established. These secondary access points would provide information and access to the formalized trail system, petroglyph viewing areas, and Mesa Top allowing visitors to circulate throughout the monument and beneficially impacting visitors' opportunities to access a diverse range of visitor experiences. Access from neighborhoods would be consolidated, and monument access would be clearly identified. All other secondary access points would be closed, restored, and rehabilitated. Communication and coordination with adjacent landowners and neighborhood communities would help disseminate information and provide clarity on designated monument access points and the need to curtail creation of additional accesses.

Wayfinding and Signage. Under alternative 2, the monument would improve trail identification and signage for the newly formalized trail system, which would result in beneficial impacts to visitor information and circulation thereby enhancing navigation throughout the monument. Property line and area closure signage would contribute to enhancing visitor awareness of entering a National Monument. Increased wayfinding and signage would likely result in beneficial impacts to the overall visitor experience as expectations for visitor behavior are clearly defined.

Diversity of Visitor Experiences and Opportunities. Under alternative 2, the overall diversity of experiences available in the monument would be adversely impacted. Leashed dog walking would be allowed on the formalized trail system, except for on trails within the Boca Negra Canyon area, the northern section of Rinconada Canyon trail, and to the tops of JA and Black volcanoes. Bicycle use would be limited to two miles of trails. Limiting bicycle use and access for dog walkers would adversely affect visitor experience by reducing the types of available activities and opportunities to enjoy the monument.

Hiking would continue to be a primary activity within the monument. The formalized trail system would provide visitors with a variety of options such as trail length, level of challenge, and natural quiet experiences. Under alternative 2, to protect the solitude and natural quiet experiences at Mesa Prieta and Rinconada and Piedras Marcadas inner canyons, the monument management would designate 'quiet zones/areas' that would result in providing a greater range of visitor opportunities for those seeking solitude experiences. There would be a variety of formalized opportunities for hiking, photography, wildlife viewing, study, solitude, or group activity through an expanded trail system and connectivity with monument resources. Setting aside trails for designated uses would mean that visitors are no longer competing to use the same spaces for activities that may interfere with one another's enjoyment of the monument. A more expansive trail system would allow for dispersal of visitors, allowing those who seek solitude and quiet to find it.

Opportunities for Visitors to Learn About and Understand Important Resources and Stories. The monument would increase the variety of opportunities for visitors to learn about the formalized trail system, appropriate visitor behavior, and minimal-impact trail use. Providing additional information and education at trailheads—especially regarding sensitive resources and staying on trails—would encourage behaviors that do not damage resources or interfere with others' enjoyment of the monument, allowing more visitors to attain their desired experiences. Increasing the number of Trail Watch volunteers would provide an opportunity for the local community to engage with and help protect important monument resources by assisting with recording incidents and disseminating

information about trail use and appropriate visitor behavior. These volunteers would learn how to act appropriately in the monument and as model “park citizens” would in turn educate others. Visitors would also have opportunities to learn about prehistoric and historic environments, soundscapes, and the acoustic environment through guided walks and listening exercises, and would come to understand the importance of natural soundscapes, especially in proximal urban environments. More ways of communicating the monument’s messages mean that more people would have a better chance of understanding them, which would in turn produce greater numbers of responsible stewards and help to preserve the monument’s resources for future generations to enjoy.

Quality of the Visitor Experience

- *Monument Facilities*—As the monument increases primary access locations from five to six under alternative 2, beneficial impacts to the quality of the visitor experience would occur as a result of increased access and amenities. Visitors would retain the freedom to choose between a number of trails that all provide access to the main destinations. With the establishment of the formalized trail system, trail conditions would be improved and visitors would have more opportunities and more ways to learn about and enjoy the monument through its more sustainable trail network.
- *Visitor Services*—Visitor services would be enhanced at the monument under alternative 2 and would result in beneficial impacts to the quality of the visitor experience. Effective directional information, such as trail signage, would ensure a safe and enjoyable experience and would reduce adverse resource impacts, and enhanced interpretive media would help to convey the important stories of the monument.

Cumulative Impacts. See Cumulative Impacts of alternative 1.

The establishment of a formalized trail system and more formalized access points called for in alternative 2 would likely help to diminish the formation of additional such visitor-created access and trails and would reduce the likelihood of use-related conflicts on trails. Enhanced wayfinding and interpretive signage would also help to mitigate those issues, as well as any damage that may occur to important natural and cultural resources if those areas of the monument are managed according to past strategies.

The effects of other past, present, and reasonably foreseeable future actions by others, in combination with the effects of the NPS action alternative 2, would result in minor, beneficial, cumulative effects. Combining the effects of implementing the NPS preferred alternative (additional formalized trail miles) with the effects of other past, current, and reasonably foreseeable future actions described above, the cumulative long-term visitor use and experience impacts would be localized (to the surrounding Albuquerque area), minor (temporarily adversely impact the visitor experience), and mostly beneficial with the additional trail miles. The incremental contribution of alternative 2 would be beneficial and cumulative impacts would continue to be beneficial.

Conclusion. Alternative 2 would contribute both beneficial and adverse effects to visitor use and experience. The establishment of a trail system, identification of access points, and improvements to wayfinding and signage would result in substantial beneficial impacts to access, circulation, and the overall quality of visitor experience. Visitor-caused damage to important monument resources is anticipated to decrease, as visitors are more likely to stay on a well-designed formalized trail system instead of veering off-trail. Road and trail conditions would be improved, enhancing the quality of the visitor experience with associated beneficial impacts. Finally, the new formalized trail system and

enhanced wayfinding and signage would aid visitors in navigating the monument and decrease the proliferation of visitor-created access points and trails throughout the monument.

Despite the highly beneficial impacts to visitor access, information, circulation, and overall quality of the visitor experience, adverse impacts would occur to the diversity of visitor experiences, as a more limited range of opportunities would become available under alternative 2. Specifically, bicyclists would have access to a reduced number of trail miles.

Overall, under alternative 2, long-term, monument-wide, beneficial impacts to visitor experience and safety on the trails would result. These effects, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, beneficial cumulative impacts to visitor experience and safety.

Alternative 3

The overall goal of alternative 3 is to provide diverse visitor experiences and purposeful access, and the formalized trail system would help to accomplish this goal as it contains 14.5 miles of multiuse trail versus 2 miles of multiuse trail in alternative 2. The quality of the visitor experience would be greatly enhanced as a result of improvements such as restoration and rehabilitation of petroglyph viewing areas, unsustainable trail corridors, and visitor-created trails, and an overall more comprehensive multiuse trail network.

See alternative 2, impact analysis.

Visitor Access, Information, and Circulation. The changes proposed in alternative 3 would result in beneficial impacts to visitor access, information, and circulation. The establishment of a comprehensive multiuse formalized trail system coupled with a minimization of the number of visitor-created trails and access points would make it clearer to visitors which trails and access points they should be using and would result in improved circulation.

Designating a comprehensive multiuse trail system, with 14.5 miles of multiuse trail, would also potentially decrease the number of occurrences of visitor-caused damage to petroglyphs, archeological sites, and ethnographic resources. Visitors are more likely to stay on a well-designed formalized trail system instead of veering off trail, thereby impacting monument resources. Under alternative 3, monument strategies may include rerouting trails and examining potential temporary closures, and increasing ranger presence/patrol in prioritized high visitor use areas. Should there be an increase in visitor-caused damage to important monument resources, area closures would likely adversely impact visitor access and circulation.

See alternative 2, impact analysis.

Access and Wayfinding and Signage.

- Common to alternatives 2 and 3. See alternative 2, impact analysis.

Diversity of Visitor Experience and Opportunities. Beneficial impacts would occur to the diverse range of appropriate opportunities available for visitors under alternative 3. In addition to the benefits listed in alternative 2, alternative 3 would allow bicycling to continue to be a primary activity within the monument. The comprehensive formalized multiuse trail system would provide visitors a variety of options for length, level of challenges, and natural quiet experiences. Conflicts among different user types could occur in areas where bicyclists, hikers, and dog walkers are allowed and

could result in adverse impacts to the quality of the visitor experience, but the overall impact would be beneficial as the number and types of activities allowed within the monument would be expanded.

Opportunities for Visitors to Learn About and Understand Important Resources and Stories.

See alternative 2, impact analysis. There are no additional management strategies in alternative 3 that vary from those described in alternative 2.

Quality of the Visitor Experience

- *Monument Facilities.* The quality of the visitor experience would be enhanced and result in beneficial impacts as strategies to manage trail widening are pursued and strategies to manage excessive soil loss are employed, creating a more sustainable trail network.
- *Visitor Services.* Common to alternatives 2 and 3. See alternative 2, impact analysis.

Cumulative Impacts. Common to alternatives 2 and 3. See alternative 2, impact analysis.

Conclusion. Many of the beneficial and adverse impacts from alternative 2 are also common to alternative 3. The primary difference in alternative 3 is an increase in the miles of formalized multiuse trails, which would provide a greater diversity of opportunities and would result in beneficial effects to those seeking this opportunity. Conflicts among different user types could occur in areas where bicyclists, hikers, and dog walkers are allowed and could result in adverse effects on the quality of the visitor experience. Overall, under alternative 3, long-term, monument-wide, improvements to visitor experience and safety on the trails would result. These effects, when considered with other past, present, and reasonably foreseeable future projects, would have long-term, monument-wide, beneficial cumulative impacts to visitor experience and safety.

CHAPTER 5: CONSULTATION AND COORDINATION

CONSULTATION WITH NATIVE AMERICAN TRIBES AND PUEBLOS

Petroglyph National Monument has 29 traditionally associated pueblos and tribes.

Pueblo of Acoma	Pueblo of Taos
Pueblo of Cochiti	Pueblo of Tesuque
Pueblo of Isleta	Pueblo of Ysleta del Sur
Pueblo of Jemez	Pueblo of Zia
Pueblo of Laguna	Pueblo of Zuni
Pueblo of Nambe	Hopi Tribe
Ohkay Owingeh	Navajo Nation
Pueblo of Picuris	Comanche Nation
Pueblo of Pojoaque	Fort Sill Apache
Pueblo of Sandia	Jicarilla Apache Nation
Pueblo of San Felipe	Mescalero Apache Tribe
Pueblo of San Ildefonso	San Carlos Apache
Pueblo of Santa Ana	Tonto Apache Tribe
Pueblo of Santa Clara	White Mountain Apache
Pueblo of Santo Domingo (Kewa Pueblo)	

LIST OF AGENCIES AND PERSONS CONSULTED

Federal Agencies

US Fish and Wildlife Service

Congressional Delegation

State Agencies

New Mexico State Historic Preservation Office

Local Government

Bernalillo County

City of Albuquerque

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APPENDIX A: IMPACT TOPICS DISMISSED

The following are additional impact topics that were considered but dismissed.

Special Status Species. Various federal and state listed species may occur in Bernalillo County. On January 10, 2018, the National Park Service accessed the US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) website to obtain an official species list for endangered and threatened species that may be in the planning area and could be affected by project activities. Five federally threatened and endangered species are on the USFWS list for Bernalillo County in which the monument is located (table A-1). No designated critical habitat is present for any of these species in this county. The following table also includes state-listed wildlife species from the New Mexico Game and Fish Biota Information System and state-listed plants from the New Mexico State Forestry website.

Table A-1. Federally and State Listed Threatened Species and Endangered Species Identified as Present in Bernalillo County

Common Name	Scientific Name	Federal Status ¹	State Status ²
Mammals: New Mexico Meadow Jumping Mouse	<i>Zapus hudsonius luteus</i>	Endangered	Endangered
Mammals: Spotted bat	<i>Euderma maculatum</i>	N/A	Threatened
Birds: Aplomado falcon	<i>Falco femoralis</i>	N/A	Endangered
Birds: Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	N/A	Threatened
Birds: Baird's sparrow	<i>Anthus spragueii</i>	N/A	Threatened
Birds: Bald eagle	<i>Haliaeetus leucocephalus</i>	N/A	Threatened
Birds: Bell's vireo	<i>Vireo bellii</i>	N/A	Threatened
Birds: Broad-billed hummingbird	<i>Cynanthus latirostris</i>	N/A	Threatened
Birds: Brown pelican	<i>Pelecanus occidentalis</i>	N/A	Endangered
Birds: Common black hawk	<i>Buteogallus anthracinus</i>	N/A	Threatened
Birds: Gray vireo	<i>Vireo vicinior</i>	N/A	Threatened
Birds: Least tern	<i>Sternula antillarum</i>	N/A	Endangered
Birds: Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened	N/A
Birds: Neotropic cormorant	<i>Phalacrocorax brasilianus</i>	N/A	Threatened
Birds: Peregrine falcon	<i>Falco peregrinus</i>	N/A	Threatened
Birds: Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered	Endangered
Birds: White-eared hummingbird	<i>Hylocharis leucotis</i>	N/A	Threatened
Yellow-billed cuckoo	<i>Coccyzus Americanus</i>	Threatened	N/A
Fish: Rio Grande silvery minnow	<i>Hybognathus amarus</i>	Endangered	Endangered
Vegetation: Great plains ladies' tresses	<i>Spirantahes magnicamporum</i>	N/A	Endangered

¹From the USFWS IPaC web site (<https://ecos.fws.gov/ipac/>)

²Wildlife species listed on <http://bison-m.org/speciesreports.aspx>. The plant species is listed on <http://www.emnrd.state.nm.us/SFD/ForestMgt/EndangeredPlantsByCounty.html#Bernalillo>

The planning team reviewed the US Fish and Wildlife Service and state-listed species to determine which species could be affected by implementation of the proposed actions described in this plan. The alternatives would not affect the five federally listed species because the habitats they depend on are not present in the monument. Informal consultations with USFWS biologists confirmed this. The Rio Grande silvery minnow requires perennial water, which is not present in the monument. The New Mexico meadow jumping mouse is found in two riparian community types: persistent emergent herbaceous wetlands and scrub-shrub wetlands (<https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0BX>)—neither of which occur here. Both the yellow-billed cuckoo and southwestern willow flycatcher depend on dense riparian vegetation habitat, which the monument lacks. Thus, this plan would have no effect on these species.

The Mexican spotted owl roosts and nests primarily in forested and rocky-canyon habitats. These forests often contain mature or old-growth stands with complex structure. The owl also is found in a variety of steep, narrow, rocky-canyon habitats (USFWS 2012). These habitat types are not present in the monument. The owls forage in a variety of habitats, and there may be some forage opportunities in the monument, such as cliff faces and terraces between cliffs. Discussions with USFWS biologists indicate that the monument does not provide habitat that would support the species for a long period of time—habitat that is present is marginal and unlikely to support prolonged use. One record of a Mexican spotted owl was documented in the monument in the spring of 2017, but this individual was a transient and was present for only a short time near the monument’s visitor center. No actions are being taken in this plan that would result in the loss of potential owl habitat or result in increased use that would disturb or prevent owls from using the monument. Thus, this plan would have no effect on the Mexican spotted owl or its habitat. If spotted owls were observed again in the monument, work would stop or be limited to activities that would not disturb the bird or its habitat, and park staff would informally consult with the US Fish and Wildlife Service on further measures that may need to be taken.

Regarding the state listed species, based on information in the New Mexico Game and Fish 2016 Biennial Review, it is unlikely that the state listed species are residents in the monument (although individuals may pass over or through, such as a bald eagle flying over). In New Mexico, these species are found in forested areas (e.g., spotted bats, white-eared hummingbird), riparian and aquatic habitats (e.g., brown pelican, common black hawk, least tern, neotropic cormorant, broad-billed hummingbird, Bell’s vireo, ladies tresses), in grasslands (e.g., Aplomado falcon, Baird’s sparrow), and in mountains and high cliffs (e.g., peregrine and arctic peregrine falcons). None of these habitats occurs in the monument. In New Mexico, the gray vireo occurs in arid woodlands with juniper, pinyon, or oak, on pinyon-juniper savannahs, oak scrub and chaparral; breeding habitat is generally in areas with pinyon-juniper (New Mexico Dept. of Game & Fish 2007). Although the monument may include some of this habitat, it is likely marginal habitat for breeding. No gray vireo was detected in a previous inventory (Johnson et al. 2007). This plan would not result in the loss of habitat that would affect the presence of the vireo in the monument.

The Migratory Bird Treaty Act mandates the protection of migratory and some nonmigratory birds from direct take of individuals, primarily during the nesting season and other times of the year, and protects their habitat. Migratory birds pass through the monument in the spring and fall. However, the actions being considered in this plan would result in a negligible amount of native vegetation removal in isolated areas where some minor trail rerouting is needed for trail sustainability. If vegetation removal activities cannot occur outside the bird nesting season, the National Park Service would conduct bird surveys prior to scheduled construction activity to determine if active nests are present within the area of impact. If active nests or breeding behavior are detected during the surveys, no vegetation removal activities would be conducted until nestlings have fledged or the nest fails or breeding behaviors are no longer observed (also see *Mitigation Measures and Monitoring Guidelines for Both Action Alternatives* in the appendix D). Indeed, the preferred alternative would close a number of visitor-created trails that would reduce fragmentation of avian habitat, restore native vegetation in currently disturbed areas that would restore desert grassland and shrubland habitat for songbirds, and concentrate human use on designated trails that would reduce

disturbances to bird behavior off trails and reduce nest disturbance or trampling. All of these actions would benefit the species. The mitigation measures identified in appendix D also would help ensure that impacts to migratory birds are avoided or minimized.

Because habitats that support federal or state listed species are not known to occur in the monument, and the actions in the plan would not be expected to measurably affect these species or their habitats, and with the application of the mitigation measures in appendix D to avoid/minimize impacts to migratory birds, this topic has been dismissed from further consideration.

Vegetation. According to the *NPS Management Policies 2006*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). The vast majority of the proposed trail system is on previously disturbed, visitor-created trails and/or on existing roads. As unauthorized visitor-created trails are closed and/or passively restored, vegetative community health would improve because of the restored continuity of native vegetation coverage (reduced community fragmentation) and reduced spreading of nonnative, invasive plants along visitor-created trail disturbance corridors. Any new trails and/or rerouted trails would be constructed following sustainable trail design principles that aim to reduce soil loss from erosive processes (e.g., from surface stormwater run-off). Under both action alternatives, only a negligible amount of native vegetation removal would occur in isolated areas where some minor trail rerouting is needed for trail sustainability. Considering the approximately 140 miles of total existing routes (roads and trails), with an estimated average width of 6 feet, roughly 100 acres of native desert grassland community or less than 2% of the total acreage of the monument would continue to be disturbed under the no-action alternative. Whereas, both action alternatives consider approximately 46.5 miles of official disturbance routes, substantially fewer miles of official routes than the current 140 miles. With passive restoration of native vegetation along the closed routes, this would reduce the estimated acreage of ground disturbance from 100 acres to roughly 33 acres. In addition, implementation of either action alternative would include mitigation to ensure that equipment, materials, and clothing are not harboring nonnative plants or plant parts to minimize the potential for introduction and/or spread of nonnative species. Because the anticipated effects of the action alternatives on vegetation are expected to be minimal and primarily beneficial, this topic is dismissed from further analysis in this document.

Wildlife. According to the *NPS Management Policies 2006*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). Wildlife commonly found in the monument includes coyotes, ground squirrels, desert cottontails, woodrats, and mice. There are at least 44 different bird species within the monument (Johnson et al. 2007). There are also numerous insect species and 17 species of reptiles.

Currently, wildlife habitat is fragmented by roughly 140 miles of routes within the monument. In addition, pets that are off-leash can disturb wildlife behavior and habitat. It is estimated that less than 2% of the total acreage of the monument is being impacted by the approximate 140 miles of routes (roughly 100 acres). By substantially reducing the mileage of routes from the existing 140 miles to about 46.5 miles and passively converting those trails and former roads back to suitable habitat and thus reducing fragmentation, there should be a notable beneficial impact to habitat connectivity and wildlife behavior under both action alternatives. In addition, improved signage, communication, and law enforcement and volunteer presence would continue to educate visitors on where pets may be present and that they must be on a leash. Improved visitor control of pets (e.g., leashes) would reduce interactions between domestic pets and wildlife that could otherwise result in wildlife injury or mortality and would reduce disturbances to wildlife behavior from pets who run off-trail. In addition, formalizing trails is not anticipated to negatively affect important wildlife habitat used for breeding, foraging, or nesting given that the formalization would occur along existing disturbance corridors and not in areas with high habitat value. Lastly, because the improved visitor

education and the reduction in route disturbance mileage would be the same under both action alternatives, the beneficial impacts to wildlife would not differ among the action alternatives. For the above reasons, this topic has been dismissed from further evaluation in this document.

Floodplains. Executive Order 11988 (Floodplain Management, 42 FR 26951) requires an examination of impacts to floodplains and the potential risk involved in placing facilities within floodplains. The NPS *Management Policies 2006*, Director's Order 77-2 provides guidelines for proposed actions in floodplains. Per this guidance, certain construction within a 100-year floodplain requires preparation of a Statement of Findings (SOF) for floodplains. In high hazard areas (areas subject to flash flooding), foot trails and associated daytime parking facilities may be placed within the 100-year floodplain, but these facilities must contain signs informing visitors of flood risk and suggested actions in the event of flooding.

In the monument, a number of arroyos originate on the mesa and drain to the east and southeast down the escarpment. Although these arroyos are typically dry, the Federal Emergency Management Agency Flood Insurance Rate maps for Bernalillo County designate these arroyos as special flood hazard areas and categorize flood flows for the 100-year flood as sheet flow, 1-3 feet in depth, with an average depth of 1 foot where the flood elevation has been determined. Some trail segments cross these drainages, and the water has historically been diverted down the trail because of the alignment and design of the trail. However, proposed trail designs would not only stabilize the trails to make them more sustainable, but would also redirect water back into the natural drainages, which would help restore the natural flow regime of the arroyos and the associated flood event dynamics. Installation of informational signs warning visitors of potential flood dangers would be considered and implemented where appropriate. No facilities that would adversely affect flood flows or floodplains would be installed in the identified special flood hazard areas, and all earthwork associated with trail construction would either have no effect on floodplains or would improve the floodplain and flood flow conditions. None of the actions considered in this document are anticipated to adversely affect the natural resources and functions of floodplains or increase flood risks, therefore, a Statement of Findings will not be prepared at this time. Best Management Practices would be implemented to help avoid any adverse effects to floodplain values during project implementation. Any effects on floodplain values or functions that result from this project would likely be beneficial and localized (in the arroyos). Therefore, the topic of floodplains was dismissed.

APPENDIX B: DETAIL TRAIL DESCRIPTIONS FOR ALTERNATIVES 1, 2, AND 3

Table B-1. Existing Designated Trails and Authorized Uses Under Alternative 1 (No-Action Alternative)

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
Cliff Base Trail	Boca Negra Canyon	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0.5 mile	Pavement / Natural surface
Macaw Trail	Boca Negra Canyon	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0.3 miles	Pavement
Mesa Point Trail (Escarpment Crossing)	Boca Negra Canyon	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 <i>(.17 mile)</i>	Pavement
Upper Boca Negra Canyon Trail (Escarpment Crossing)	Upper Boca Negra Canyon	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 <i>(.21 mile)</i>	Natural surface
Boca Negra Canyon Multiuse Trail Following the Original Atrisco Drive Alignment (Escarpment Crossing)	Boca Negra Canyon	<ul style="list-style-type: none"> • Bicycling • Pedestrian • Leashed dog walking 	0.5 mile	Pavement
Rinconada Canyon Trail	Rinconada Canyon	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	2.0 miles	Natural surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	3.0 miles	Natural surface
Piedras Marcadas Canyon Trail	Piedras Marcadas Canyon	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	1.5 miles	Natural surface
Visitor Center Nature Trails	Las Imágenes Visitor Center	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	0 <i>(0.06 mile)</i>	Concrete
Visitor Center Amphitheater Accessible Trail	Las Imágenes Visitor Center	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	0 <i>(0.08 mile)</i>	Concrete
Total Mileage of Existing Designated Trails	N/A	N/A	8.0 miles	

Note: Mileages are rounded to the nearest 0.5 mile. If mileage is equal to or less than 0.24 mile, the mileage appears as 0 for calculation purposes. In these instances, the actual mileage appears in italics.

Table B-2. Existing Designated Trails and Authorized Uses Under Alternative 2 (NPS Proposed Action and Preferred Alternative)

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
Rinconada Canyon Trail	Rinconada Canyon	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	1.0 mile	Natural surface
Rinconada Canyon Trail	Rinconada Canyon	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	1.0 mile	Natural surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	3.0 miles	Natural surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 (0.08 mile [access to top of Black Volcano])	Natural surface
Total mileage*	N/A	N/A	8.0 miles	N/A

*The total mileage of existing designated trails is the same as presented in table B-1 for the no-action alternative. The type of use for the Rinconada Canyon Trail and in the Volcanoes area is different from the no-action alternative and is described above.

Table B-3. Proposed Trails and Authorized Uses Under Alternative 2 (NPS Proposed Action and Preferred Alternative)

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	17.5 miles	Natural surface or crusher-fines
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 (0.09 mile [access to top of JA Volcano])	Natural surface or crusher-fines
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Bicycling • Pedestrian • Leashed dog walking 	1.0 mile	Natural surface or crusher-fines
Escarpment Crossings (10 additional escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	Three in Piedras Marcadas Canyon.	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	0.5 mile	Natural surface
Escarpment Crossings (10 additional escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	Two between area south of Paseo del Norte and north of Boca Negra Canyon.	<ul style="list-style-type: none"> • Bicycling • Pedestrian • Leashed dog walking 	0 (0.13 mile)	Natural surface
Escarpment Crossings (10 additional	Two between area south of	<ul style="list-style-type: none"> • Pedestrian 	0.5 mile	Natural

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	Paseo del Norte and north of Boca Negra Canyon.	<ul style="list-style-type: none"> Leashed dog walking 		surface
Escarpment Crossings (10 additional escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	Two between area south of Paseo del Norte and north of Boca Negra Canyon.	<ul style="list-style-type: none"> Pedestrian Leashed dog walking 	1.0 mile	Natural surface
Escarpment Crossings (10 additional escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	One in the Visitor Center area.	<ul style="list-style-type: none"> Pedestrian Leashed dog walking 	0 <i>(0.17 mile)</i>	Natural surface
Escarpment Crossings (10 additional escarpment crossing trails that connect the Mesa Top Trails with the Below Escarpment Trails)	One in Mesa Prieta.	<ul style="list-style-type: none"> Pedestrian Leashed dog walking 	0.5 mile	Natural surface
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> Pedestrian Leashed dog walking 	9.0 miles	Natural surface
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> Pedestrian No dogs allowed 	0.5 mile	Natural surface
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> Bicycling Pedestrian Leashed dog walking 	0.5 mile	Natural surface
Total Mileage of Proposed Trails	N/A	N/A	31.0 miles	N/A
Total Mileage of Existing Designated and Proposed Trails	(8.0 miles +31.0 miles)	N/A	39.0 miles	N/A

Note: Mileages are rounded to the nearest 0.5 mile. If mileage is equal to or less than 0.24 mile, the mileage appears as 0 for calculation purposes. In these instances, the actual mileage appears in italics.

Table B-4. Existing Designated Trails and Authorized Uses Under Alternative 3

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	1.5 mile	Natural Surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 (0.08 mile (access to top of Black Volcano))	Natural Surface
Volcanoes Loop Trails, including access to the top of Black Volcano	Volcanoes Area	<ul style="list-style-type: none"> • Bicycling • Pedestrian • Leashed dog walking 	1.5 mile	Natural Surface
Total mileage*	N/A	N/A	8.0 miles	N/A

*The total mileage of existing designated trails is the same as presented in table B-2 for alternative 2. The type of use in the Volcanoes Area is different from alternative 2 and is described above.

Table B-5. Proposed Trails and Authorized Uses Under Alternative 3

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	7.5	Natural surface or Crusher-fines
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed 	0 (0.09 mile (access to top of JA Volcano))	Natural surface or Crusher-fines
Mesa Top Trails (including access to the top of JA Volcano)	Trails on the mesa top above the 17-mile escarpment.	<ul style="list-style-type: none"> • Bicycling • Pedestrian • Leashed dog walking 	11.0	Natural surface or Crusher-fines
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking 	8.0	Natural surface
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> • Pedestrian • No dogs allowed. 	0.5	Natural surface
Below Escarpment Trails	Trails below the 17-mile escarpment.	<ul style="list-style-type: none"> • Bicycling 	1.5	Crusher-fines or potential pavement.

Trail Name or Area	Location	Type of Use	Distance (miles)	Surface
		<ul style="list-style-type: none"> • Pedestrian • Leashed dog walking. 		
Total mileage*	N/A	N/A	31.0 miles	N/A
Total Mileage of Existing Designated and Proposed Trails	(8.0 miles +31.0 miles)	N/A	39.0 miles	N/A

*The total mileage of proposed trails is the same as alternative 2 (see table B-3). The type of use for the escarpment crossings is the same as alternative 2 (see table B-3). The type of use for the Mesa Top trails and Below Escarpment trails is different from alternative 2 and is described above.

Note: Mileages are rounded to the nearest 0.5 mile. If mileage is equal to or less than 0.24 mile, the mileage appears as 0 for calculation purposes. In these instances, the actual mileage appears in italics.

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APPENDIX C: IDENTIFICATION AND ANALYSIS OF VISITOR CAPACITY

REVIEW EXISTING DIRECTION AND KNOWLEDGE

Monument staff collects daily visitor count monitoring data for the majority of the locations it has deemed necessary to identify visitor capacity. Based on existing data collection efforts, visitor capacity estimates in most cases will be based on daily visitation numbers and will be represented as people-in-one-day (PIOD). However, in some cases, the visitor capacity identifications will be based on the number of people-at-one-time (PAOT) in an area. Delineations of sites may vary depending on the specific location, and monitoring can be done in a variety of ways, but should serve to approximate as best as possible the total number of people present.

Visitor Counting Methodology. Tracking and recording visitation levels for large geographic areas with multiple entrances and exits that are not constantly monitored by personnel is a challenge for many units of the National Park Service. Inductive loop traffic counters were installed in January 2004-2010 along the visitor center's entrance road, and the entrances to Boca Negra Canyon, Rinconada Canyon, and the Volcanoes area. The inductive loop traffic counters were removed and replaced by infrared trail counters. In addition, a TRAFx infrared trail counter was installed at Piedras Marcadas Canyon in 2014. Regarding Boca Negra Canyon, the City of Albuquerque's Open Space Division installed an inductive loop traffic counter in 1994 at the entrance station, and this is still in use today. A PPV multiplier of 2.5 is used to approximate visitation. The trail counters are used to inform the official visitation records kept by the NPS Public Use Statistics Office.

During the 2016 calendar year, the monument collected TRAFx trail count data at four of the primary trailheads including Piedras Marcadas Canyon, Rinconada Canyon, the Las Imágenes Visitor Center, and the Volcanoes area. Unsurprisingly, the visitor center received the highest visitation of the four locations, followed by Piedras Marcadas Canyon, Rinconada Canyon, and then the Volcanoes area. The Volcanoes area is located on the west side of the monument, farther from Albuquerque, and receives considerably less visitation. Visitation is recorded by site, and the numbers collected at four of the five primary trailheads are represented in figure C-1. When considering visitor counts at Boca Negra Canyon, it is the second most visited location within the monument after the visitor center.

Monument staff also keep records that include counts of visitors who attend programs and the number of visitors with which the interpretive staff make contacts. It is the combination of staff-recorded numbers and official visitation numbers that are presented in the following descriptions of the setting at the monument as well as in the visitor capacity analysis. The one exception is monthly visitation, which is based solely on the NPS Public Use Statistics Office numbers.

The traffic count PPV multiplier for PETR is 2.5, which is consistent with national standards. The monuments' counting methodology was updated in 2016. For additional information on counting adjustments applied to avoid duplication in reporting annual visitation, please visit the NPS Public Use Statistics Office for PETR (<https://irma.nps.gov/Stats/Reports/Park/PETR>). It should be noted that due to malfunctions in technology these counting methods are occasionally out of order, and therefore are not entirely accurate.

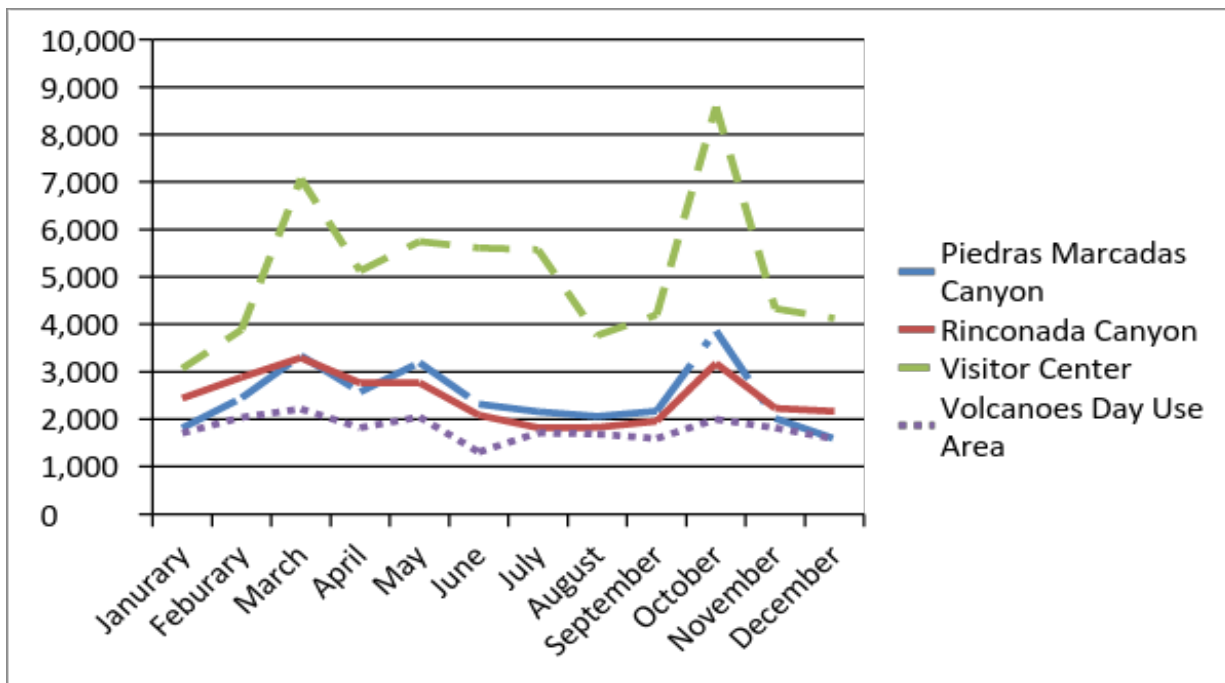


FIGURE C-1. 2016 VISITATION BY MONTH AND LOCATION

Since there are many secondary access points at which visitation has not been historically recorded, actual monument use is higher than represented by the overall numbers. The amount of additional use is currently unknown; however, in September 2017, the National Park Service installed trail counters at an additional 28 locations throughout the monument with four more trail counters slated to be installed, for a total of 36 (considering the four existing trail counters). The trail use monitoring system and protocols provide information that would be used to establish a baseline for trail use from secondary access points and help inform management of the trail system.

IDENTIFY THE LIMITING ATTRIBUTE

Described below.

IDENTIFY VISITOR CAPACITY

Described below.

ANALYSIS OF KEY AREAS

Las Imágenes Visitor Center

Review of Existing Direction and Knowledge. The Las Imágenes Visitor Center area is a primary public access point with core amenities including large parking areas, outdoor amphitheater, restroom facilities, trash receptacles, shade structures, interpretive kiosks and wayside exhibits, with visitor-created trails leading to the escarpment. The Las Imágenes Visitor Center is open daily from 8:30 a.m. to 4:30 p.m. and includes a gift shop/bookstore and offers an orientation film about the monument. The visitor center's parking lot can accommodate 35 vehicles and 4 buses. Most visitors spend about 20-30 minutes in the visitor center area. The goal for the Las Imágenes Visitor Center is to continue to provide development to support

the area as high-use and provide opportunities for visitors with orientation and resources to allow them to appreciate the significance of the monument, and to provide them with information on opportunities in the monument for guided or self-guided experiences. The Las Imágenes Visitor Center is also a place to provide universally accessible opportunities for visitors to connect with monument resources. Regarding the trail system to be established through this VUM Plan, the visitor center would serve as a hub for trails that connect to the Mesa Top and along the base of the volcanic escarpment.

Visitation to the Las Imágenes Visitor Center averages weekday numbers of 157 with much higher visitation on the weekends reaching an average of 207. The maximum visitation the visitor center received in one day was 356 people.

Limiting Attribute and Relevant Indicator. The most limiting attribute in this area is the parking area capacity. Visitor uses in this area include the visitor center, orientation film, amphitheater, and it is a primary access for the proposed trail system. The related indicator is associated with the quality of the visitor experience experiential condition and is the percent of visitors satisfied with the monument’s facilities, trailheads, trail corridors, visitor center, and interpretative programs.

Visitor Capacity Identification. Given current conditions of the Las Imágenes Visitor Center, monument staff determined that current use levels could be increased while achieving and maintaining goals and objectives. A variety of strategies would be employed by monument staff to ensure the goals and objectives are maintained and visitor capacity is not exceeded. In the action alternatives, the designated trail system would link to trails departing from the visitor center area. As part of maintaining quality visitor experiences, monument staff would continue to monitor the percent of visitors satisfied with monument facilities, trailheads, trail corridors, the visitor center, and interpretive programs. The annual visitor satisfaction survey would continue. As facilities are improved, as a part of the implementation of the VUM Plan, monument staff expect to continue to see at least 98% of visitors satisfied with the monument facilities and interpretive programs. This will ensure the goals and objectives for the Las Imágenes Visitor Center are achieved and maintained.

With the goals and objectives, current visitor use levels, most limiting attributes and implementation of the management strategies listed above, it was determined that no more than 225 PAOT would be appropriate in the visitor center area (table C-1).

Table C-1. Visitor Capacity for the Las Imágenes Visitor Center Area

Parking Lot Capacity	Bus Parking Capacity	Total
35 vehicles x 2.5 PPV	4 buses x 35 PPB (people per bus)	N/A
87.5	140	225 PAOT (rounded down)

Boca Negra Canyon

Review of Existing Direction and Knowledge. Aside from the Las Imágenes Visitor Center, Boca Negra Canyon is the most visited area of the monument. Boca Negra Canyon is an area where the existing paved trail system provides visitors with very close proximity to resources and guided learning in a fully developed setting with some universally accessible opportunities. Located off Unser Boulevard, ¼ mile north of Montaña Road, this canyon provides quick and easy access to three self-guided trails (Mesa Point, Macaw, and Cliff Base) where several hundred petroglyphs can be viewed. Combined walking time is approximately 1 hour. Visitors would independently and/or through interpretive programs experience and learn about the setting (e.g., petroglyph viewing). In collaboration with the City of Albuquerque’s Open Space Division, visitor access would be sustainably managed so that access and preservation remain compatible and

complementary. The trail system would provide a variety of large group opportunities for first-time visitors to connect with monument resources. Dog walking would continue to be prohibited in the Boca Negra Canyon area because of narrow trail width, high visitation, and concern for visitor safety. Ongoing residential development adjacent to the monument is likely to contribute to an increase in visitor use from neighbors utilizing the area and unauthorized nighttime use.

The majority of visitors to the monument visit Boca Negra Canyon and one of the goals is to continue to provide visitor activities, facilities and services that support this area as high-use. Typical visitors include families, bus tours, neighborhood residents, school groups, seniors, and individuals. The highest period of use for Boca Negra Canyon is between the months of March and October. At high use times, this area is very busy and parking availability limits the number of people that may park and access the area. According to visitor counts provided by the City of Albuquerque's Open Space Division, the highest monthly visitation occurred in October 2017 with 10,179 counts over the course of the month, which equates to an average of 328 a day. These numbers include school bus groups, which are scheduled with monument staff, and added to the monthly reported visitation numbers. Additional visitation occurs from neighbors and visitors passing through the area. StravaMetro data, from June 2015 to July 2016, indicated that over the course of that one-year time frame, 128 unique activities were reported at Boca Negra Canyon with 36 unique users. It is estimated that 36 vehicles can reasonably be accommodated with an additional three buses in the Boca Negra Canyon parking lots.

Given the parking lots capacity to accommodate 36 vehicles with the PPV factor applied (2.5), this translates to 90 PAOT. Monument staff and the City of Albuquerque's Open Space Division staff recommend no more than two buses at the same time at Boca Negra Canyon. Beyond two buses, the quality of the visitor experience would change causing issues such as crowding and congestion at the shade structures. While the parking area can accommodate up to three buses, the monument's goal for this area is to have a maximum of two buses on site, at one time. On average, a bus transports about 35 people.

Limiting Attributes and Relevant Indicator. The most limiting attribute for amount of use in the Boca Negra Canyon area is the trail system and cultural resources. For example, there is more parking capacity than ecological conditions can accommodate. As a result of full parking, surrounding trails and petroglyph viewing areas are also full. The conditions of the trails and the surrounding landscape, including petroglyphs, become at risk given the overwhelming volume of people on the few narrow trails in Boca Negra Canyon.

The most relevant indicator based on the limiting attributes of ecological sensitivity along the trail system and cultural resources is associated with potential damage to petroglyphs, archeological sites, and ethnographic resources and is the:

- Number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of site erosion or compaction) adjacent to trail system.

Visitor Capacity Identification. When considering the goals and objectives for the Boca Negra Canyon area and current use levels, monument staff determined that current use levels were acceptable to maintain and achieve the goals and objectives of the visitor use management plan. Monument staff and the City of Albuquerque's Open Space Division staff have worked in this area during the high use times around the Albuquerque International Balloon Fiesta and determined that the levels of use during that event would be unacceptable to maintain on a regular basis and are only appropriate for special events. A variety of strategies would be employed by monument staff to ensure the goals and objectives are maintained and visitor capacity is not exceeded in the Boca Negra Canyon area. Education would focus on informing visitors of sensitive resources and the importance of on-trail travel and improved signage and wayfinding would identify the trail system. Site management strategies would consider sustainable design and possible construction of boardwalks, rails, borders, and pavement to improve designated trails in the Boca Negra Canyon area. Redirecting visitors to other locations would also assist in maintaining visitor use levels at Boca Negra

Canyon. Monitoring the relevant indicator and threshold will indicate when monument staff might need to consider employing some of the suggested mitigation strategies to minimize the potential for impacts on cultural resources.

In consideration of the goals and objectives, current visitor use levels, most limiting attributes, and the management strategies listed above, it was determined that no more than 180 PAOT would be appropriate in the Boca Negra Canyon area (table C-2). The one exception to this capacity identification for the Boca Negra Canyon area is during the Albuquerque International Balloon Fiesta that occurs annually one week out of the year. It was important for the planning team to consider the Balloon Fiesta but not determine visitor capacity in Boca Negra Canyon based on the one-time high-use special event. While the ecological impacts are a concern during this event, given constraints to parking in the area, the capacity is naturally limited to the number of cars that can fit in the parking lot. No additional visitor capacity was determined for this one-time special event.

Table C-2. Visitor Capacity for the Boca Negra Canyon Visitor Center Area

Parking Lot Capacity	Bus Parking Capacity	Residential Walk-in Access	Total
36 vehicles x 2.5 PPV	2 buses x 35 PPB	20 PAOT	N/A
90	70	20	180 PAOT

Piedras Marcadas Canyon

Review of Existing Direction and Knowledge. This area offers visitors the opportunity to see thousands of petroglyphs that are accessed by a 1.5-mile round-trip hike. Goals for this area are that the trail system would provide visitors with close proximity to resources and the opportunity to experience a quiet and contemplative setting including opportunities for solitude in a semi-primitive setting, natural quiet soundscapes, and views. Site orientation and safety messages, as well as connections to the monument’s trail system, would be made available. Visitors would be able to independently learn about the setting (e.g., petroglyph viewing). Visitor access would be sustainably managed so that access and preservation remain compatible and complementary.

The inner canyon at Piedras Marcadas is one of the best areas in the monument to experience solitude and natural quiet because it is difficult to see the city or other development from the inner canyon and due to the sense of enclosure. Objectives of this plan relative to this area include providing opportunities for visitor and neighborhood access for petroglyph viewing and trail hiking, facilitating connections to the monument’s trail system, as well as providing opportunities to experience solitude, natural quiet soundscapes, and views. Other important goals at Piedras Marcadas Canyon are to provide a variety of ways to learn about monument resources that could include creating platforms for petroglyph viewing and interpretive signs, and to provide visitors with an understanding of the resources and encourage visitor stewardship of the resources (e.g., educational program offerings).

Challenges at Piedras Marcadas Canyon include encroachment from neighbors, especially from homes immediately adjacent to the monument that have no backyard fencing. A substantial increase in visitor-created trails can be observed in this area. This is leading to concerns regarding erosion in some portions of the canyon. As a result, goals for this area are to limit visitor impacts to resources, reduce erosion, reduce visitor-created trails, and implement resource condition monitoring protocols.

Visitation is increasing at Piedras Marcadas Canyon. According to trail counters installed at access points into Piedras Marcadas Canyon, the average visitation is about 120 people. The average weekday count is 101 and weekend count is 140. The parking lot at Piedras Marcadas Canyon (not including the parking at Las Marcadas Park or any overflow parking) can reasonably accommodate 19 vehicles and 2 RV's. With the PPV factor of 2.5 applied; this translates to 52.5 people from the parking area. The parking lot turns over every 1.5 hours; given a 10-hour day of access, the parking lot may turn over 6.5 times. There is currently no restroom at the Piedras Marcadas Canyon parking area.

Limiting Attribute and Relevant Indicators. The most limiting attribute in this area are the cultural resources, specifically the nearby petroglyphs. The petroglyphs are vulnerable to damage from visitors as a result of visitor-created trails and the lack of a well-defined trail system in this area. The related indicators are associated with: 1) damage to petroglyphs, archeological sites, and ethnographic resources; 2) natural soundscapes, and 3) trail conditions. The three indicators are:

- number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of site erosion or compaction) adjacent to trail system,
- increase in decibel level over natural ambient in the inner canyon of Piedras Marcadas as a measure of solitude and natural quiet, and
- percent change in trail width and depth as compared to the desired standard.

Visitor Capacity Identification. A variety of strategies would be employed by monument staff to ensure the goals and objectives are achieved and visitor capacity is not exceeded. One goal for the Piedras Marcadas Canyon area is to maintain a sense of solitude and natural quiet. This goal would be met under the visitor capacity determination by designating natural quiet areas and adding information to the monument newsletters and on the website about the importance of the natural soundscape, especially proximal to the large urban environment. The majority of visitors do not travel back into the canyon and use is dispersed throughout the area. Monument staff plan to formalize a rim top trail and finish defining the interior trail system as a part of implementing the VUM Plan. The completion of these loop trails would allow visitors to disperse throughout the area. Additionally, trail condition standards would be defined and monitoring protocols would be implemented. Trail reroutes and temporary closures are strategies that may be pursued if the thresholds are approached.

Monument staff and the City of Albuquerque's Open Space Division staff estimate that based on the goals and objectives for the area, current visitor use levels, the most limiting attributes, and the management strategies listed above, that the established trail system under either action alternative could sustain 600 PIOD (table C-3).

Table C-3. Visitor Capacity for Piedras Marcadas Canyon

Parking Lot Capacity	Parking Lot Turnover	Residential Walk-in Access	Total
19 vehicles + 2 RV's x 2.5 PPV	6.5 times a day	300 PIOD	N/A
52.5	6.5	300	600 PIOD (rounded down)

Rinconada Canyon

Review of Existing Direction and Knowledge. At Rinconada Canyon, visitors can walk into the canyon along an approximate 2-mile loop trail and see prehistoric and historic petroglyphs, wildlife, and native vegetation. Rinconada Canyon is one of the best areas in the monument to experience solitude and natural quiet because it is difficult to see the city or other development from the inner canyon, and due to the sense of enclosure. Goals for the Rinconada Canyon area are to provide trail access to petroglyph viewing areas and to provide opportunities to experience solitude, natural quiet soundscapes, and views. These goals would be met under the present visitor capacity identification by designating natural quiet areas and adding information to the monument newsletters and on the website about the importance of the natural soundscapes especially proximal to the large urban environment. Additionally, trail condition standards would be defined and monitoring protocols would be implemented. Trail reroutes and examining potential temporary closures are strategies that may be pursued if the threshold is approached. Vegetation is returning on areas previously disturbed by visitor-created trails that were closed for restoration.

The Rinconada Canyon trailhead has a paved parking area, shade shelters, picnic table, benches, bicycle rack, and vault toilets. According to the trail counter installed at the trailhead of Rinconada Canyon, the average daily visitation is about 104 people. The average weekday count is 85 and weekend count is 133. The Rinconada Canyon parking lot can accommodate 50 vehicles and three buses at one time with a turnover rate of about every 2 hours not including any overflow parking. The parking lot opens at 8 a.m. and closes at 5 p.m. Access is available from sunrise to sunset by parking outside of the gate in an overflow parking area.

The visitor capacity was based on a full parking lot turning over about 2.5 times a day, realizing that theoretically the parking lot could turn over more often than that, the parking lot is rarely full to capacity. Monument staff, based on their best professional judgement, estimate that the established trail system under either action alternative could sustain an additional 40 visitors throughout the day from neighborhood access locations. This number is significantly less than the Piedras Marcadas Canyon since this area is not as surrounded by development.

Limiting Attribute and Relevant Indicators. The most limiting attribute in this area is the cultural resources, specifically the nearby petroglyphs. The petroglyphs are vulnerable to damage from visitors as a result of visitor-created trails and visitors wanting to go beyond the established trail to be closer to the petroglyphs.

The related indicators are associated with: 1) potential damage to petroglyphs, archeological sites, and ethnographic resources, 2) natural soundscapes, and 3) trail conditions. The three indicators are:

- number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of erosion or compaction) adjacent to the trail system,
- percent change in decibel level over natural ambient in the inner canyon of Rinconada as a measure of solitude and natural quiet, and
- percent change in trail width and depth of trails as compared to the desired standard.

Visitor Capacity Identification. A variety of strategies would be employed by monument staff to ensure the goals and objectives are achieved and visitor capacity is not exceeded. One goal for the Rinconada Canyon area is to maintain a sense of solitude and natural quiet. This goal would be met under the visitor capacity by designating natural quiet areas and adding information to the monument newsletters and on the website about the importance of the natural soundscape, especially proximal to the large urban environment. As part of the plan, the northern portion of the trail would be designated a “no pets allowed” area to better preserve the natural sounds in this area. Visitors generally follow the established trail delineated by post and cable. As part of implementing the VUM Plan, monument staff plan to finish defining the trail system and improving a trail along the southern portion of the canyon to offer another loop trail opportunity. The completion of this

trail work would allow visitors to disperse throughout the area. Additionally, trail condition standards would be defined and monitoring protocols would be implemented. Trail reroutes and temporary closures are strategies that may be pursued if the thresholds are approached.

Monument staff estimate that based on the goals and objectives for the area, current visitor use levels, most limiting attributes, and the management strategies listed above, that the established trail system under either action alternative could sustain 600 PIOD (table C-4).

Table C-4. Visitor Capacity for Rinconada Canyon

Parking Lot Capacity	Bus Parking Capacity	Parking Lot Turnover	Residential Walk-in Access	Total
50 vehicles x 2.5 PPV	3 buses x 35 PPB	2.5 times a day	40 PIOD	N/A
125	105	2.5	40	600 PIOD (rounded down)

Mesa Prieta

Review of Existing Direction and Knowledge. Mesa Prieta would be a new primary access location under both action alternatives. The goals for the Mesa Prieta area include providing visitors the opportunity to learn about, interact with, and understand monument resources and stories and encourage visitor stewardship of resources. Additional goals for this area are to maintain opportunities for sustainable access to the monument's trail system, to provide opportunities for petroglyph viewing, and to rehabilitate areas disturbed by visitor-created trails.

Urban development adjacent to the monument is one of the most challenging visitor use issues. Trails in this area are anticipated to receive increased use. There are more than 1,000 new homes adjacent to the monument boundary with a forthcoming school campus and sports complex. Albuquerque Public Schools (APS) will build a parking lot and trailhead adjacent to the southernmost portion of the monument that will be available as a primary access point into the monument. The parking area will reasonably accommodate 20 vehicles. Albuquerque Public Schools will allow the monument to build a shade structure and provide visitor orientation at the parking area. Mesa Prieta would have three secondary access points to the east and one to the west.

Current use levels are limited in this area. The majority of the people going into this area are originating from the surrounding residential areas. StravaMetro data from June 2015 to July 2016 indicated that over the course of that one-year time frame, 285 unique users and 662 activities were documented in this area. Access to this area would be facilitated by the forthcoming parking lot (on APS property) that would be able to accommodate 20 vehicles, and with the 2.5 PPV applied, equates to 50 PAOT. The estimated turnover rate for the parking lot is an average of three hours for about 10 hours a day, which is about 150 people accessing the trail network from the parking lot. Based on StravaMetro data for this area, it is estimated that an additional 30 visitors a day could access the trail network from each of the three secondary access locations adding about 90 visitors to the 150.

Limiting Attribute and Relevant Indicators. The most limiting attribute in this area is the cultural resources, including the nearby petroglyphs and historic and prehistoric sites in the area. These vulnerable resources are located within close proximity to the proposed trail system and are susceptible to damage from off-trail visitor use and by visitor-created trails. Given the cultural resource sensitivity of the area, the most

relevant indicators are associated with 1) damage to petroglyphs, archeological sites, and ethnographic resources, and 2) unauthorized resource-related activity and 3) natural soundscapes. The three indicators are

- number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of site erosion or compaction) adjacent to the trail system,
- number of incidents of unauthorized resource-related activity, and
- increase in dBA (a-weighted decibels) over natural ambient in a portion of Mesa Prieta.

Visitor Capacity Identification. Considering that current use is minimal, but increasing, in the Mesa Prieta area, monument staff determined that use levels could be increased while achieving the goals and objectives of the VUM Plan. A variety of strategies would be employed by monument staff to ensure the goals and objectives are maintained and visitor capacity is not exceeded. As the threshold for unauthorized resource-related activity is approached, assessments of the area would be conducted in conjunction with increased law enforcement patrols oriented towards educating visitors. Area closures would be considered after a range of management strategies have been implemented and proven to be noneffective. Monument staff would also work to increase the number of Trail Watch volunteers to assist with recording incidents and disseminating information about low-impact trail use and appropriate visitor behavior. Trail reroutes and examining potential temporary closures are strategies that may be pursued if the threshold is approached.

Taking into consideration the goals and objectives, current visitor use levels, the most limiting attributes, the management strategies listed above, and the establishment of a new trail system, monument staff estimate that a visitor capacity of 240 PIOD in the Mesa Prieta area would be acceptable to maintain goals and objectives as well as to accommodate the additional growth occurring in this area (table C-5). Specifically, by monitoring the relevant indicators, monument staff would establish baseline conditions and would be informed of when use levels are approaching the visitor capacity determination.

Table C-5. Visitor Capacity for the Mesa Prieta Area

Parking Lot Capacity	Parking Lot Turnover	Residential Walk-in Access	Total
20 vehicles x 2.5 PPV	3 hours per 10 hours/day	90 PIOD	N/A
50	3	90	240 PIOD

Volcanoes

Review of Existing Direction and Knowledge. The Volcanoes area is a primary access point with core amenities including large parking areas, restroom facilities, trash receptacles, shade structures, bicycle rack, interpretive kiosks, and wayside exhibits, providing access near three distinct volcanoes conveniently connected by a series of loop trails. In the past, monument staff have closed and rehabilitated visitor-created trails and increased signage in the area. At the Volcanoes, visitors would independently and/or through interpretive programs experience and learn about the setting (e.g., cultural landscape, Mesa Top access, trail hiking). Visitor access would be sustainably managed so that access and preservation remain compatible and complementary. Expansive views would continue to be preserved and protected in the Volcanoes area and disturbed areas would continue to be restored.

The Volcanoes parking lot can reasonably accommodate 25 vehicles with an average of about 1.5-2 hours spent hiking on the trails. The parking lot officially opens at 9 a.m. and closes at 5 p.m. Access is available from sunrise to sunset by parking outside of the gate in an overflow parking area.

According to the TRAFx passive infrared trail counter installed at the trailhead of the Volcanoes, the average daily visitation is about 60 people with a maximum use level of 200 PIOD. The average weekday count is 76 and weekend count is 160. Also according to daily visitation reports, the highest use level this site has experienced is 200 people in one day.

Limiting Attributes and Relevant Indicators. The most limiting attributes in this area are the ecological conditions and the cultural significance. Damage to monument resources is occurring on the surrounding landscape as a result of visitor use, especially off-trail travel. While there are established trails around the volcanoes and currently to the top of Black Volcano, there has been damage to monument resources from visitors wanting to reach the tops of JA and Vulcan volcanoes. Under the action alternatives in the VUM Plan, a sustainable trail providing access to the top of JA Volcano would be established.

The related indicators are associated with 1) trail conditions and 2) visitor-created trails. The two indicators are:

- percent change in trail width and depth as compared to the desired standard, and
- number of visitor-created trails.

Visitor Capacity Identification. A variety of strategies would be employed by monument staff to ensure the goals and objectives for the Volcanoes are achieved and visitor capacity is not exceeded. Management strategies associated with monitoring conditions for this area are directly related to the relevant indicators. Areas disturbed by visitor-created trails would be rehabilitated. Site management techniques would be used to delineate the designated trails as well as restrictions to off-trail travel. Area closures would be considered if the goals and objectives were not being met in the Volcanoes. Baseline conditions for trail width and depth would be determined. Strategies would be taken to manage trail widening and to minimize excessive soil loss. These management strategies and associated monitoring protocols would serve as a mechanism for the monument to maintain goals and objectives in the area. In both alternatives, access to the tops of JA and Black volcanoes would be pedestrian only (no pets) to protect the traditional values in the area. The exception to this would be issuance of special use permits and group permits including for traditional cultural uses by tribes and pueblos.

Considering the goals and objectives, current visitor use levels, most limiting attributes, and the management strategies listed above, it was determined that no more than 400 PIOD would be appropriate in the Volcanoes area (table C-6).

Table C-6. Visitor Capacity for the Volcanoes Area.

Parking Lot	Parking Lot Turnover	Total
25 vehicles x 2.5 PPV	5 times a day	N/A
62.5	5	325 PIOD (rounded up)

Mesa Top

Review of Existing Direction and Knowledge. The Mesa Top encompasses large areas of the monument above the escarpment with spectacular views. The goals for the Mesa Top area include providing visitors the opportunity to learn about, interact with, and understand monument resources and stories and encourage visitor stewardship for resources. Additionally, visitors would independently and/or through interpretive programs experience and learn about the setting. Mesa Top viewsheds would be preserved and protected and damaged areas would be restored through ongoing rehabilitation efforts.

Current use levels by hikers and bicyclists are low. While the Mesa Top can be accessed from a number of areas, the main access to this area is facilitated by the City of Albuquerque’s Open Space Division’s parking lot, which also provides access to the Paseo de la Mesa multiuse trail on city land. The parking lot accommodates 38 vehicles including four ADA spaces, with the 2.5 PPV applied equates to 95 PAOT. The estimated turnover rate for the parking lot is an average of three times a day, which is about 285 PIOD accessing the trail network from the parking lot.

Limiting Attributes and Relevant Indicators. The most limiting attributes for accommodating higher levels of use in this area are the ecological conditions and, as is true across the volcanic landscape of Albuquerque’s West Mesa, the ethnographic resources and cultural landscape.

The related relevant indicators are associated with 1) trail conditions and 2) visitor-created trails. The two indicators are:

- percent change in trail width and depth as compared to the desired standard, and
- number of visitor-created trails.

Visitor Capacity Identification. A variety of strategies would be employed by monument staff to ensure the goals and objectives for the Mesa Top area are achieved and visitor capacity is not exceeded. Management strategies associated with monitoring conditions for this area are directly related to the relevant indicators. Areas disturbed by visitor-created trails would be rehabilitated to minimize the number of visitor-created trails that are harmful to ecological conditions and cultural resources. Site management techniques would be used to delineate the designated trails as well as restrict off-trail travel. Potential area closures would be considered if the goals and objectives were not being met in the Mesa Top area. Baseline conditions for trail width and depth would be determined. Strategies would be taken to manage trail widening and to minimize excessive soil loss. These management strategies and associated monitoring protocols would serve as a mechanism for the monument to maintain goals and objectives in the area, given the visitor capacity.

Taking into consideration the goals and objectives, current visitor use levels, most limiting attributes, the management strategies listed above, and the establishment of a new designated trail system, the National Park Service and City of Albuquerque’s Open Space Division staff estimate that a visitor capacity of 300 PIOD in the Mesa Top area would be acceptable to maintain goals and objectives as well as accommodate the additional growth expected in this area (table C-7). Specifically, monitoring the relevant indicators for the monument and the city’s open space area would establish baseline conditions and identify when use levels are approaching the visitor capacity determination.

Table C-7. Visitor Capacity for the Mesa Top Area

Parking Lot	Parking Lot Turnover	Total
38 vehicles (including 4 ADA spaces) x 2.5 PPV	3 times a day	N/A
95	3	300 PIOD (rounded up)

Northern Geologic Window

Review of Existing Direction and Knowledge. Goals for the Northern Geologic Window include establishing public access points to provide access along an existing north-south road/trail on the western side of the Northern Geologic Window to facilitate connection with the Paseo de la Mesa multiuse trail on city land. Access into the remainder of the Northern Geologic Window would be limited since it is only open to public use by permit or guided tour.

This area is isolated from other areas of the monument, making it more vulnerable to area pressures. In the near future, an additional 2,000 or more residents moving into this area are anticipated, which further increases the pressure from growing development. Monument staff installed boundary fencing along the northern portion of the Northern Geologic Window in 2016 to complete fencing of the area, which has decreased unauthorized entry. There are two private land parcels within the northwestern portion of the Northern Geologic Window; access by landowners would be maintained.

Visitor use in the Northern Geologic Window tends to be visitors hiking, bicycling, and/or walking their dogs to gain access to the Paseo de la Mesa multiuse trail on city land. Most of the visitor use is occurring on the north-south road/trail along the western side of the Northern Geologic Window, and according to StravaMetro data, that is where most of the bicycling is occurring. There are three schools immediately adjacent to this portion of the monument and ongoing and planned development of new neighborhoods. Use in this area is expected to increase.

Limiting Attributes and Relevant Indicators. The most limiting attributes to visitor use in this area are the petroglyphs, cultural resources, and ecological resources. These cultural and ecological resources are susceptible to damage by unauthorized visitor use.

The related indicators are associated with 1) damage to petroglyphs, archeological sites, and ethnographic resources, 2) visitor-created trails, and 3) unauthorized resource-related activity. The three indicators are:

- number of features impacted by visitor activity (rocks moved and/or newly recorded modern graffiti or artifacts missing, evidence of site erosion or compaction) adjacent to the trail system,
- number of visitor-created trails, and
- number of incidents of unauthorized resource-related activity.

Visitor Capacity Identification. Given limited damage to ecological conditions and cultural resources from visitor-related activities, monument staff determined that current use levels could be increased along the north-south road/trail, while achieving the goals and objectives of the VUM Plan for the Northern Geologic Window. A variety of strategies would be employed by monument staff to ensure the goals and objectives are maintained and visitor capacity is not exceeded. The monument would pursue involving the adjacent local school in land stewardship activities, and would work to purchase segments of land within the Northern Geologic Window from private landowners. Because this area is accessible by an approved permit or guided tours, monument staff would not direct general visitors to this area and would not include the Northern Geologic Window on the monument's trail map.

Considering the two accesses on the west side of the Northern Geologic Window to retain north-south access along the existing road/multiuse trail, the National Park Service and City of Albuquerque Open Space Division staff used their best professional judgement to determine that 75 PIOD would be acceptable for the north-south corridor, since other access would be by permit or guided tour only (table C-8). Below that level of visitation, goals and objectives would be met and managers would be able to maintain the integrity of cultural and ecological resources.

Other Locations

Table C-8. Visitor Capacity for Other Locations in the Monument

Location	Current Use Level	Visitor Capacity Determination	Rationale
Southern Geologic Window	Access by permit or guided tours.	Remain at permit use and guided tours only.	Monument staff determined it is best to leave this area accessible by permit and guided tours only to protect the cultural significance of the place.
Piedras Marcadas Pueblo	Access by permit or guided tours.	Remain at permit use and guided tours only. Tours are limited to 25 people a tour. Tours typically occur no more than once a month.	Monument staff determined it is best to leave this area accessible by permit and guided tours only to protect the cultural significance of the place.
Area North of Boca Negra Canyon and South of Paseo del Norte	Visitor use will be increased in that entire stretch 7,000 + people once ongoing development is completed.	600 PIOD	This is the narrowest part of the monument that will be surrounded by residential units. The action alternatives have potential trail connectors to the escarpment crossing as well as opening a rim trail that would go through this area. Despite the narrowness of this area, the connector trails would provide linkages to the city's trail system and provide access to the broader monument trail system allowing for a larger visitor capacity given the potential for visitor dispersal throughout the trail system.

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APPENDIX D: MITIGATION MEASURES AND MONITORING

MITIGATION MEASURES AND MONITORING GUIDELINES FOR BOTH ACTION ALTERNATIVES

Mitigation measures are designed to prevent or minimize adverse impacts or to contain impacts within acceptable limits during and after project implementation. Mitigation measures and guidance have been included in each alternative. The following are additional guidance and mitigation measures that would be incorporated into project implementation.

Protect Ethnographic Resources and Archeological Resources

- Cultural resources would be considered during all phases of planning and implementation of the visitor use management plan. Archeological surveys have been completed for almost the entire monument. Many of the current trails in the monument pass through or near historic and prehistoric sites. In addition, administrative roads/trails may use historic routes. The greatest risks to these sites include continued use by visitors and pets and ground-disturbing activities, such as those associated with visitor-created trail use, trail construction, maintenance, closure, and installation of trail upgrades. All trail corridors that may be subject to maintenance or restoration would be reviewed by subject matter experts meeting or exceeding the Secretary of Interior's Standards. Section 106 compliance would be completed on a project-by-project basis.
- Adverse effects on National Register eligible archeological sites would be avoided if at all possible. If not, then the National Park Service would consult with the state historic preservation officer and other consulting parties, including traditionally associated tribes and pueblos, to develop and evaluate alternatives or modifications to the undertaking that could avoid, minimize, or mitigate adverse effects on historic properties under a Memorandum of Agreement. The National Park Service shall notify the Advisory Council on Historic Preservation of the adverse effect finding and the preparation of a Memorandum of Agreement and invite the council to participate in the consultation.
- Mitigating potential adverse effects to archeological sites with trails passing through them would be accomplished in consultation with the New Mexico State Historic Preservation Office traditionally associated tribes, pueblos, and other consulting parties. Site protection measures would be employed, that may include but would not be limited to protecting the surface of the site on and adjacent to the trail with geo-technical fabric, adding clean fill soil as a second protective barrier over the fabric, replanting native vegetation in the clean fill material, and reconstructing the trail in the fill soil across the protected site.
- Where ground disturbance is involved, an archeologist would be on-site to monitor the project work.
- Prior to rehabilitating or restoring abandoned trails, relevant cultural resources review and any applicable surveys would occur.
- Should previously unknown historic or prehistoric resources be unearthed during project implementation, work would be halted in the discovery area, the site secured, and a qualified cultural resource management specialist notified if not already present. The area would be examined as soon as possible and the procedures of 36 CFR Part 800.13[c] will be followed.

- In the event that human remains are discovered during maintenance activities, all work on the project must stop and the park archeologist contacted immediately. As required by law, the coroner will be notified first. All provisions outlined in the Native American Graves Protection and Repatriation Act (1990) will be followed.

Protect Natural Resources

- Removal of, or impact on, native vegetation adjacent to trails would be minimized as much as possible. The trail construction activity would be confined to the minimum area required for construction. All staging and stockpiling areas would use existing disturbed lands to the extent possible and be rehabilitated to natural conditions following trail construction.
- Project personnel would make daily checks of clothing, boots, laces, and gear to ensure no exotic plant seeds or reproductive parts are transported to the work site.
- Areas used by visitors would be monitored for signs of native vegetation disturbance and for the presence of new exotic species of plants. The park would use a variety of mitigation tools such as public education, erosion control, and barriers to control visitor use impacts on vegetation.
- Impacted bare areas (e.g., old trail sections that have been realigned, impacted areas along the trail corridor) would be scarified and regraded to reestablish the original surface contours and allowed to naturally revegetate or be planted and/or seeded with native species to minimize erosion. Determination of treatment (natural revegetation or seeding) would be done on a case-by-case basis and would seek to reconstruct the natural spacing, abundance, and diversity of native plant species as much as possible.
- Any required fill, rock, topsoil, or other earth materials would be sourced from approved sites (e.g. both in-monument and outside of the monument).
- Resource management staff would provide trail crews with an orientation/briefing that would appraise them of and sensitize them to relevant natural resource issues and the importance of minimizing impacts. The resource management division would be notified and consulted when wildlife must be disturbed or handled. Staff would assist with handling and moving snakes and other wildlife, when necessary.
- Soils and other materials would not be placed within arroyos or drainages to avoid potential sedimentation during rain events.
- Substantial ground-disturbing work would be scheduled to occur outside of anticipated heavy rain events. Erosion control devices would be used as necessary.
- Conduct plant and wildlife surveys to ensure routes of new trails do not destroy or alter special or rare vegetation, plant communities, and important wildlife habitat.
- Conduct vegetation removal work outside of the peak bird breeding season, typically March through August for most species, to the maximum extent practicable.
- If vegetation removal activities cannot occur outside the bird nesting season, conduct surveys prior to scheduled activity to determine if active nests are present within the area of impact. If active nests or breeding behavior (e.g., courtship, nest building, territorial defense, etc.) are detected during these surveys, no vegetation removal activities should be conducted until nestlings have fledged or the nest fails or breeding behaviors are no longer observed. Contact the Resource Management office if active nests or breeding behaviors are observed.

Protect Natural Soundscapes

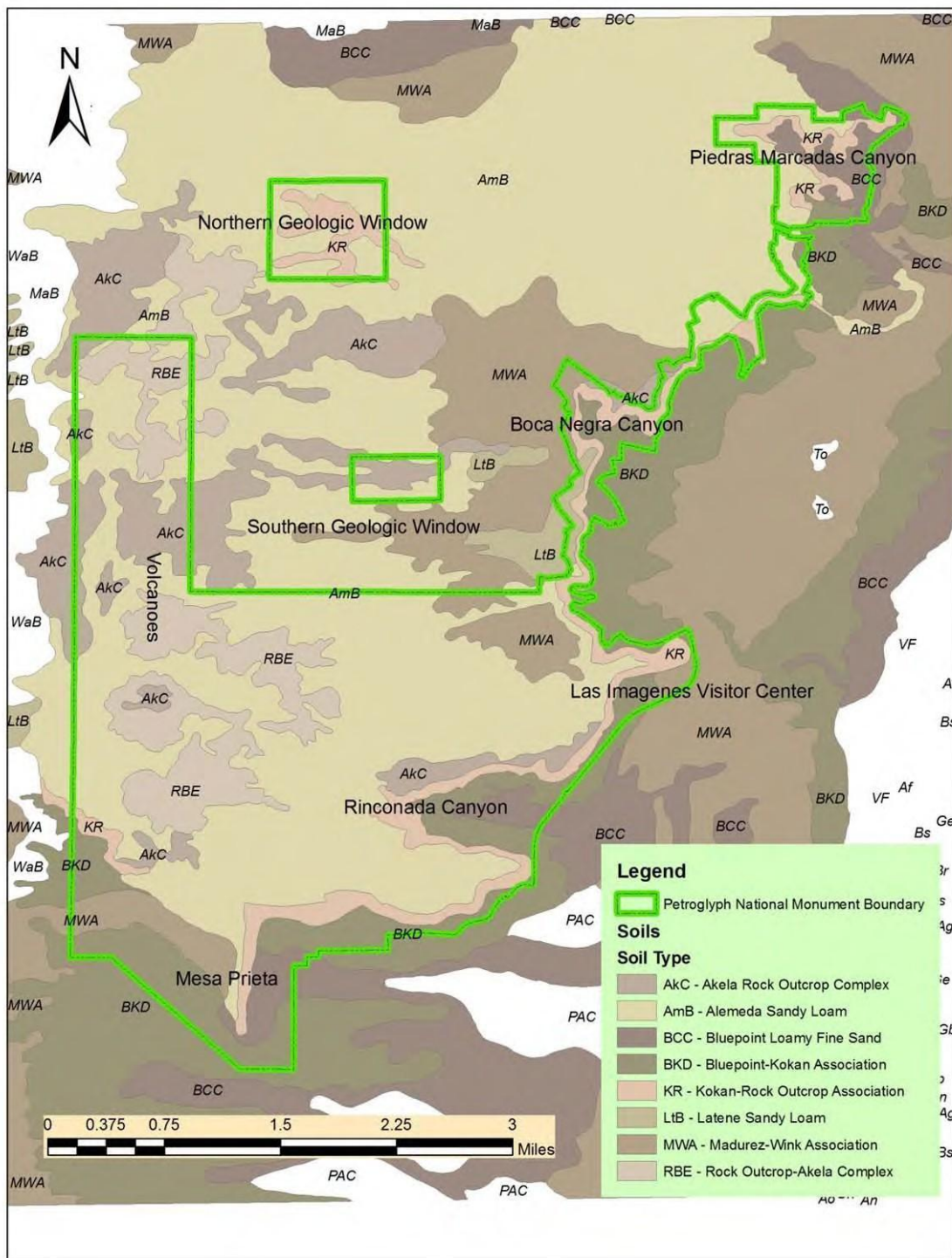
- Create interpretive materials that instill a culture of awareness of and respect for the value of natural soundscapes.
- Advise visitors and monument staff about the growing impact of loud vehicles, motors, and other unnecessary noise disturbances (e.g., radios).
- Enforce existing noise ordinances (36 CFR §2.12). 36 CFR §2.12 is a federal regulation related to audio disturbances and prohibits noise that "... exceeds a noise level of 60 decibels measured on the A-weighted scale at 50 feet..." Regulations also define this as "noise which is unreasonable, considering the nature and purpose of the actor's conduct, location, time of day or night, purpose for which the area was established, impact on park users, and other factors that would govern the conduct of a reasonably prudent person under the circumstances."
- Implement standard noise abatement measures during construction activities. Standard noise abatement measures may include the following elements: a schedule that minimizes impacts on adjacent noise-sensitive uses; the use of best available noise control techniques wherever feasible; the use of quieter impact tools when feasible; the use of hand tools when feasible; the placement of stationary noise sources as far from sensitive uses as possible; and the use of noise-muffling, shielding, or fencing. Functioning mufflers would be installed and maintained on all motorized equipment. Engine idling would be reduced or eliminated.

Visitor Use and Experience

Public notification via the monument's website at www.nps.gov/petr would provide updates should there be any trail closures for visitor planning purposes. This website would also provide updates on work that has been accomplished and access to trail sections as they become available.

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APPENDIX E: MONUMENT SOIL TYPES



Source: USDA-NRCS, n.d.

FIGURE E-1. MONUMENT SOIL TYPES IN PETROGLYPH NATIONAL MONUMENT

Table E-1. Soil Types and Erosion Characteristics

Soil Type	Soil Characteristics
Akela-Rock Outcrop Complex (AkC), 1-9% slopes	Medium runoff potential. Light or moderate potential for erosion by water.
Alameda Sandy Loam (AmB), 0-5% slopes	Medium runoff potential. Moderate to severe potential for erosion by wind and slight potential for erosion by water.
Bluepoint Loamy Fine Sand (BCC), 1-9% slopes	Slow runoff potential. Severe potential for erosion by wind.
Bluepoint-Kokan Association (BKD), hilly	Slow runoff potential. Moderate to severe potential for erosion by water.
Kokan-Rock Outcrop Association (KR)	Rapid runoff potential. Slight potential for erosion by water.
Latene Sandy Loam (LtB), 1-5% slopes	Medium runoff potential. Moderate potential for erosion by water or wind.
Madurez-Wink Association (MWA), gently sloping	Slow runoff potential. Gently sloping. Moderate to severe potential for erosion by wind.
Rock Outcrop-Akela Complex (RBE), 10-50% slopes	Medium runoff potential. Slight to moderate potential for erosion by water.

APPENDIX F: CITY OF ALBUQUERQUE RESOLUTION

CITY OF ALBUQUERQUE

TWENTY SECOND COUNCIL

COUNCIL BILL NO. FS R-17-171 ENACTMENT NO. _____

SPONSORED BY: Isaac Benton

RESOLUTION

REAFFIRMING THE AGREEMENT BETWEEN THE CITY OF ALBUQUERQUE AND THE UNITED STATES PARK SERVICE FOR THE MANAGEMENT AND PROTECTION OF THE PETROGLYPH NATIONAL MONUMENT AND CALLING FOR THE CREATION OF A JOINT VISITOR USE AND RESOURCE MANAGEMENT PLAN.

WHEREAS, New Mexico is blessed with a unique cultural treasure including petroglyphs of ancient cultures in the Petroglyph National Monument; and

WHEREAS, the PL-101-313 an Act of Congress, June 27, 1990 (104 STAT. 274) established the Petroglyph National Monument and mandated that the National Park Service concurrently with the City of Albuquerque administer, manage and protect the Monument in such a manner as to preserve, for the benefit and enjoyment of future generations, its cultural and natural resources, and to provide for the interpretation of and research on such resources; and

WHEREAS, the City of Albuquerque owns approximately 4,200 acres within the boundary of the Petroglyph National Monument and owns approximately 2,200 acres of Major Public Open Space on the boundary of the Monument; and

WHEREAS, the United States National Park Service and the City of Albuquerque, in 1991 (renewed in May, 2013) entered into an agreement to manage the Petroglyph National Monument jointly (“the agreement”), and have, since that time, provided maintenance on the land and facilities of the Monument at considerable cost to each; and

WHEREAS, the Petroglyph National Monument is located in an expanding urban area and is continuously subject to new incursions from surrounding urbanization, and the City of Albuquerque approves new development close to, and even abutting the Monument boundary.

BE IT RESOLVED BY THE COUNCIL, THE GOVERNING BODY OF THE CITY OF ALBUQUERQUE:

Section 1. The Parks Department shall work with the National Parks Service to create a Joint Visitor Use and Resource Management Plan (“the plan”) for the Monument, incorporating current and anticipated demands for preservation and maintenance of the Monument including the following components:

- A. The plan shall specify the visitor capacity, level of use and expected requirements for preservation of the cultural and natural resources of the Monument.
- B. The plan shall define the requirements for security and cultural preservation of the Monument, particularly the petroglyphs, and specify the methods for securing the Monument and authorizing new points of access.

- C. The plan shall endeavor to protect the Monument from urban incursions including by limiting access points, limiting new trails; by excluding all motorized vehicles (except official vehicles), aerial drones, wheeled vehicles (except wheelchairs and strollers); by prohibiting unescorted group passage in sensitive areas, and by prohibiting other activities harmful to the purpose of preservation of the cultural and natural resources.
- D. The plan shall include appropriate, low-impact educational and cultural points of interest and escorted interpretive tour routes for both tourists and local students, groups, and individual visitors.

Section 2. The City planning process, including recommendations made by the Open Space Advisory Board, and decisions or recommendations by the Department of Parks and Recreation, the Planning Department, the Environmental Planning Commission, the Development Review Board, and any other relevant City agencies, shall implement the planned limits on access and incursions into the Monument by applying the relevant policies from the plan and imposing requirements and reasonable conditions for newly proposed or amended subdivisions applications, or other relevant land use applications, to help prohibit or limit access points to the monument consistent with plan, and to prevent the expansion of bicycle or other trails into the Monument and other activities injurious to the petroglyphs.

Section 3. The plan shall guide City planning decisions, regulations, and City operations for development and infrastructure near the Monument, including special design requirements for Unser Boulevard.

Section 4. City budgets shall prioritize sufficient funding in accordance with the agreement and the City's responsibilities in the Joint Visitor Use and Resource Management Plan, including maintaining fencing, repairing surface damage to the terrain, closing unauthorized access points, removing trash, debris, and materials dumped in the Monument boundary, and providing part of the educational and cultural program managed by the National Park Service. City budgets shall also prioritize adequate law enforcement for preventing unauthorized vehicles from traveling in the Monument, unauthorized access by pedestrians or bicyclists, damage to fences, signs or facilities of the Monument, and damage to the petroglyphs.

Section 5. At least once per year, the Open Space Advisory Board shall review the Joint Visitor Use and Resource Management Plan to assess its proper implementation, its adequacy for preserving the petroglyphs and natural resources and any improvements made under the plan, and shall advise the National Park Service, the Mayor, and the City Council of its recommendations.



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



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

.....
PETROGLYPH NATIONAL MONUMENT • VISITOR USE MANAGEMENT PLAN / ENVIRONMENTAL ASSESSMENT
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NEW MEXICO • NOVEMBER 2018