



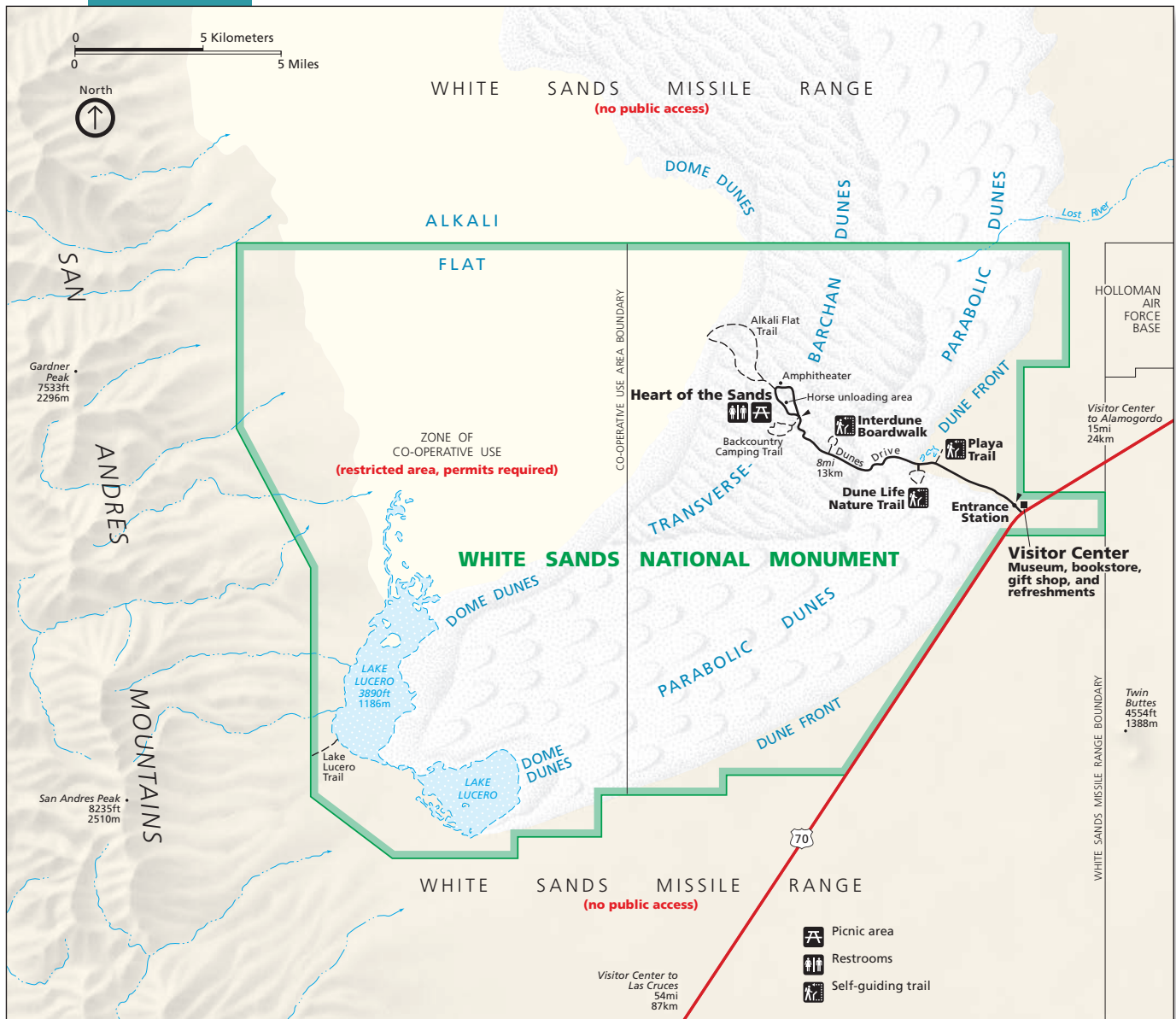
# Foundation Document

## White Sands National Monument

New Mexico

January 2016







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## Mission of the National Park Service

The National Park Service (NPS) preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The National Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

The NPS core values are a framework in which the National Park Service accomplishes its mission. They express the manner in which, both individually and collectively, the National Park Service pursues its mission. The NPS core values are:

- **Shared stewardship:** We share a commitment to resource stewardship with the global preservation community.
- **Excellence:** We strive continually to learn and improve so that we may achieve the highest ideals of public service.
- **Integrity:** We deal honestly and fairly with the public and one another.
- **Tradition:** We are proud of it; we learn from it; we are not bound by it.
- **Respect:** We embrace each other's differences so that we may enrich the well-being of everyone.

The National Park Service is a bureau within the Department of the Interior. While numerous national park system units were created prior to 1916, it was not until August 25, 1916, that President Woodrow Wilson signed the National Park Service Organic Act formally establishing the National Park Service.

The national park system continues to grow and comprises more than 400 park units covering more than 84 million acres in every state, the District of Columbia, American Samoa, Guam, Puerto Rico, and the US Virgin Islands. These units include, but are not limited to, national parks, monuments, battlefields, military parks, historical parks, historic sites, lakeshores, seashores, recreation areas, scenic rivers and trails, and the White House. The variety and diversity of park units throughout the nation require a strong commitment to resource stewardship and management to ensure both the protection and enjoyment of these resources for future generations.



*The arrowhead was authorized as the official National Park Service emblem by the Secretary of the Interior on July 20, 1951. The sequoia tree and bison represent vegetation and wildlife, the mountains and water represent scenic and recreational values, and the arrowhead represents historical and archeological values.*



## Introduction

Every unit of the national park system will have a foundational document to provide basic guidance for planning and management decisions—a foundation for planning and management. The core components of a foundation document include a brief description of the park as well as the park’s purpose, significance, fundamental resources and values, other important resources and values and interpretive themes. The foundation document also includes special mandates and administrative commitments, an assessment of planning and data needs that identifies planning issues, planning products to be developed, and the associated studies and data required for park planning. Along with the core components, the assessment provides a focus for park planning activities and establishes a baseline from which planning documents are developed.

A primary benefit of developing a foundation document is the opportunity to integrate and coordinate all kinds and levels of planning from a single, shared understanding of what is most important about the park. The process of developing a foundation document begins with gathering and integrating information about the park. Next, this information is refined and focused to determine what the most important attributes of the park are. The process of preparing a foundation document aids park managers, staff, and the public in identifying and clearly stating in one document the essential information that is necessary for park management to consider when determining future planning efforts, outlining key planning issues, and protecting resources and values that are integral to park purpose and identity.

While not included in this document, a park atlas is also part of a foundation project. The atlas is a series of maps compiled from available geographic information system (GIS) data on natural and cultural resources, visitor use patterns, facilities, and other topics. It serves as a GIS-based support tool for planning and park operations. The atlas is published as a (hard copy) paper product and as geospatial data for use in a web mapping environment. The park atlas for White Sands National Monument can be accessed online at: <http://insideparkatlas.nps.gov/>.



## Part 1: Core Components

The core components of a foundation document include a brief description of the park, park purpose, significance statements, fundamental resources and values, other important resources and values, and interpretive themes. These components are core because they typically do not change over time. Core components are expected to be used in future planning and management efforts.

### Brief Description of the Park

White Sands National Monument was established on January 18, 1933 under the presidential proclamation of President Herbert Hoover “for the preservation of the white sands and additional features of scenic, scientific, and educational interest . . .” The monument is situated about 15 miles southwest of Alamogordo, New Mexico, at the northern end of the Chihuahuan Desert in the Tularosa Basin. Positioned between the Organ, Sacramento, and San Andres mountain ranges, the monument protects a major portion (about 115 square miles) of the world’s largest gypsum dunefield. Among the most prominent features of the park are the brilliant white dunes that rise up to 60 feet in some places and move as much as 30 feet per year.

What may appear to many as a virtual wasteland actually supports a diverse ecosystem that is uniquely adapted to the gypsum dune landscape. Described as part of a “wet eolian system,” the White Sands dunefield is influenced by eolian (wind-related) processes and surface and groundwater hydrology. The two principal features in White Sands National Monument—the gypsum dunes and playas—typify these processes, attesting to past and present eolian and pluvial (precipitation-related) activities and groundwater discharge. Alkali Flat covers the northwest portion of the monument and extends southward to Lake Lucero, a playa lake in the southeast corner of the monument. Here, dazzling displays of selenite crystals, which serve as the source of the gypsum dunes, extend across the alkaline mudflats of the lakeshore, creating a geologic showcase found nowhere else in the national park system. Uniquely adapted “white-colored” species can also be found throughout the monument, and include an animal from every class of vertebrate, except birds, in North America. Additionally, White Sands National Monument is a host to a variety of vegetation communities including alkali sacaton grasslands, desert scrub (mesquite and creosote), and isolated groves of cottonwood trees.





While the gypsum dunes and the playas are the two principal features at the monument, White Sands National Monument is “more than a sandbox.” Extraordinary cultural, paleontological, and outdoor recreation opportunities abound. The monument features perhaps thousands of archeological sites scattered throughout the backcountry, including unique archeological sites called gypsum hearth mounds that are found nowhere else in North America. Additionally, the park headquarters is a historic district listed in the National Register of Historic Places. This unique setting inspires learning, appreciation, and stewardship. The richness and diversity of human interaction with this region—from an unusual density of ancient hearth sites, to explorations of Spanish Conquistadores, to the posting of Buffalo Soldiers, to aeronautical experimentation—provides opportunities for comparing and contrasting the values and adaptations of former cultures to those of our own.

About 12,000 to 24,000 years ago, the monument’s playa lakes were part of a much larger lake known as Lake Otero, which sustained a wide array of Cenozoic species. Today, Ice Age fossils can be found along the much broader shoreline of the Lake Otero, including fossil track sites of Pleistocene mammals, primarily proboscidean (mammoth or mastodon), as well as a variety of other plant and animal life from the era. A mega-track site is the most significant paleontological discovery at White Sands National Monument to date, and represents one of the largest concentrations of Cenozoic fossil tracks within the United States and possibly the world. Significant trackways have also been found on Alkali Flat and the southern shoreline of Lake Lucero.

Nearly 500,000 people come to the monument each year to experience and learn about this amazing place. In the process, visitors also enjoy one-of-a kind hiking, sledding, backcountry camping, and other dispersed outdoor recreation experiences. In addition, the wide-open landscape offers unparalleled scenery and vast, unfettered views spanning from horizon to horizon. By night, blankets of stars stretch across the sky, creating exceptional photographic and stargazing opportunities.



## Park Purpose

The purpose statement identifies the specific reason(s) for establishment of a particular park. The purpose statement for White Sands National Monument was drafted through a careful analysis of its enabling legislation and the legislative history that influenced its development. The monument was established by presidential proclamation on January 18, 1933. (See appendix A for enabling legislation and legislative acts). The purpose statement lays the foundation for understanding what is most important about the park.

*An island of white within the Chihuahuan Desert, WHITE SANDS NATIONAL MONUMENT provides for and promotes scenic, scientific, and educational opportunities while preserving the world's largest gypsum dunefield—a dynamic environment created and sustained by wind and water—and protects endemic flora and fauna, unique human and paleontological history, and the quiet solitude of the dunes.*



## Park Significance

Significance statements express why a park's resources and values are important enough to merit designation as a unit of the national park system. These statements are linked to the purpose of White Sands National Monument, and are supported by data, research, and consensus. Statements of significance describe the distinctive nature of the park and why an area is important within a global, national, regional, and systemwide context. They focus on the most important resources and values that will assist in park planning and management.

The following significance statements have been identified for White Sands National Monument. (Please note that the sequence of the statements does not reflect the level of significance.)

1. In 1933, President Hoover established White Sands National Monument to preserve the world's largest gypsum dunefield and its sources of gypsum sand. This enormous dunefield—more than 275 square miles—is used by astronauts in space as a geographic reference.
2. The hydrologic, geologic, and climatic forces of the Tularosa Basin create the gypsum cycle that gave birth to and sustains this active and dynamic gypsum dunefield. Rainfall, groundwater, and a regional aquifer are essential ingredients that nourish the world's largest gypsum dunefield.
3. Vast and brilliant white, the geologically young—less than 10,000 years old—gypsum dunefield has provided the conditions for evolution through rapid adaptation in the flora and fauna of the dunefield and surrounding desert scrub communities. Adapted white-colored species include an animal from every class of vertebrate, except birds, in North America.
4. Legislated to protect resources of scientific interest, White Sands National Monument promotes a wide range of innovative research that globally leads the way in the fields of rapid evolution and dune dynamics. Internationally recognized experts study aspects of the monument to expand understanding in subjects as diverse as soil microfauna to space exploration.
5. At first glance, the dunefield appears inhospitable and uninhabitable, yet the monument protects numerous and diverse evidence of more than 10,000 years of human history. The physical properties of gypsum create time capsules when heated, preserving dateable charcoal, plant, and animal remains, and other cultural material, which leads to the production of unique archeological sites called gypsum hearth mounds not known to occur anywhere else on earth.
6. The monument contains a mega-track site with the largest and highest density of Cenozoic era fossilized-gypsum footprints in North America. These highly ephemeral tracks are found in sediments of ancient Lake Otero and range in age from 20,000 to 40,000 years BP (before present). The trackways, found in gypsum sand and lake sediments, are revealed in an unpredictable manner by wind and rain.
7. White and stark, the awe-inspiring gypsum dunefield offers distinctive opportunities to hike barefoot on cool, moist sands, sand sled year-round, and experience solitude broken only by wind and occasional military-related sound events. This unique setting inspires learning, appreciation, and stewardship.

## Fundamental Resources and Values

Fundamental resources and values (FRVs) are those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to warrant primary consideration during planning and management processes because they are essential to achieving the purpose of the park and maintaining its significance. Fundamental resources and values are closely related to a park's legislative purpose and are more specific than significance statements.

Fundamental resources and values help focus planning and management efforts on what is truly significant about the park. One of the most important responsibilities of NPS managers is to ensure the conservation and public enjoyment of those qualities that are essential (fundamental) to achieving the purpose of the park and maintaining its significance. If fundamental resources and values are allowed to deteriorate, the park purpose and/or significance could be jeopardized.

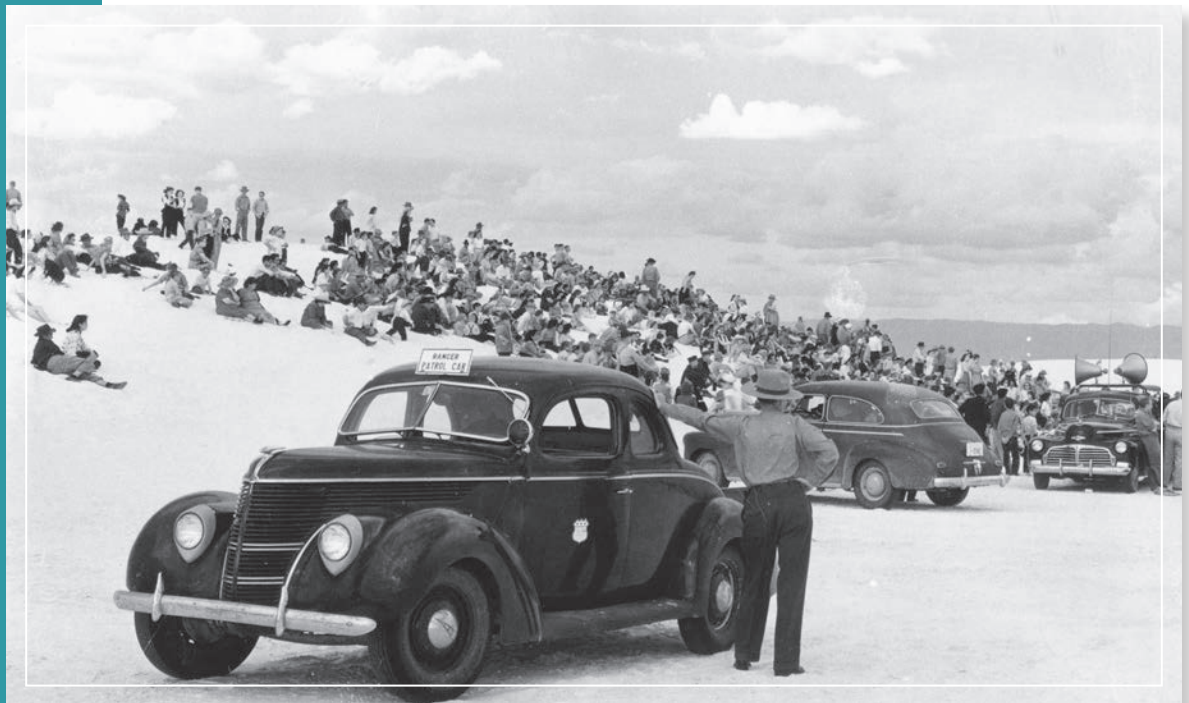
The following fundamental resources and values have been identified for White Sands National Monument:

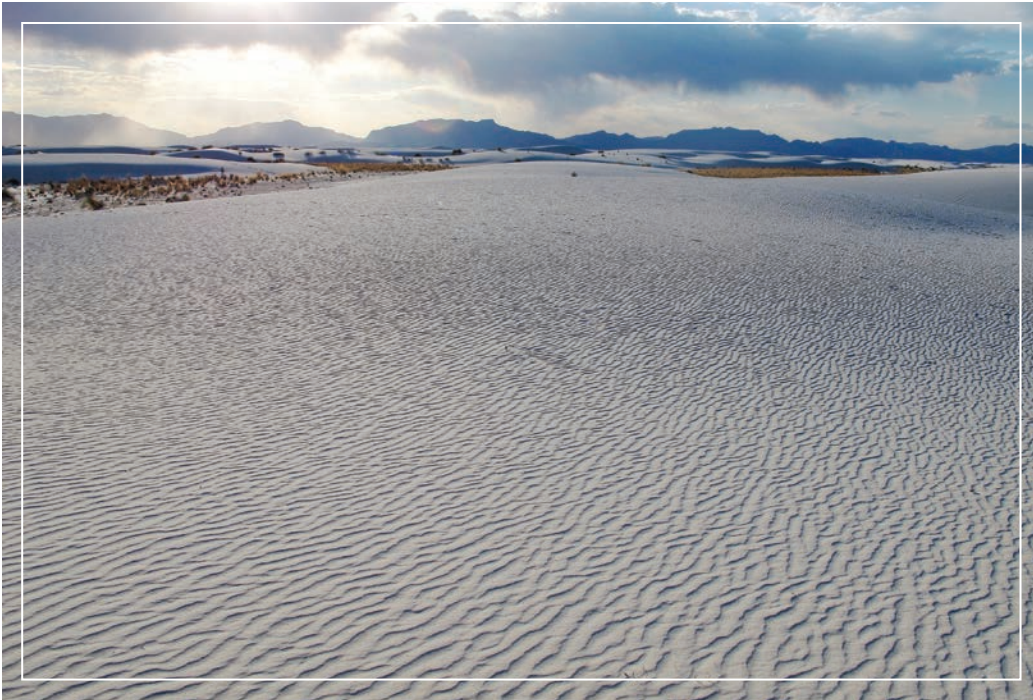
- **Gypsum Dunefield.** White Sands National Monument preserves almost half (40%) of the world's largest gypsum dunefield, which is 275 square miles in total size. Described as a wet eolian system, the White Sands dunefield is shaped by wind and water, as well as surface and ground water hydrology. The monument preserves Alkali Flat and Lake Lucero, which serve as a repository for gypsum eroding from nearby mountains that surround the Tularosa Basin. This gypsum contributes to the formation of new selenite crystals that are subsequently broken down by wind and rain and amassed in the form of gypsum dunes over time. The unique process of rock, to sand, to dunes continues today in Alkali Flat and Lake Lucero, forming the world's largest gypsum dunefield. The formation of crystals to dunes provides critical habitat for a variety of endemic plants and animals.
- **Surface Water and Ground Water Hydrology.** The gypsum dunefield is intricately tied to and sustained by surface and groundwater hydrologic processes occurring both within the monument and the Tularosa Basin. Gypsum is common throughout the world, but the unique surface and groundwater hydrology that supports the gypsum dunefield is very rare. At White Sands National Monument, groundwater is typically present 6–18 inches below the foot of the dunes. This layer serves as a high water table that maintains a high soil-moisture content throughout the year. The dunefield is situated within a much broader groundwater recharge area that is comprised of a shallow water aquifer that is sustained by a larger and deeper regional aquifer. Although precipitation and surface water contribute to the hydrological dynamics of the area, it is the water from the regional groundwater that is mostly responsible for dune stability.





- **Paleontological Resources.** White Sands National Monument preserves the largest and densest concentration of ephemeral gypsum fossil tracks in the Americas and possibly the world. Significant paleontological resources include vertebrate tracks from the Cenozoic epoch including mammoth, American lion, dire wolf, Harlan's ground sloth, ancient camel, and 18,000 year old plant seeds. These resources are found along the shores of Alkali Flat and Lake Lucero, which are remnants of the much larger ancient Lake Otero.
- **Visitor Experience and Opportunities.** The rolling white dunes provide visitors with an expansive and unencumbered outdoor recreation experience. This unique environment invites visitors to walk barefoot and sled year round on cool sand, camp under unobscured night skies, experience solitude, and take advantage of unparalleled photographic opportunities.
- **Research, Education, and Partnerships.** White Sands National Monument is mandated to provide opportunities for research and education and serves as a living laboratory for cutting-edge research led by a variety of national and international institutions. Partnerships with educational institutions, youth education groups, and the public provide resource-based learning opportunities found only in the world's largest gypsum dunefield. The monument also maintains a vibrant international partnership with its Mexican sister park, Cuatrociénegas Flora and Fauna Protected Area, home to the world's second largest gypsum dunefield. Collaborative research between these two parks has provided insights into the potential effects of climate change as well as the unique adaptations of flora and fauna.
- **Prehistoric and Historic Sites.** The White Sands landscape has been a magnet for people for more than 10,000 years. The earliest human history is marked by a Paleo-Indian presence along the ancient shorelines of Lake Otero. Later prehistoric peoples took advantage of fresh water and diverse flora and fauna at the edge of the dunefield. This use is noted by thousands of gypsum hearth mounds that are not known to occur anywhere else in the world. Historic cultural resources include traces of roads and trails, ranches, a nationally significant historic district featuring Works Progress Administration Spanish Mission Pueblo Revival-style architecture, and Cold War period structures.





- **Soundscapes and Viewscapes.** As the Tularosa Basin is almost exclusively held in public trust, White Sands National Monument provides an opportunity for visitors to experience unimpeded panoramic views of the horizon, which is largely devoid of human presence. Visitors enjoy extraordinary views of the white sand dunefield and exceptional night skies. This vast undeveloped landscape allows for natural quiet and solitude supporting a high quality visitor experience.
- **Biological Richness and Diversity.** The convergence of geologic, hydrologic, and geographic forces and the interdependence of these influences create an extraordinary environment that supports wetlands, playa lakes, gypsum dunes, and extensive remnants of Chihuahuan Desert grasslands. This island of white in the Chihuahuan Desert forms a system of ecotones that allow for a high density and diversity of flora and fauna, rapid adaptations of endemic species, and one of the richest assortments of moth species in North America.

## Other Important Resources and Values

White Sands National Monument contains other resources and values that are not fundamental to the purpose of the park and may be unrelated to its significance, but are important to consider in planning processes. These are referred to as “other important resources and values” (OIRV). These resources and values have been selected because they are important in the operation and management of the park and warrant special consideration in park planning.

The following other important resources and values have been identified for White Sands National Monument:

- **Cross-Boundary Management.** Almost completely surrounded by US Department of Defense-owned lands, the monument works with the military to achieve mutually compatible goals that include management of the world’s largest gypsum dunefield, visitor safety, and preservation of cultural values for the benefit of future generations. White Sands National Monument and White Sands Missile Range have a legally mandated cooperative relationship that ensures the long-term success of their divergent missions.

## Interpretive Themes

Interpretive themes are often described as the key stories or concepts that visitors should understand after visiting a park—they define the most important ideas or concepts communicated to visitors about a park unit. Themes are derived from, and should reflect, park purpose, significance, resources, and values. The set of interpretive themes is complete when it provides the structure necessary for park staff to develop opportunities for visitors to explore and relate to all park significance statements and fundamental and other important resources and values.

Interpretive themes are an organizational tool that reveal and clarify meaning, concepts, contexts, and values represented by park resources. Sound themes are accurate and reflect current scholarship and science. They encourage exploration of the context in which events or natural processes occurred and the effects of those events and processes. Interpretive themes go beyond a mere description of the event or process to foster multiple opportunities to experience and consider the park and its resources. These themes help explain why a park story is relevant to people who may otherwise be unaware of connections they have to an event, time, or place associated with the park.

The following interpretive themes have been identified for White Sands National Monument:

- Shifting geologic and climatic processes created ideal conditions for the source of Earth’s largest and geologically recent gypsum dunefield, prompting ongoing wonder at its unspoiled uniqueness found nowhere else on Earth.
- Water is essential to the creation, formation, and preservation of the dune system, without which the dunefield would be irreparably damaged and scientific and recreational pursuits would be permanently degraded.
- The monument’s biological richness and diversity, with more than 50 endemic species, offers insights into the amazing resilience of life and its ability to thrive in what would commonly be thought of as an inhospitable desert environment.
- Scientific research and discoveries regarding the monument’s biological and geological richness—so evident and important that it garners international scientific interest—and the ongoing sharing of this work with the public, offer insight into the degree to which scientific pursuits inform our lives.
- The richness and diversity of human interaction within this region—from habitation by the Paleo-Indians to aeronautical experimentation—provides opportunities for comparing and contrasting the values and adaptations of former cultures to those of our own.
- For generations the driving forces of wind and water behind these timeless dunes have both delighted and bewitched, teased and tormented visitors, rewarding the patient with a sense of appreciation, learning, and stewardship.
- Although the monument is located beneath the nation’s largest military airspace and is bordered by military installations, this incongruous relationship enables a deeper understanding of the underlying mission that both institutions share in common: to preserve cultural values for the benefit of future generations.





## Part 2: Dynamic Components

The dynamic components of a foundation document include special mandates and administrative commitments and an assessment of planning and data needs. These components are dynamic because they will change over time. New special mandates can be established and new administrative commitments made. As conditions and trends of fundamental and other important resources and values change over time, the analysis of planning and data needs will need to be revisited and revised, along with key issues. Therefore, this part of the foundation document will be updated accordingly.

### Special Mandates, Administrative Commitments, and Other Relevant Agency Policies and Regulations

Many management decisions for a park unit are directed or influenced by special mandates and administrative commitments with other federal agencies, state and local governments, utility companies, partnering organizations, and other entities. Special mandates are requirements specific to a park that must be fulfilled. Mandates can be expressed in enabling legislation, in separate legislation following the establishment of the park, or through a judicial process. They may expand on park purpose or introduce elements unrelated to the purpose of the park. Administrative commitments are, in general, agreements that have been reached through formal, documented processes, often through memorandums of agreement. Examples include easements, rights-of-way, arrangements for emergency service responses, etc. Special mandates and administrative commitments can support, in many cases, a network of partnerships that help fulfill the objectives of the park and facilitate working relationships with other organizations. They are an essential component of managing and planning for White Sands National Monument.

For more information about the existing special mandates, administrative commitments, and other relevant agency policies and regulations that apply to White Sands National Monument, please see appendix B.

### Assessment of Planning and Data Needs

Once the core components of part 1 of the foundation document have been identified, it is important to gather and evaluate existing information about the park's fundamental and other important resources and values, and develop a full assessment of the park's planning and data needs. The assessment of planning and data needs section presents planning issues, the planning projects that will address these issues, and the associated information requirements for planning, such as resource inventories and data collection, including GIS data.

There are three sections in the assessment of planning and data needs:

1. analysis of fundamental and other important resources and values
2. identification of key issues and associated planning and data needs
3. identification of planning and data needs (including spatial mapping activities or GIS maps)

The analysis of fundamental and other important resources and values and identification of key issues leads up to and supports the identification of planning and data collection needs.

### Analysis of Fundamental Resources and Values

The fundamental resource or value analysis table includes current conditions, potential threats and opportunities, planning and data needs, and selected laws and NPS policies related to management of the identified resource or value.



Fundamental Resource or Value	Gypsum Dunefield
Related Significance Statements	Significance statement 1.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• The amount of material that is entering and leaving the dune system is unknown.</li> <li>• There is strong evidence that past and ongoing deflation of Lake Otero sediments which produced the modern dunefield is the result of falling groundwater levels over the past ~7,000 years due to increased aridity.</li> <li>• The greater White Sands dunefield (WSDF) covers about 275 square miles in the Tularosa Basin between the San Andres Mountains to the west and the Sacramento Mountains to the east. About 40% of the dunefield is located within White Sands National Monument, and the remainder located within the White Sands Missile Range and Holloman Air Force Base.</li> <li>• The overall geomorphic setting is one in which a core of crescentic and barchan dunes is rimmed by parabolic dunes to the north, east and south. To the west, the dunefield yields abruptly to an extensive gypsum plain, Alkali Flat. Yet westward into the lowest elevations of the basin are active playa lakes, the largest and most persistent being Lake Lucero.</li> <li>• Dominant winds are from the west/southwest and are strongest during the winter and spring; a second mode of winds from the north/northwest occurs during the fall and winter; and a third mode of winds from the south/southeast occurs during the spring and summer.</li> <li>• The dunefield is a “wet system” in the classification of Kocurek and Havholm (1994) in which sediment availability is a function of the shallow water table and gypsum surface cementation.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• The leading edge of the dunefield seems to have stopped moving and is becoming vegetated.</li> <li>• Along the leading edge, the dunes are piling up on themselves.</li> <li>• The declining rate of movement in the dunefield has caused an abrupt increase in vegetation density, which in turn has led to increased changes in groundwater depth and salinity (Jerolmack et al. 2012).</li> </ul>

Fundamental Resource or Value	Gypsum Dunefield
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Disturbances to or losses of surface or groundwater within the basin could potentially make the dunes unstable, disrupt sand production, and cause the dunefield to migrate east toward the airfield.</li> <li>• Climate change will threaten ground water and dune moisture, surface water of the lake system / Lake Lucero, crystal/sand production, and also enhanced proliferation of nonnative and invasive species, all of which strongly influence dune morphology.</li> <li>• Changes to the ground water flow regime (e.g., ground water withdrawals, increase evapotranspiration) could change the water table that sustains the dunes.</li> <li>• Tamarisk (saltcedar) siphons large quantities of water and out-competes other forms of native vegetation, such as the Rio Grande cottonwood. It also destroys entire dunes by removing soil moisture and increasing wind erosion.</li> <li>• Desalination and geothermal plants require high volumes of water to operate and could affect the regional aquifer that sustains the dunefield.</li> <li>• Construction along and maintenance of the Dunes Drive affects dune dynamics.</li> <li>• Increased frequency and severity of dust storms affect visibility and access to Dunes Drive.</li> <li>• Solar thermal farms (mirror system vs photovoltaic cells) could place additional demands on already limited water resources.</li> <li>• Issues related to the proximity of the missile range include: elevated erosion, contaminated runoff, unexploded ordnance, and missile/debris retrieval efforts.</li> <li>• Blowing gypsum sand can adhere to surfaces and affect functionality of machinery, windows, and doors.</li> <li>• If soil moisture and the shallow water table were to decrease, the dunes could rapidly move to the east toward Holloman Air Force Base, the airfield, and the high-speed test track and could close off the only public access route into the heart of the dunes, as well as access to the monument's northern boundary.</li> <li>• An increase in temperature and decrease in moisture in the dunefield as a result of climate change will affect the transition zones—the area between the parabolic and barchan dunes—and change the structure and stability of the entire dunefield.</li> <li>• The arid park ecosystems are particularly vulnerable to the nutrient enrichment effects of nitrogen deposition, currently a moderate concern based on NPS Air Resources Division benchmarks. Some invasive plant species thrive in areas with excess nitrogen deposition, displacing native vegetation adapted to low nitrogen conditions. Increases in nitrogen have been found to promote invasions of fast-growing nonnative annual grasses and forbs, including Russian thistle, at the expense of native species.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• New research is being conducted to better understand dune integrity.</li> <li>• Long-term monitoring is needed of the regional aquifer flows to better understand how water is moving under the dunefield and for early detection of water withdrawals beneath the dunes.</li> <li>• Partnerships with universities (Texas A&amp;M, University of Texas at Austin, University of Pennsylvania, University of Texas – El Paso, New Mexico State University), United States Department of Agriculture Research Service Jornada Experimental Range, state climatologists, White Sands Missile Range, Holloman Air Force Base, Las Cruces Climate Hub (US Department of Agriculture), Chihuahuan Desert Network Inventory and Monitoring, Washington Support Office Climate Change Response Program, Guadalupe Mountains National Park, and Cuatrociénegas Flora and Fauna Protected Area provide an opportunity to share and expand knowledge about dune dynamics.</li> </ul>



Fundamental Resource or Value	Gypsum Dunefield
<p><b>Threats and Opportunities</b></p>	<p><b>Opportunities (continued)</b></p> <ul style="list-style-type: none"> <li>• Lots of data exists, but it needs to be synthesized to better understand trends.</li> <li>• Collaborations with neighbors on land management with respect to the dunefield would help ensure that data is being transferred among adjacent landowners; furthering research to inform best practices in dune and water management across boundaries (to inform management and decision making).</li> <li>• Shared research corridor (with White Sands Missile Range and Holloman Air Force Base) – along the northern boundary where co-collection of data across all dune types and ecotones can be easily done.</li> <li>• Creation of a shared database to ensure that the data and other collection that have already been collected are being used to advance rather than repeat science. Need a central repository to make sure that data and other collections information are available for future researchers/projects. (This ideally needs to be located somewhere where it can be jointly accessed by Department of the Interior, Department of Defense, and academics).</li> <li>• Increasing awareness of eolian processes and the saline groundwater system is necessary for developing sustainable infrastructure in areas of gypsum sand.</li> <li>• Advancing understanding of the corrosive nature of saline groundwater for infrastructure, as well as the possibility of gypsum dissolution in the presence of freshwater, creating sinkholes.</li> </ul>
<p><b>Existing Data and Plans Related to the FRV</b></p>	<ul style="list-style-type: none"> <li>• LiDAR images of the dunes (Kocurek et al. 2012).</li> <li>• Multi-year LiDAR images of study area.</li> <li>• “Hydrologic Investigation at White Sands National Monument” (Newton and Allen 2014).</li> <li>• “Hydrologic Modeling of the White Sands Dune Field, New Mexico” (Bourret et al. 2015).</li> <li>• Inventory of water rights and groundwater evaluation data (Embid and Finch 2011).</li> <li>• Basinwide hydrology data set – hydrology modeling.</li> <li>• Water well inventory.</li> <li>• Historical climatological data (1930s to present).</li> <li>• Holloman groundwater monitoring report (same report from White Sands Missile Range).</li> <li>• Vegetation mapping classification data and report.</li> <li>• Soils survey report (Natural Resources Conservation Service) – includes mapping.</li> <li>• Geologic report (includes mapping).</li> <li>• Mesocarnivore study.</li> <li>• Small mammals on Holloman Air Force Base (Texas Tech).</li> <li>• Soil disturbance reports from Holloman Air Force Base.</li> <li>• Bill Reid report (massive, flora and fauna communities in the 1980s).</li> <li>• Holloman integrated natural resources management plan, White Sands Missile Range integrated natural resources management plan, Lake Toba Catchment Area.</li> <li>• Ground penetrating radar study.</li> <li>• Regional air quality monitoring including ozone, deposition, and visibility.</li> </ul>
<p><b>Data and/or GIS Needs</b></p>	<ul style="list-style-type: none"> <li>• Integrated metaanalysis of dune data (and shared use of the data through a database system).</li> <li>• Dunes air quality study (particulate matter study).</li> <li>• Inventory museum collections and catalog into the Interior Collections Management System.</li> </ul>

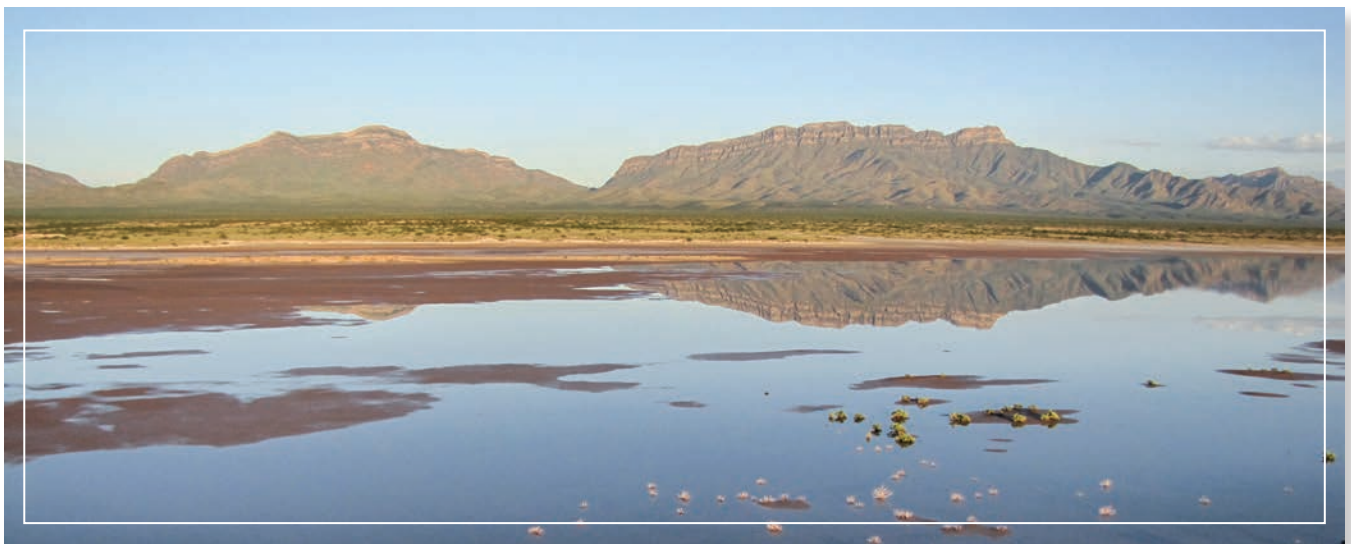
Fundamental Resource or Value	Gypsum Dunefield
<p><b>Planning Needs</b></p>	<ul style="list-style-type: none"> <li>• Tularosa Basin aquifer management plan (this is a state-led plan that White Sands National Monument should participate in).</li> <li>• White Sands National Monument water management plan (integration of the two plans; these are basinwide systems that are critically connected).</li> </ul>
<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b></p>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• Water rights adjudication and law</li> <li>• Clean Air Act</li> <li>• Museum Property Act</li> <li>• National Invasive Species Act of 1996</li> <li>• Executive Order 13112, "Invasive Species"</li> <li>• Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources"</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director's Orders)</b></p> <ul style="list-style-type: none"> <li>• Director's Order 24: <i>NPS Museum Collections Management</i></li> <li>• <i>NPS Management Policies 2006</i> (§4.6.1) "Protection of Surface Waters and Groundwaters"</li> <li>• <i>NPS Management Policies 2006</i> (§4.6.2) "Water Rights"</li> <li>• <i>NPS Natural Resource Management Reference Manual 77</i></li> <li>• <i>NPS Management Policies 2006</i> (§1.6) "Cooperative Conservation Beyond Park Boundaries"</li> <li>• <i>NPS Management Policies 2006</i> (§4.1) "General Management Concepts"</li> <li>• <i>NPS Management Policies 2006</i> (§4.1.4) "Partnerships"</li> <li>• <i>NPS Management Policies 2006</i> (§4.7.2) "Weather and Climate"</li> </ul>



<b>Fundamental Resource or Value</b>	<b>Surface Water and Ground Water Hydrology</b>
<b>Related Significance Statements</b>	Significance statement 2.
<b>Current Conditions and Trends</b>	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Strong connection between the local and regional aquifer (2013 discovery). Actions on the regional aquifer will critically affect the local aquifer (Newton and Allen 2014).</li> <li>• Precipitation has shown statistically significant increases at the weather station since 1939 and for the park since 1950. Precipitation increases have been higher on the western and eastern edges of the park.</li> <li>• On average, climate models project precipitation decreases, but many individual models project precipitation increases. The greatest decreases could occur in summer (June–August).</li> <li>• Ongoing studies are looking to see if water pumping east of the Jarilla Fault could lower water levels in the shallow dune aquifer.</li> <li>• Water that is coming into the regional aquifer takes a long time to recharge. Water pumped from the aquifer is brackish and requires desalination before municipal use.</li> <li>• Current water withdrawal plan for the basin allows for 1.5 feet of draw down each year for the next 40 years from the regional aquifer.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Science is rapidly advancing in our understanding of the hydrology in the Tularosa Basin. This could reveal future conditions, threats, and opportunities.</li> <li>• Any change in seismic activity could change the groundwater flows.</li> </ul>
<b>Threats and Opportunities</b>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Increased groundwater pumping on the east side of the Tularosa Basin could decrease groundwater levels beneath the dunes making the gypsum sands more available for transport by wind, changing the dune dynamics and local ecosystem.</li> <li>• Groundwater withdrawals from the larger, brackish regional aquifer could alter the salinity of the local aquifer.</li> <li>• Drier dunes would mean faster movement that could outpace the reasonable maintenance of Dunes Drive.</li> <li>• Drier dunes could move further; they could eventually extend to infrastructure at Holloman Air Force Base.</li> <li>• Climate change-driven reduction in precipitation could drastically impact the dune regime as well as local and regional aquifers.</li> <li>• Tamarisk (Saltcedar) siphons large quantities of water destroying entire dunes by removing soil moisture and increasing wind erosion.</li> <li>• Lack of integration of similar studies regarding the hydrologic and biologic systems basinwide.</li> <li>• Data collected on hydrologic and biologic systems in the basin is not readily available for use/reference.</li> <li>• Water contamination from military operations.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Installation of additional monitoring wells to track the trends of the local aquifer.</li> <li>• Creation of a shared data network amongst all of the monitoring wells in the basin.</li> <li>• Installation of additional weather stations to track climate change data for impacts on water regimes.</li> <li>• Education and integration of shared knowledge about the hydrologic and biologic systems basin wide (as well as public knowledge).</li> </ul>



Fundamental Resource or Value	Surface Water and Ground Water Hydrology
<p><b>Existing Data and Plans Related to the FRV</b></p>	<ul style="list-style-type: none"> <li>• Regional aquifer plan (due for an update- current plan doesn't include White Sands National Monument or the shallow aquifer under it).</li> <li>• US Geological Survey regional groundwater assessment.</li> <li>• US Geological Survey percolate report.</li> <li>• New Mexico Bureau of Geology and Mineral Resources geographical studies.</li> <li>• Holloman groundwater monitoring report (2003).</li> <li>• Springwater report from Chihuahuan Desert Network.</li> <li>• Reports on Garten Pond.</li> <li>• Tularosa water availability report.</li> </ul>
<p><b>Data and/or GIS Needs</b></p>	<ul style="list-style-type: none"> <li>• Wetland restoration services and impact analysis.</li> <li>• Comprehensive hydrological evaluation</li> <li>• Missile impacts on surface and groundwater.</li> <li>• GIS of groundwater modeling and mapping (3D models).</li> <li>• Inventory museum collections and catalog into the Interior Collections Management System.</li> </ul>
<p><b>Planning Needs</b></p>	<ul style="list-style-type: none"> <li>• Water management plan</li> <li>• Tularosa Basin aquifer management plan (this is a state-led plan that White Sands National Monument should participate in).</li> <li>• White Sands National Monument water management plan (integration of the two plans, these are basinwide systems that are critically connected).</li> </ul>
<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b></p>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• Water rights adjudication and law</li> <li>• Executive Order 11514, "Protection and Enhancement of Environmental Quality"</li> <li>• Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources"</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director's Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS Management Policies 2006 (§4.6.1) "Protection of Surface Waters and Groundwaters"</li> <li>• NPS Management Policies 2006 (§4.6.2) "Water Rights"</li> </ul>



Fundamental Resource or Value	Paleontological Resources
<b>Related Significance Statements</b>	Significance statements 5 and 6.
<b>Current Conditions and Trends</b>	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• High density and diversity of fossil track types.</li> <li>• Ephemeral mega-track sites are susceptible to erosion.</li> <li>• Largely associated with Lake Otero’s ancient shorelines, however, there are other body fossils of invertebrates, plants, and other microfossils scattered around the park.</li> <li>• Preservation of exposed fossils is a continuing challenge.</li> <li>• High level of resource complexity and lack of sufficient staff with knowledge of and expertise on the resource makes preservation and management of exposed fossils is a continuing challenge.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Erosion is exposing fossils at a relatively rapid rate.</li> <li>• Fossils are continually eroding due to climatic and weather influences once exposed.</li> </ul>
<b>Threats and Opportunities</b>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Fossils are continually eroding due to climatic and weather influences once exposed (i.e., flooding).</li> <li>• Climate change may alter precipitation patterns, long-term surface and groundwater hydrology dynamics, and subsequently, erosion patterns.</li> <li>• Disturbances from military activity (missile impacts and associated recovery efforts).</li> <li>• Disturbances from search and rescue and other ongoing park management activities.</li> <li>• Potential looting or trampling, although public awareness of these resources is currently limited.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Area digital data capture and analysis would enable relatively rapid assessments of fossil resources.</li> <li>• Research potential is significant in the area of paleontology and geology.</li> <li>• Potential for determining best preservation techniques of the fossil tracks (and serving as a model for future similar discoveries elsewhere).</li> <li>• Mentoring and collaborating with students in the field.</li> </ul>
<b>Existing Data and Plans Related to the FRV</b>	<ul style="list-style-type: none"> <li>• New Mexico Natural History Museum (Spencer Lucas) publications.</li> <li>• White Sands National Monument publications.</li> <li>• White Sands Missile Range publications.</li> <li>• New Mexico Tech publications.</li> <li>• Paleontological Resource Inventory and Monitoring, Chihuahuan Desert Network, 2007.</li> </ul>
<b>Data and/or GIS Needs</b>	<ul style="list-style-type: none"> <li>• Parkwide LiDAR imagery and/or other high quality aerial imagery.</li> <li>• Additional rapid paleontological resource surveys to prioritize future field surveys.</li> <li>• Follow-up thorough paleontological field surveys.</li> <li>• Park inventory of archeological and paleontological resources.</li> <li>• Military Impact assessment to paleontological resources.</li> <li>• Museum collection fire and security survey.</li> <li>• Inventory museum collections and catalog into the Interior Collections Management System.</li> </ul>

Fundamental Resource or Value	Paleontological Resources
<p><b>Planning Needs</b></p>	<ul style="list-style-type: none"> <li>• Conservation/preservation plan for existing paleontological resources including those in museum collections.</li> <li>• Management strategy and collection protocol for paleontological resources.</li> <li>• Impact site response and rehabilitation plan / military mishap plan (environmental assessment) and human evacuation plan.</li> </ul>
<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b></p>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• Museum Property Act</li> <li>• Paleontological Resources Protection Act</li> <li>• Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources"</li> </ul> <p><b>NPS Policy-level Guidance (NPS <i>Management Policies 2006</i> and <i>Director's Orders</i>)</b></p> <ul style="list-style-type: none"> <li>• NPS <i>Natural Resource Management Reference Manual 77</i></li> <li>• Director's Order 24: <i>NPS Museum Collections Management</i></li> <li>• NPS <i>Management Policies 2006</i> (§8.10) "Natural and Cultural Studies, Research, and Collection Activities"</li> <li>• NPS <i>Management Policies 2006</i> (§2.3.1.4) "Science and Scholarship"</li> <li>• NPS <i>Management Policies 2006</i> (§5.1) "Research"</li> </ul>





Fundamental Resource or Value	Visitor Experience and Opportunities
Related Significance Statements	Significance statement 7.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Approximately 160,000 visitors have direct/indirect contact with in-park ranger/interpretive material annually (as of 2014). The monument receives more than 1 million visitors to its website annually.</li> <li>• Dunes Drive and historic visitor center are key parts of visitor experience.</li> <li>• The 10 existing backcountry campsites are used by roughly 1,200 campers annually.</li> <li>• Roads and trails provide visitors with access to wild places within the monument.</li> <li>• Occasional diminished visitor experience as a result of trash, crowding in/around the visitor center area, and challenges associated with infrastructure (e.g., inadequate parking).</li> <li>• Monument closures due to military testing, typically 1–3 times/week (in 2014, 90+ tests were supported by the monument).</li> <li>• Low park staff to visitor ratio resulting in fewer park staff and visitor encounters.</li> <li>• Variety and diversity of visitor experiences.</li> <li>• One of the premier attractions in New Mexico, as seen by the New Mexico Tourism Department.</li> <li>• Largest visitation of any NPS unit (about half a million visitors in 2014) in New Mexico—supported by 14.5 full-time equivalent and 10 full-time equivalent seasonal staff in fiscal year 2014.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Visitation continues to increase slightly each year.</li> <li>• Comprehensive visitor survey conducted in 2012 (Begly et al. 2013). <ul style="list-style-type: none"> <li>• 19% of visitors have visited the park multiple times that year, 58% of visitors were visiting for first time.</li> <li>• International visitors comprise 10% of total visitation, 41% of visitors are from Texas, and 11% of visitors were residents of the area.</li> <li>• Most commonly visited places in the park are the bookstore (73%), Dunes Drive (73%), and the gift shop (59%).</li> <li>• 12% of visitors attended ranger-led activities; those who did not attend stated lack of time as their reason.</li> </ul> </li> <li>• Search and rescue: approximately 60% of lost visitors are international.</li> <li>• Continued increase in special events and increased attendance (e.g., full moon hikes).</li> </ul>
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Facility and infrastructure design/construction (historic adobe structures, Dune Drive) cause unique maintenance/management challenges; maintenance is a challenge due to limited staffing and strained resources.</li> <li>• Wind, rain, flooding and unique environment at the monument cause ongoing and unpredictable maintenance issues.</li> <li>• Limited visitor contacts may result in more search and rescue efforts, injuries, resource damage. This also affects the staff's ability to maintain day-to-day operations.</li> <li>• Climate change-driven warming may influence both total visitation and seasonal visitation patterns, providing both opportunities and threats (i.e., increased pressure on facilities, resources, and aspects of the visitor experience such as solitude).</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• The monument has developed a leave no trace program to increase public awareness of littering and promote proper stewardship through education, encouragement, signage, and installation of various receptacles.</li> <li>• Improve and target signage for international visitors to address White Sands National Monument visitor study (messaging).</li> </ul>

Fundamental Resource or Value	Visitor Experience and Opportunities
<b>Threats and Opportunities</b>	<p><b>Opportunities (continued)</b></p> <ul style="list-style-type: none"> <li>• Opportunities to expand educational programs (distance learning/education, reaching out to local school districts).</li> <li>• Opportunity to partner with Take it Outside New Mexico coalition and with other local partners for educational opportunities.</li> <li>• Restructure and update visitor and staff facilities at the entrance to White Sands National Monument.</li> <li>• Expand interpretive and educational tools to communicate the connections between the Gypsum Dunefield, climate change, hydrology, biodiversity, air quality / pollution, views, night sky, sensitive park resources, human health, and other associated resources.</li> </ul>
<b>Existing Data and Plans Related to the FRV</b>	<ul style="list-style-type: none"> <li>• “White Sands National Monument visitor study: Summer 2012” (Begly et al. 2012).</li> <li>• “Management Strategy for White Sands National Monument” (2009).</li> <li>• Transportation Study for the White Sands National Monument Final Report; September 1978.</li> <li>• A Road Safety Audit conducted for the New Mexico Department of Transportation in conjunction with National Parks Service for the US Route 70 at White Sands National Monument (MP 200) District 2; April 2014.</li> </ul>
<b>Data and/or GIS Needs</b>	<ul style="list-style-type: none"> <li>• Teacher needs assessment (to inform comprehensive interpretive plan).</li> <li>• Data analysis of past search and rescue reports (leverage cooperative ecosystem studies units).</li> </ul>
<b>Planning Needs</b>	<ul style="list-style-type: none"> <li>• Comprehensive interpretive plan (finalized by end of 2015).</li> <li>• Finalize park safety plan.</li> <li>• Development concept plan to address front entrance reconfiguration (parking, road access, and visitor services, comfort station, and intersection with US Highway 70).</li> <li>• Backcountry/visitor use management plan (address leave no trace).</li> <li>• Special park uses and commercial services plan.</li> <li>• Commercial filming and photography strategy.</li> <li>• Environmental management plan.</li> </ul>
<b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• Americans with Disabilities Act of 1990</li> <li>• Architectural Barriers Act of 1968</li> <li>• Architectural Barriers Act Accessibility Standards 2006</li> <li>• Rehabilitation Act of 1973</li> <li>• NPS Concessions Management Improvement Act of 1998</li> <li>• “Concession Contracts” (36 CFR 51)</li> <li>• Secretarial Order 3289, “Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources”</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director’s Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS <i>Management Policies 2006</i> (chapter 7) “Interpretation and Education”</li> <li>• NPS <i>Management Policies 2006</i> (chapter 8) “Use of the Parks”</li> <li>• NPS <i>Management Policies 2006</i> (chapter 9) “Park Facilities”</li> <li>• NPS <i>Management Policies 2006</i> (chapter 10) “Commercial Visitor Services”</li> <li>• Director’s Order 6: <i>Interpretation and Education</i></li> <li>• Director’s Order 42: <i>Accessibility for Visitors with Disabilities in NPS Programs, Facilities, and Services</i></li> <li>• Director’s Order 48A: <i>Concession Management</i></li> <li>• Director’s Order 48B: <i>Commercial Use Authorizations</i></li> <li>• NPS <i>Transportation Planning Guidebook</i></li> </ul>



Fundamental Resource or Value	Research, Education, and Partnerships
Related Significance Statements	Significance statement 4.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>Existing research is robust; on average four new projects start each year. The majority of the projects are focused on endemic species (from the microbes that live in the soil and water to moths and the plants that inhabit the dunes), unique geological, paleontological and archeological, and planetary science. Many of these projects are leading the way in their fields or redefining previous science.</li> <li>Research scope is international, national, and regional, crosses many bodies of literature/ fields of study, and includes interdisciplinary work.</li> <li>Interpretation: Take it Outside New Mexico – existing partnership coalition.</li> <li>Law enforcement, structural, emergency response partnerships are used to support park operations (park has concurrent jurisdiction for law enforcement).</li> <li>Sister park partnership with Cuatrociénegas Flora and Fauna Protected Area (Mexico) was initiated in 2009 and remains active (5–6 activities/year with sister park). This partnership includes initiatives in many divisions (interpretive, biological, etc.); Intermountain Region International Program funds help to maintain this partnership.</li> <li>Native American relations: the monument is reaching out to traditionally associated tribes and hopes to develop meaningful relationships as we move forward.</li> <li>White Sands Institute (through New Mexico University) programs were discontinued in fiscal year 2014 due to lack of institute staffing.</li> <li>Strong partnership with cooperating association and concessioner.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>Monument is building relationships with traditionally associated tribes with many opportunities to expand in the future.</li> <li>Existing partnerships continue to strengthen over time.</li> <li>Limited capacity to maintain and leverage additional partnerships.</li> </ul>



Fundamental Resource or Value	Research, Education, and Partnerships
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Limited staff time requires the monument prioritize all new potential partnerships.</li> <li>• Working with White Sands National Monument’s sister park can be challenging because of funding, international travel approval, and visa approvals, etc. Despite the challenges the monument has a good relationship with its sister park.</li> <li>• The monument is at risk by not having the ability to maintain extensive and robust partnerships which can help sustain long-term initiatives and protective measures.</li> <li>• Missile test scheduling limits research opportunities due to planned closures and limited access in support of these tests.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Opportunity to identify support (funding, sponsors) for White Sands Institute moving forward.</li> <li>• Additional partnership opportunities could be explored if staffing existed.</li> <li>• To share data gathered through research collaborations with other scientist and through interpretive services.</li> <li>• More local universities collaborations could increase research and education partnership opportunities.</li> <li>• Explore establishing a “friends” group.</li> <li>• Greater engagement with local communities will facilitate local stewardship of the monument and its resources.</li> <li>• Develop a partnership with military neighbors for data sharing.</li> <li>• Investigate ongoing opportunities through federal air quality programs for the National Park Service to work cooperatively with other federal and state air quality agencies and local stakeholders to potentially reduce air quality impacts in parks from sources of air pollution.</li> </ul>
Data and/or GIS Needs	<ul style="list-style-type: none"> <li>• Analysis of search and rescue past reports to inform future needs.</li> <li>• Inventory museum collections and catalog into the Interior Collections Management System.</li> </ul>
Planning Needs	<ul style="list-style-type: none"> <li>• Partnership strategy (there is an existing strategy being developed just for interpretation under comprehensive interpretive plan).</li> <li>• Education plan.</li> <li>• Research strategic plan.</li> </ul>
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments”</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director’s Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS <i>Management Policies 2006</i> (chapter 7) “Interpretation and Education”</li> <li>• NPS <i>Management Policies 2006</i> (chapter 8) “Use of the Parks”</li> <li>• NPS <i>Management Policies 2006</i> (§1.6) “Cooperative Conservation Beyond Park Boundaries”</li> <li>• NPS <i>Management Policies 2006</i> (§2.3.1.4) “Science and Scholarship”</li> <li>• NPS <i>Management Policies 2006</i> (§4.1.4) “Partnerships”</li> <li>• NPS <i>Management Policies 2006</i> (§5.1) “Research”</li> <li>• NPS-75 Natural Resources Inventory and Monitoring Guideline</li> <li>• NPS <i>Natural Resource Management Reference Manual 77</i></li> <li>• Director’s Order 6: <i>Interpretation and Education</i></li> </ul>



Fundamental Resource or Value	Prehistoric and Historic Sites
Related Significance Statements	Significance statements 5 and 6.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Approximately 10% of White Sands National Monument has been surveyed for cultural resources.</li> <li>• Approximately 300 archeological resource sites have been documented to date.</li> <li>• Diverse array of prehistoric resources (hearth mounds, dense artifact scatters, burials) and historic resources (roads, trails, ranching, and mining features).</li> <li>• Condition of historic district buildings is fair to good overall.</li> <li>• Work underway on a preliminary historic structures report.</li> <li>• Hundreds to thousands of archeological hearth sites that have yet to be recorded.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• The extent of cultural resources found at the monument is only beginning to be understood.</li> <li>• Working on improving conditions at the historic buildings within the historic district by upgrading infrastructure (e.g., plumbing, heating, electrical, fire, and roof).</li> </ul>
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Potential for looting archeological sites.</li> <li>• Disturbances from military activity (missile impacts and associated recovery efforts).</li> <li>• Disturbances from search and rescue, hazardous materials recovery, and other ongoing park management activities.</li> <li>• Climate change and associated impacts.</li> <li>• Overuse of the historic buildings. These were not built to accommodate the numbers of visitors that the park sees. Visitation is easily 10 times what it was when structures were developed.</li> <li>• Gypsic soils are corrosive and unstable (causing sinkholes).</li> <li>• Water withdrawals and subsequent erosional impacts on hearth mounds and other cultural resources.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Potential research associated with archeological hearth sites may help shed insight on human occupation and land use, climate change, and geology.</li> <li>• Cultural surveys of prehistoric resources (hearth mounds, dense artifact scatters) and historic resources (roads, trails, ranching, and mining features) would fulfil section 110 requirements because these sites have the potential to be destroyed by missile impacts.</li> </ul>
Existing Data and Plans Related to the FRV	<ul style="list-style-type: none"> <li>• “Management Strategy for White Sands National Monument” (2009).</li> </ul>

Fundamental Resource or Value	Prehistoric and Historic Sites
Data and/or GIS Needs	<ul style="list-style-type: none"> <li>• Comprehensive inventory and assessment of archeological resource sites.</li> <li>• Parkwide LiDAR study (see note in paleontological resources).</li> <li>• Access to multi-spectral imagery (through Mike Story, Natural Resource Stewardship and Science, Inventory &amp; Monitoring Division).</li> <li>• Cultural resource assessments: identify and evaluate other possible cultural landscapes throughout the park such as hearth mounds, ranching, mining, and Cold War structures.</li> <li>• Structural integrity assessment of the historic structures.</li> <li>• Ethnographic overview and assessment.</li> <li>• Sound monitoring of impacts on cultural resources (historic district, historic, and prehistoric sites).</li> <li>• Long-term monitoring and cumulative effects study of impacts on resources.</li> <li>• Historic structures report.</li> </ul>
Planning Needs	<ul style="list-style-type: none"> <li>• Cultural resource management plan.</li> <li>• Collections management plan.</li> <li>• Update cultural landscape inventory report (for the park historic district).</li> <li>• Hearth mound cultural landscape inventory and national register nomination.</li> </ul>
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• National Historic Preservation Act of 1966, as amended (54 USC §300101 et seq.)</li> <li>• The Clean Air Act (42 USC 7401 et seq.) gives federal land managers the responsibility for protecting air quality and related values, including visibility, plants, animals, soils, water quality, cultural resources, and public health, from adverse air pollution impacts</li> <li>• Archeological and Historic Preservation Act of 1974</li> <li>• American Indian Religious Freedom Act of 1978</li> <li>• Archaeological Resources Protection Act of 1979</li> <li>• Native American Graves Protection and Repatriation Act of 1990</li> <li>• Museum Act (16 USC 18f through 18f-3)</li> <li>• Executive Order 11593, "Protection and Enhancement of the Cultural Environment"</li> <li>• Executive Order 13007, "Indian Sacred Sites"</li> <li>• "Curation of Federally-Owned and Administered Archaeological Collections" (36 CFR 79)</li> <li>• "Protection of Historic Properties" (36 CFR 800)</li> <li>• Paleontological Resources Preservation Act of 2009</li> <li>• Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources"</li> <li>• Religious Freedom Restoration Act</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director's Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS <i>Management Policies 2006</i> (§4.1) "General Management Concepts"</li> <li>• NPS <i>Management Policies 2006</i> (§4.1.4) "Partnerships"</li> <li>• NPS <i>Management Policies 2006</i> (chapter 5) "Cultural Resource Management"</li> <li>• Director's Order 24: <i>NPS Museum Collections Management</i></li> <li>• Director's Order 28: <i>Cultural Resource Management</i></li> <li>• Director's Order 28A: <i>Archeology</i></li> <li>• NPS <i>Museum Handbook</i>, parts I, II, and III</li> <li>• <i>The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation</i></li> </ul>



Fundamental Resource or Value	Soundscapes and Viewscapes
Related Significance Statements	Significance statements 1 and 7.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Air quality and scenic resources are impacted by international, regional, and local sources of air pollution such as agriculture, power plants, industry, oil and gas development, and urban sprawl.</li> <li>• Although the park night sky quality is partially degraded due to the proximity of the multiple population centers, the conditions are better than surrounding areas and represent an important but threatened resource. At night, air pollution sometimes scatters artificial light, increasing the effect of light pollution on the night sky.</li> <li>• Most (if not all) of the viewscape is under federal management and ownership.</li> <li>• Increased military activity (missile testing, flyovers, sonic booms).</li> <li>• Natural quiet experience in sections of park.</li> <li>• 77% of visitors come for general park sightseeing, 5% of visitors come for night viewing (Begly et al. 2013).</li> <li>• Visibility warrants moderate concern based on NPS Air Resources Division benchmarks as views are sometimes obscured by pollution-caused haze, impacting the distant panoramic views of the horizon outside of the park boundary.</li> <li>• At White Sands National Monument, natural sounds dominate the acoustic environment. The amount of noise, as compared to natural sounds, is predicted to be just 1 decibel, which is a sound level hard for the average person to detect.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Park impacted by noise related to military activity, primarily sonic booms and low flying jet aircraft.</li> <li>• Visitors express interest to revisit for night sky/full moon experiences.</li> </ul>
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Dust storms impact viewshed experience and may become more frequent with ongoing climate change.</li> <li>• Military infrastructure/installations impact viewshed experience (especially at Alkali Flat).</li> <li>• New technologies in the oil and gas industry could result in a new extraction boom in shale formations in the Permian Basin to the east and thus increase visual intrusions, noise, and artificial light reaching the monument.</li> <li>• Increasing light pollution from surrounding communities within 100 miles, US Highway 70, and Holloman Air Force Base.</li> <li>• Military activity increasing, currently 90+ military tests occur a year (often one to two tests per week) that require monument closure.</li> <li>• Population centers of nearby communities of Alamogordo, Holloman Air Force Base, El Paso, and Las Cruces are expected to increase in the future; the increase may cause impacts on the park. There is ebb and flow in the population base due to changing military missions at three military installations.</li> <li>• New infrastructure/buildings (solar installations) on adjacent property could impact viewshed.</li> <li>• Regional power plants are believed to contribute to air quality impacts in the park. Significant emissions reductions are scheduled by 2017 for the protection of regional Class I areas, which will also improve air quality conditions at White Sands National Monument.</li> </ul>

Fundamental Resource or Value	Soundscapes and Viewscapes
<b>Threats and Opportunities</b>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Partner with military installations and local communities to work toward dark sky certifications.</li> <li>• Pursue New Mexico dark sky certification.</li> <li>• Engage with neighbors and city (planning) to understand future proposed projects and impacts on park.</li> <li>• Engage with regional strategic planning (economic and land use planning).</li> <li>• Population centers of nearby communities of Alamogordo, Holloman Air Force Base, El Paso, and Las Cruces are expected to increase in the future.</li> <li>• Continue to engage in other ongoing planning as cooperating agency for plans involving viewsheds and soundscapes related to the park.</li> <li>• Investigate ongoing opportunities through federal air quality programs (e.g., regional haze program), for the National Park Service to work cooperatively with other federal and state air quality agencies and local stakeholders to potentially reduce air quality impacts in parks from sources of air pollution.</li> </ul>
<b>Existing Data and Plans Related to the FRV</b>	<ul style="list-style-type: none"> <li>• Bureau of Land Management SunZia viewshed analysis.</li> <li>• Regional air quality monitoring including visibility, ozone, and deposition.</li> </ul>
<b>Data and/or GIS Needs</b>	<ul style="list-style-type: none"> <li>• Light monitoring (specific to White Sands National Monument).</li> <li>• Soundscape and sonic boom assessment (available within Air Force environmental assessment).</li> <li>• Air quality assessment.</li> <li>• Scenic resources inventory (viewshed analysis).</li> </ul>
<b>Planning Needs</b>	<ul style="list-style-type: none"> <li>• Viewshed management plan.</li> <li>• Cooperative agency management plan.</li> </ul>
<b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• The Clean Air Act (42 USC 7401 et seq.) gives federal land managers the responsibility for protecting air quality and related values, including visibility, plants, animals, soils, water quality, cultural resources, and public health, from adverse air pollution impacts</li> <li>• National Parks Air Tour Management Act of 2000</li> <li>• National Parks Overflight Act of 1987 (Public Law. 100-91)</li> <li>• "Audio disturbances" (36 CFR § 2.12)</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director's Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS Management Policies 2006 (§1.4) "Park Management"</li> <li>• NPS Management Policies 2006 (§1.6) "Cooperative Conservation Beyond Park Boundaries"</li> <li>• NPS Management Policies 2006 (§4.7) "Air Resource Management"</li> <li>• Director's Order 47: <i>Soundscape Preservation and Noise Management</i></li> <li>• NPS Management Policies 2006 (§4.9) "Soundscape Management"</li> <li>• NPS Management Policies 2006 (§4.10) "Lightscape Management"</li> <li>• NPS Management Policies 2006 (§5.3.1.7) "Cultural Soundscape Management"</li> <li>• NPS Management Policies 2006 (§8.4) "Overflights and Aviation Uses"</li> <li>• NPS Management Policies 2006 (§8.2.3) "Use of Motorized Equipment"</li> </ul>



Fundamental Resource or Value	Biological Richness and Diversity
Related Significance Statements	Significance statements 2, 3, and 4.
Current Conditions and Trends	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Rapid adaptation of biologic species has occurred in this young dunefield.</li> <li>• Due to the high water table, soils are fully saturated.</li> <li>• Some of the species are used as a monitor for climate change in the region.</li> <li>• The monument supports more than 48 endemic species (many are white colored).</li> <li>• Great heterogeneity.</li> <li>• The monument is home to more than 800 different animal species, many of them nocturnal. Included in this number are species from all groups of the animal kingdom: mammals, reptiles, amphibians, birds, fish, and insects.</li> <li>• Plants have adapted to flourish here, including many that have long been used by Native Americans for food, clothing, and medicines.</li> <li>• Data is limited on biological richness overall; there is not much data on how military activity may be impacting the biologic communities.</li> <li>• Past overgrazing has impacted biotic environments in and around the monument.</li> <li>• The natural quiet and solitude contributes to high-quality wildlife habitat and thus biological richness and diversity.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Continuing to discover new species within the monument.</li> <li>• Groundwater withdrawals and evapotranspiration are increasing.</li> <li>• Distribution patterns of kitfox may be changing over time; this could be attributed to litter and trash in the dunefield.</li> </ul>
Threats and Opportunities	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Timing and amount of precipitation is important to maintaining the diversity of wildlife, changes in these patterns could result in impacts on the biological diversity of White Sands National Monument.</li> <li>• Climate change could lead to fragmentation of the world’s largest gypsum, dunefield by altering the ground and surface water that sustain the entire system; climate change will probably reduce the soil moisture within the dunes, increase the rate of dune movement, thereby affecting the overall size of the dunefield and the diverse array of endemic flora and fauna.</li> <li>• The arid park ecosystems are particularly vulnerable to the nutrient enrichment effects of nitrogen deposition, currently a moderate concern based on NPS Air Resources Division benchmarks. Some invasive plant species thrive in areas with excess nitrogen deposition, displacing native vegetation adapted to low nitrogen conditions. Increases in nitrogen have been found to promote invasions of fast-growing nonnative annual grasses and forbs, including Russian thistle, at the expense of native species.</li> <li>• Ground-level ozone warrants moderate concern for vegetation health based on NPS Air Resources Division benchmarks. The park contains at least two ozone-sensitive plant species, including skunkbush sumac and Goodding’s willow.</li> </ul>



Fundamental Resource or Value	Biological Richness and Diversity
<p><b>Threats and Opportunities</b></p>	<p><b>Threats (continued)</b></p> <ul style="list-style-type: none"> <li>• Increased dust storms (resulting from changes to temperature and moisture within the dunes) could alter species distributions, both within the monument and the region.</li> <li>• A change in the precipitation regime and intensity could subsequently change or affect the current growing season in the monument; plants or animals may not be able to adapt fast enough to these changes.</li> <li>• Nonnative species (like oryx, saltcedar, or other plants) could impact environments where native species currently live.</li> <li>• Increase in salinity or soil contaminants, changes in land cover, and habitat contamination could impact native environments.</li> <li>• The continued increase in groundwater withdrawals could increase dune movement and threaten habitat availability.</li> <li>• Military impacts and associated debris from military operations can be found throughout the monument, the debris probably impacts biologic communities.</li> <li>• The full extent of impacts on biological richness and diversity from increased military activity is not fully known.</li> <li>• Energy development, such as water drawdowns, large powerlines, etc., could impact and interrupt migration patterns.</li> <li>• Increased soil erosion has been observed in response to overgrazing</li> <li>• Fiber optic installation and the installation of Range Road 7 continue to result in sheet wash, soil erosion, and loss of topsoil. New technologies in the oil and gas industry could result in a new extraction boom in shale formations in the Permian Basin to the east. Increases in oil and gas development near the park could become a concern by contributing to nitrogen deposition and ozone levels considered harmful to sensitive vegetation.</li> <li>• Potential loss of park specimens and associated field records due to lack of accountability (accessioning and cataloging).</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Increased collaboration opportunities with researchers to understand more about the biology and the impacts that might be imposed on them.</li> <li>• Encourage more local collaboration with universities, the military, and other partners to understand the nature of the resource and challenges presented at the monument.</li> <li>• Cuatrociénegas Flora and Fauna Protected Area and Guadalupe Mountains National Park – continued collaboration.</li> <li>• Investigate ongoing opportunities through federal air quality programs for the National Park Service to work cooperatively with other federal and state air quality agencies and local stakeholders to potentially reduce air quality impacts in parks from sources of air pollution.</li> </ul>
<p><b>Existing Data and Plans Related to the FRV</b></p>	<ul style="list-style-type: none"> <li>• “Landbird Monitoring in the Chihuahuan Desert Network: 2013 Annual Report.”</li> <li>• “Chihuahuan Desert National Parks Reptile and Amphibian Inventory” (2011).</li> <li>• “Development of Invasive Plant Species Monitoring Protocol for Park Units in the Chihuahuan Desert Network, National Park Service” (2009).</li> <li>• National Park Service – Soil Survey Geographic for White Sands National Monument, New Mexico – in progress.</li> <li>• Wetland plans and associated reports – Department of Defense (DoD).</li> <li>• Soils and vegetation studies (DoD).</li> <li>• Vegetation mapping (in progress).</li> <li>• Mesocarnivore study.</li> <li>• Microbial inventory.</li> <li>• Regional air quality monitoring including ozone, deposition, and visibility.</li> <li>• Other associated White Sands National Monument research publications.</li> <li>• See appendix C.</li> </ul>

Fundamental Resource or Value	Biological Richness and Diversity
<p><b>Data and/or GIS Needs</b></p>	<ul style="list-style-type: none"> <li>• Kit fox study – understanding if the food and trash is changing their behavior patterns, specifically related to foraging.</li> <li>• Military impacts on wildlife related to debris from missile crashes and activities.</li> <li>• Document and mapping of saltcedar in the basin and associated treatment.</li> <li>• Chihuahuan Desert Network monitoring (ongoing).</li> <li>• Military impact site study for natural, paleontological, and cultural resources.</li> <li>• Traditional ecological knowledge study.</li> <li>• Special studies to examine pollution dose-response relationships in sensitive park ecosystems. Assess impact of mercury and other toxics on biota in the park, including invertebrate insects and fish, and better understand the ecosystem characteristics that enhance mercury methylation at the park.</li> <li>• Inventory museum collections and catalog into the Interior Collections Management System.</li> </ul>
<p><b>Planning Needs</b></p>	<ul style="list-style-type: none"> <li>• Saltcedar mitigation plan (environmental assessment).</li> <li>• Integrated pest management plan.</li> <li>• Missile impact response plan (environmental assessment).</li> <li>• Research strategic plan.</li> <li>• Data management plan.</li> <li>• Collections management plan.</li> </ul>
<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance</b></p>	<p><b>Laws, Executive Orders, and Regulations That Apply to the FRV</b></p> <ul style="list-style-type: none"> <li>• National Invasive Species Act</li> <li>• National Environmental Policy Act of 1970; 42 USC 4321</li> <li>• Executive Order 13112, “Invasive Species”</li> <li>• Secretarial Order 3289, “Addressing the Impacts of Climate Change on America’s Water, Land, and Other Natural and Cultural Resources”</li> <li>• Endangered Species Act of 1973 (PL 95-632, 16 USC 1531 et seq.)</li> <li>• Federal Insecticide, Fungicide and Rodenticide Act (7 USC 136 et seq.)</li> <li>• Federal Noxious Weed Act of 1976 (7 USC 2801)</li> <li>• Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.)</li> <li>• Fish and Wildlife Conservation and Natural Resource Management Programs on Military Reservation (amends Public Law 86-797 [Sikes Act] [PL 96-561])</li> <li>• Migratory Bird Treaty Act (PL 65-186; 16 USC 703 et seq.)</li> <li>• Outdoor Recreation on Federal Lands (16 USC 4601{1} et seq.)</li> <li>• Plant Protection Act of 2000 (7 USC 7701 et seq.) (replaces Federal Noxious Weed Act of 1973 (PL 93-629))</li> <li>• Sikes Act (PL 105-85, as amended through 2004 including PL 108-136; 16 USC 670 et seq.)</li> <li>• Soil and Water Conservation Act (16 USC 2001)</li> <li>• Clean Air Act</li> <li>• Museum Property Act</li> <li>• Secretarial Order 3206, “American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act”</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director’s Orders)</b></p> <ul style="list-style-type: none"> <li>• Director’s Order 24: <i>NPS Museum Collections Management</i></li> <li>• NPS <i>Management Policies 2006</i> (§4.4.1) “General Principles for Managing Biological Resources”</li> <li>• NPS <i>Natural Resource Management Reference Manual 77</i></li> <li>• Director’s Order 12: <i>Conservation Planning, Environmental Impact Analysis, and Decision-making</i></li> </ul>



### Analysis of Other Important Resources and Values

Other Important Resource or Value	Cross-Boundary Management
<p><b>Current Conditions and Trends</b></p>	<p><b>Conditions</b></p> <ul style="list-style-type: none"> <li>• Issues related to the proximity of the missile range include exacerbated erosion, contaminated runoff, and unexploded ordnance.</li> <li>• Mandated cooperation with the Department of Defense (White Sands Missile Range and Holloman Air Force Base).</li> <li>• Park airspace is under military command and ownership.</li> <li>• US Highway 70, border patrol, Bureau of Land Management, and US Fish &amp; Wildlife are key partners.</li> <li>• Ongoing attempts to tap ground water within the Tularosa Basin for municipal and commercial uses.</li> <li>• Regional population increases have resulted in increased demand for water in the Tularosa Basin.</li> <li>• Visitors are not able to access all areas of the park due to periodic military operations. There were 90+ planned tests in fiscal year 2014 that affected the monument.</li> </ul> <p><b>Trends</b></p> <ul style="list-style-type: none"> <li>• Increased growth and economic development in Alamogordo.</li> <li>• Ebb and flow in the kinds and amounts of military operations influences a variety of park management factors.</li> </ul>
<p><b>Threats and Opportunities</b></p>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Increased water withdrawals in the future could jeopardize the dunefield and park resources.</li> <li>• Concern about military impacts (including “mishaps” or, accidents that may occur within monument boundaries).</li> <li>• Degradation of the viewshed, air quality, and soundscape.</li> <li>• Border patrol of checkpoints, US/Mexico border is within a 100-mile radius of the monument. Numerous checkpoints could influence large numbers of visitors.</li> </ul> <p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Participate in National Environmental Policy Act documents that are external to the National Park Service but have potential impacts on the monument.</li> <li>• Collaboration opportunities with key partners for public education: land, water, and climate change management/monitoring; integrated pest management; air quality and scenic views; data sharing, research and planning. Seek basinwide and watershedwide opportunities.</li> <li>• Data sharing and educating partners noted above about science and research potential.</li> <li>• Develop cross-boundary best management practices for water use, missile impacts and remediation, and search and rescue operations.</li> <li>• Work with the New Mexico state historic preservation officer to implement a Site Stewards program for monitoring of sites.</li> </ul>

Other Important Resource or Value	Cross-Boundary Management
<p><b>Existing Data and Plans Related to the OIRV</b></p>	<ul style="list-style-type: none"> <li>• Joint land use study.</li> <li>• Tularosa/Salt Basin regional water plan.</li> <li>• White Sands National Monument natural resources condition assessment.</li> <li>• White Sands Missile Range integrated natural and cultural resources management plan (2015).</li> <li>• Holloman Air Force Base integrated natural and cultural resources management plan (2011).</li> <li>• Holloman Air Force Base environmental restoration program management plan.</li> <li>• Holloman Air Force Base instruction 11-250.</li> </ul>
<p><b>Data and/or GIS Needs</b></p>	<ul style="list-style-type: none"> <li>• Sound monitoring of impacts on cultural resources (historic district, historic and prehistoric sites).</li> <li>• Impact study: determine impacts of missile debris on cultural and natural resources.</li> <li>• Comprehensive hydrological evaluation.</li> <li>• Regional air quality monitoring including ozone, deposition, and visibility.</li> </ul>
<p><b>Planning Needs</b></p>	<ul style="list-style-type: none"> <li>• Tularosa Basin regional aquifer management plan.</li> <li>• Cooperative agency management plan.</li> <li>• Interagency management plan for border patrol (beyond interagency agreement).</li> <li>• Water management plan.</li> <li>• Impact site response and rehabilitation plan / military mishap plan (environmental assessment) and human evacuation plan.</li> </ul>
<p><b>Laws, Executive Orders, and Regulations That Apply to the OIRV, and NPS Policy-level Guidance</b></p>	<p><b>Laws, Executive Orders, and Regulations That Apply to the OIRV</b></p> <ul style="list-style-type: none"> <li>• Clean Water Act</li> <li>• Clean Air Act</li> <li>• National Parks Air Tour Management Act of 2000</li> <li>• National Parks Overflight Act of 1987 (Public Law. 100-91)</li> <li>• "Audio disturbances" (36 CFR § 2.12)</li> </ul> <p><b>NPS Policy-level Guidance (NPS Management Policies 2006 and Director's Orders)</b></p> <ul style="list-style-type: none"> <li>• NPS Management Policies 2006 (§1.6) "Cooperative Conservation Beyond Park Boundaries"</li> <li>• NPS Management Policies 2006 (§4.1) "General Management Concepts"</li> <li>• NPS Management Policies 2006 (§4.1.4) "Partnerships"</li> <li>• NPS Management Policies 2006 (§5.1) "Research"</li> </ul>





## Identification of Key Issues and Associated Planning and Data Needs

This section considers key issues to be addressed in planning and management and therefore takes a broader view over the primary focus of part 1. A key issue focuses on a question that is important for a park. Key issues often raise questions regarding park purpose and significance and fundamental and other important resources and values. For example, a key issue may pertain to the potential for a fundamental and other important resource or value in a park to be detrimentally affected by discretionary management decisions. A key issue may also address crucial questions that are not directly related to purpose and significance, but which still affect them indirectly. Usually, a key issue is one that a future planning effort or data collection needs to address and requires a decision by NPS managers.

The following are key issues for White Sands National Monument and the associated high and medium priority planning and data needs. Additional planning and data needs can be found in the Planning and Data Needs section of this document.

- **Climate Change.** Similar to the effects on mountain glaciers, increases in temperatures as little as 1.5°C and changes to precipitation volumes and patterns could have drastic impacts on the dune system that White Sands National Monument protects. Temperature has shown a statistically significant increase at the White Sands weather station since 1939 and a substantial increase for White Sands National Monument as a whole since 1950. This trend is expected to continue with temperatures rising between 3°F and 9°F over the next 50–100 years. Additionally, mean annual temperature is projected to slightly decrease 1% and 4% decrease in precipitation over the next 50 to 100 years. Such changes will impact dune structure, preservation of archeological resources, and distribution of nonnative and invasive species, including current biotic life (moths). Changes may also increase the frequency of large dust events. Changes in climate could increase demands for water on the regional aquifer. Isolated wind events may accelerate dune movements beyond normal historic variations. These changes to the dune movements would result in more frequent road closures of the only public road into the heart of the dunes, visitor use access impacts, and reduced air quality due to wind storm events.
  - *Associated high and medium priority planning and data needs:* Climate change scenario planning, resources stewardship strategy, resource data management plan.
- **Visitor Use, Crowding, and Congestion.** White Sands National Monument experiences high visitation days during the early spring and summer months. Visitor use during these peak times often result in increased litter and trash left along the roadside and throughout portions of the park. Wind events cause this debris to move across the dunes and cause “trash plumes” in the dunefield. Additionally, improper disposal of human and domestic animal waste (left on the dunefield) can become problematic in this unique environment. Other visitor-related impacts on the monument may include looting of archeological sites, poaching, and carving into archeological features in the dunefield. Finally, access from US Highway 70 through the only the entrance into the monument was designed in the 1930s, and does not easily or safely accommodate the speed and size of 21st century vehicles. In addition, inadequate parking, traffic management, and other road related issues are of continuing concern with regards to safety and traffic flow.
  - *Associated high and medium priority planning and data needs:* Historic development concept plan/front entrance: US Highway 70 reconfiguration, visitor use and transportation study, state of the park report.

- **Inadequate Facilities and Infrastructure.** During road closures for military testing over the monument, the aging infrastructure and services at the visitor center within the historic district are often overwhelmed by a large influx of visitors seeking an opportunity to leave the roadway, use the restrooms, and simply walk around. While this is an opportunity to educate visitors that may not have directly planned on visiting the monument, existing facilities at the monument entrance lack the capacity to deal with the influx of visitors (especially during heavy visitation times and weekly military closures). The surges of use put added pressure on aging and outdated infrastructure, including plumbing, electrical, waste water, and other facilities and services. In addition, underground utilities are susceptible to corrosion and build-up of minerals deposited by the gypsic soils and are in need of upgrades. Furthermore, outdated roadway intersections and limited parking create potentially hazardous conditions for both visitors and resources. Lastly, the 67 miles of boundary fence, which protects the monument from invasive nonnative species like the oryx, must be regularly maintained due to the highly erosive quality of gypsic soils. When upgrades to outdated park facilities are undertaken in the future, the new designs should consider additional facilities for staff work and collections storage and sustainable maintenance of the historic adobe structures and supporting infrastructure.

  - *Associated high and medium priority planning and data needs:* Historic development concept plan/front entrance: US Highway 70 reconfiguration, parkwide inventory of archeological and paleontological resources, underground infrastructure assessment.
  
- **Hydrological Impacts.** As scientists continue to study the hydrology in and around White Sands National Monument, more is being understood about the dynamic relationship between the regional hydrology and the dune systems. The water in the Tularosa Basin does not adhere to political boundaries, and requires a holistic management approach. White Sands National Monument is located within two aquifers: the regional aquifer (which is larger, deeper, and saline) and a local aquifer under the monument (which is shallower and fresher than the regional aquifer). Water drawdowns from the regional aquifer could cause saline intrusions into the shallow aquifer or reduced volumes of the shallow aquifer. Additionally, increased evapotranspiration as well as energy development proposed near the monument could put additional demands on the water needs of the region and affect resources within the monument. In the future, it will be critical to support sustainable development both within and outside park boundaries to ensure the maintenance of adequate resources to maintain the dunefield and its associated resources.

  - *Associated high and medium priority planning and data needs:* Water management plan, comprehensive hydrological evaluation.
  
- **Strengthening Education Outreach and Programs.** As education is explicitly cited in the legislation as a part of the purpose of White Sands National Monument, it is important to ensure that the monument has adequate resources to provide educational programs and services for visitors. Currently, White Sands National Monument does not have a facility to host large class (50+) programs, which limits the monument's ability to serve local and regional school groups, as well as host larger events. White Sands National Monument has an opportunity to educate local residents about the purpose and potential threats to the monument, which would enable the monument to build constituencies and stronger partnerships with the local and state school systems—expanding valuable awareness among future generations of voters, scientists, and advocates. Due to pressing parkwide issues in other areas of park management, it has been challenging to allocate resources for educational programs.

  - *Associated high and medium priority planning and data needs:* Education plan.

- **Military Use and Impacts.** White Sands National Monument is surrounded on three sides by land owned and managed by the Department of Defense, which poses a unique and sometimes challenging management condition for park staff. The Department of Defense helps to protect a large section of the dunefield from boundary encroachment, contributes to research activities, and helps protect the viewshed from within the monument. However, frequent closures of Dune Drive due to missile testing events limit visitor access, while sonic booms and vibrations may cause impacts on the historic structures. Other impacts include those to soundscapes and night skies, which can affect the overall visitor experience. In addition, there is the potential of destruction of dunes or structures by downed missiles and aircraft, and release of hazardous materials, which may impact wildlife and groundwater. To date, there are 350 documented crash sites within the monument. Unexploded ordnance can pose a safety hazard to those visitors, staff and researchers who access backcountry areas of the park. Finally, notable staff time is required to support ongoing military operations which affect park operations, including monument closures, educating visitors about closures, relationship building, crash impact site restoration and commitment to environmental regulations associated with the missile range (roughly 1–2 full-time equivalent staff per year).
  - *Associated high and medium priority planning and data needs:* Impact site response and rehabilitation plan/military mishap plan (environmental assessment), human evacuation plan, vibration and noise event study, military impact site study for natural, paleontological, and cultural resources, state of the park report.
  
- **Protection and Monitoring of Resources.** White Sands National Monument is not currently able to monitor resources efficiently or effectively given the variety and demand of resource protection and regular data collection and monitoring needs that include but are not limited to monitoring water drawdowns, climate change, protecting paleontological resources, monitoring missile impacts, rehabilitating military impact areas, mitigating invasive species, and managing other resources. There are also needs for new monitoring programs that measure potential impacts on resources, such as the unknown effects of sonic booms on historic structures and hearth mound sites. To date, less than 10% of the monument has been inventoried for cultural resources, and less than 1% of the park area has been inventoried for paleontological resources.
  - *Associated high and medium priority planning and data needs:* Conservation/preservation plan for existing paleontological resources, integrative metaanalysis of dune dynamics, parkwide inventory of archeological and paleontological resources, resource data management plan, resources stewardship strategy, cultural resource management plan, structural integrity study/evaluation for historic resources, archeological erosion rates study.

## Planning and Data Needs

To maintain connection to the core elements of the foundation and the importance of these core foundation elements, the planning and data needs listed here are directly related to protecting fundamental resources and values, park significance, and park purpose, as well as addressing key issues. To successfully undertake a planning effort, information from sources such as inventories, studies, research activities, and analyses may be required to provide adequate knowledge of park resources and visitor information. Such information sources have been identified as data needs. Geospatial mapping tasks and products are included in data needs.

Items considered of the utmost importance were identified as high priority, and other items identified, but not rising to the level of high priority, were listed as either medium- or low-priority needs. These priorities inform park management efforts to secure funding and support for planning projects.

Planning Needs – Where A Decision-making Process Is Needed			
Related to an FRV, OIRV, and/ or Key Park Issue	Planning Needs	Priority (H, M, L)	Notes
FRV/Key Park Issue	Water management plan	H	The groundwater under the dunefield is critical to the protection of this resource. Changes to the groundwater regime could impact the health and viability of the dunes. The Cuatrociénegas Flora and Fauna Protected Area has already lost 85% of its protected dunefield due to water drawdowns in its watershed. While the data is already in place to support this plan, a water management plan would help communicate the role of regional water in maintaining the dunefield and would help inform other dune protection areas. This plan might also include strategic plans for water drawdowns.
OIRV/Key Park Issue	Impact site response and rehabilitation plan/military mishap plan (environmental assessment) – and human evacuation plan	H	Within the last 20 years, there have been 350 military mishaps within the monument, the most recent of which impacted access to Dunes Drive and landed only 2 miles from the monument’s visitor center. With continuing flyovers, this risk continues, and therefore additional guidance on how to deal with the immediate and long-term effects of these crashes would enable the park to more effectively and efficiently respond to these events. This plan would include both rapid assessment and long-term rehabilitation efforts for impact sites.
FRV/Key Park Issue	Conservation/ preservation plan for existing paleontological resources	H	White Sands National Monument contains the most extensive and densest Pleistocene trackways in the United States. Given the monument’s proximity to an active missile range corridor, these resources are under continual threat to damage or loss. These resources are composed of very soft gypsum soils and threatened by constant dune migration. This plan would outline a process for the timely and thorough evaluation and documentation of these trackways as they are uncovered from passing dunes and exposed lake shores.
FRV/Key Park Issue	Historic development concept plan/ front entrance: US Highway 70 reconfiguration	H	The current alignment and design of the monument entrance is outdated and inadequate. The current parking, traffic, flow, and infrastructure capacity do not meet the current needs of monument visitors. Most pressing is the entrance intersection alignment which does not match with traffic speeds along US 40 and current vehicle sizes. This intersection has been the site of multiple highway fatalities. Parking capacity and the historic district in general is often overwhelmed during large events and missile closures. This plan would address transportation issues, and other visitor use management issues for the main entrance and the monument’s historic district.
Key Park Issue	Resource stewardship strategy	H	Would provides an interdisciplinary resource condition assessment including desired cultural and natural resource conditions as part of a comprehensive strategic plan for achieving and maintaining resource protection.
Key Park Issue	State of the park report	H	



Planning Needs – Where A Decision-making Process Is Needed			
Related to an FRV, OIRV, and/or Key Park Issue	Planning Needs	Priority (H, M, L)	Notes
FRV	Resource data management plan	M	The monument is of great scientific interest to many fields of study. As lots of data comes into the park, storing and tracking all of this data has become cumbersome for the monument. This plan would define a strategy for collecting, storing, and disseminating data for research and interpretation (as well as informing public policy). This plan would also include strategies for appropriate storage, maintenance, and cataloging of all data collected (including collections, photos, field notes, blueprints, GIS, historical documents, and other research-related documentation).
FRV/Key Park Issue	Climate change scenario planning	M	Scenario-based planning that considers the full range of potential climate futures. NPS Climate Change Response Program would work with White Sands National Monument and research partners to prepare the initial documentation, then apply models to park and analyze results.
FRV	Management strategy and collection protocol for paleontological resources	M	
Key Park Issue	Education plan	M	Critical need given current demand for services from schools and organizations; part of Call to Action.
FRV	Saltcedar mitigation plan (environmental assessment)	M	Saltcedar is an invasive plant to the Tularosa Basin and more than 300 acres of White Sands National Monument has saltcedar trees. Each acre of saltcedar trees can uptake nearly 200 gallons of water per day, which in high densities (like those seen at White Sands National Monument) can have profound impacts on the structure and movement of the surrounding dunes. This plan would analyze and define management actions for identifying, removing, and monitoring site in the monument impacted by saltcedar.
Key Park Issue/FRV	Cultural resource management plan	M	The plan would address how to protect and manage the park's cultural resources. The plan would identify other potential cultural landscape reports, such as, ranching, Paleo-Indians, shorelines, and military. It would include an updated cultural resource landscape inventory.
FRV	Update to cultural landscape inventory for historic district	M	Report would help inform future development concept plans and would help to maintain the historic landscape.
FRV	Research strategic plan	L	This plan would tier from the metaanalysis and would provide strategic guidance for research efforts within White Sands National Monument. This plan would help set strategic goals and objectives for the scientific research programs within the monument.
FRV	Backcountry management plan	L	This plan would enable the monument to more proactively manage backcountry use and resources. This plan would outline a strategy for identifying where and when to relocate campsites on a cyclical basis. This plan would also consider the appropriate use of horses in backcountry areas, the potential for commercial use authorization, and implementation and education of leave no trace principles.

Planning Needs – Where A Decision-making Process Is Needed			
Related to an FRV, OIRV, and/ or Key Park Issue	Planning Needs	Priority (H, M, L)	Notes
FRV/Key Park Issue	Collections management plan	L	The plan would address how to protect and manage the park’s museum collections. This includes museum housekeeping. It would identify and catalog collections from park lands and associated field records, focusing on nonfederal repositories. This plan could also update the Scope of Collections Statement to include collection of voucher specimens to document biodiversity and climate change and establish repository agreements for long-term collection storage at nonfederal repositories.
FRV	Tularosa Basin aquifer management plan	L	Tularosa Basin currently has a watershed management plan, but it is dated and does not include the shallow aquifer under the monument as a part of the water resources in that system. An updated plan is needed that considers contemporary issues as well as the monument’s shallower, smaller aquifer within this larger system. Recent science has shown that these aquifers are connected. The monument would participate/consult on this plan, but would not lead/author.
FRV	Viewshed management plan	L	There are near 360-degree views from many places within the monument that are unobstructed. This viewshed management plan would help to ensure the continued protection of these viewsheds.
FRV	Cooperative agency management plan	L	This plan would outline the communication and cooperation strategy for those agencies managing lands within the Tularosa Basin. This effort would include cooperative agencies such as White Sands Missile Range, Holloman Air Force Base, US Forest Service, US Border Patrol, and others.
FRV	Integrated pest management plan	L	One plan to manage nonnative plants and animals with the monument. At this time the main concerns are saltcedar, African rue, Malta star thistle, and oryx.
FRV	Hearth mound cultural landscape inventory and national register nomination	L	
FRV	Partnership strategy	L	
FRV	Special park uses and commercial services plan	L	
FRV	Commercial filming and photography strategy	L	
FRV	Environmental management plan	L	This plan would address solid waste management throughout the park.

<b>Data Needs – Where Information Is Needed Before Decisions Can Be Made</b>			
<b>Related to an FRV, OIRV and/ or Key Park Issue?</b>	<b>Data and GIS Needs</b>	<b>Priority (H, M, L)</b>	<b>Notes, Including Which Planning Need This Data Need Relates To</b>
Key Park Issue	Visitor use and transportation study	H	The current transportation and visitor services infrastructure is not serving current visitation patterns near the park entrance and in the historic district. This situation is often exacerbated during the busy season and during monument and/or road closures associated with missile testing. This study would look at the transportation system, visitor services, and visitor experiences at the entrance and monument historic district. Outcomes of this study would discuss the feasibility for improvements to visitor and transportation patterns and inform the redesign of the monument entrance.
Key Park Issue	Parkwide inventory of archeological and paleontological resources	H	The monument currently protects the only known gypsum hearth sites in the world and the largest Cenozoic trackway recorded. Documenting these and other critical resources is critical to informing science and will provide for better interpretation of these resources. This study would provide full documentation of the archeological and paleontological resources for the monument. Priority area for this study is under the fly zone and missile impact zone, where these resources are most at risk.
Key Park Issue	Integrative metaanalysis of dune dynamics	H	The monument's dune system is of great scientific interest. While there have been a number of studies that have looked at individual elements of the dune system in the past, this study would develop a more comprehensive understanding of the overall dune system through metaanalysis of existing research including hydrology, vegetation, soil moisture, historical climate data, and climate projections. This study will help inform water rights, regional policy, interpretation, climate change adaptation, and education opportunities.
Key Park Issue	Underground infrastructure assessment	H	The underground infrastructure and associated utilities in the monument serve not only the National Park Service, but also neighboring agencies (Border Patrol and Holloman Air Force Base). This aging infrastructure is cause for concern for NPS operations, concessioner operations, as well as public health and safety. An awareness of eolian processes and the saline groundwater system is necessary for developing sustainable infrastructure in areas of gypsum sand. This study would provide a comprehensive assessment of all the underground infrastructure and associated utilities within White Sands National Monument. This study would include information on status, condition, and recommended upgrades.
FRV	Traditional ecological knowledge study	H	This study would provide an opportunity to learn more about traditional ecological knowledge associated with some of the monument's unique archeological sites, and could be integrated along with other information gained through Western science.

<b>Data Needs – Where Information Is Needed Before Decisions Can Be Made</b>			
<b>Related to an FRV, OIRV and/ or Key Park Issue?</b>	<b>Data and GIS Needs</b>	<b>Priority (H, M, L)</b>	<b>Notes, Including Which Planning Need This Data Need Relates To</b>
Key Park Issue	Vibration and noise event study	M	Vibrations and noise events associated with military operations over the monument as well as other sources may be causing impacts on cultural resources within the monument (including historic properties, adobe structures, and hearth mounds). This study would investigate the existing extent of damage (crack analysis) and evaluate the risk profile of these resources. Potential mitigation and protection strategies would also be included.
FRV/Key Park Issue	Structural integrity study/evaluation for historic resources	M	Much of the monument’s historic district is made up of adobe structures that require intentional and highly-specific strategies to maintain. This study would evaluate the current structural integrity of the historic resources (specifically adobe integrity) and recommend strategies for improving or maintaining these structures.
Key Park Issue	Archeological erosion rates study	M	This study would investigate the erosional rates on archeological sites to aid researchers in understanding how to best protect or document these resources.
Key Park Issue	Comprehensive hydrological evaluation	M	This study would evaluate the relationships between surface water duration/depth, crystal production/formation, and the extent of fill (persistence) for Lake Lucero, Alkali Flat and the associated wetlands. This data would inform and enable the park to integrate data with statewide and basinwide data sets to ensure that White Sands National Monument data is considered and incorporated into regional water planning initiatives.
FRV	Access to multispectral imagery	M	Multispectral imagery (through Mike Story, Natural Resource Stewardship and Science, Inventory & Monitoring Division) to help identify potential archeological and paleontological sites.
FRV/Key Park Issue	Military impact site study for natural, paleontological, and cultural resources	M	This study would investigate the extent of impacts on resources within military impact sites (including density mapping of these sites) and inform response and mitigation plans for impacts on resources.
Key Park Issue	Weather station data	L	Additional weather station data needed for micro environments within the dunefield to monitor changes over time. This would help inform larger studies related to hydrology, ground water, and other dune related resources.
Key Park Issue	Historic structures report (condition assessments)	L	Historic American Building Survey report for the historic district condition assessments are out of date, schedule for condition assessments needs to be established and implemented (historic structure report for the district is in progress, still needed for each building). Will follow the stability report, provide recommendations, include info on maintenance.
Key Park Issue	Cultural resource management report	L	A new cultural resource management report is needed that incorporated the hundreds of new archeological sites, the effects of climate change, missile impacts, and army operations.



<b>Data Needs – Where Information Is Needed Before Decisions Can Be Made</b>			
<b>Related to an FRV, OIRV and/ or Key Park Issue?</b>	<b>Data and GIS Needs</b>	<b>Priority (H, M, L)</b>	<b>Notes, Including Which Planning Need This Data Need Relates To</b>
FRV	Air quality study	L	Vistas at White Sands National Monument are sometimes obscured by pollution-caused haze. Currently, visibility condition at the park is a moderate concern. In addition to being a concern to the health of park staff and visitors, long-term exposures to ozone can cause injury to ozone-sensitive plants. Also, nitrogen deposition can increase the risk of nonnative invasive plants.
FRV	Light monitoring study	L	Available light monitoring data is not specific to the monument. Light monitoring data specific to the monument is needed to inform many planning and education initiatives.
FRV	Teacher needs assessment	L	Needed to inform comprehensive interpretive plan (finalized by the end of 2015).
FRV	Kit fox study	L	Study would help to understand if the food and trash in the dunes is changing behavior patterns, specifically related to foraging.
FRV	Document and mapping of saltcedar in basin	L	Study would inform the extent to which saltcedar is present in the monument as well as document the effectiveness of current treatments.
FRV	Rapid paleontological resource surveys	L	These surveys would prioritize future field survey locations.
FRV	Thorough paleontological field surveys	L	These surveys would follow the “rapid” paleontological resource surveys noted above and would include more thorough paleontological field surveys at targeted sites.
FRV	Inventory museum collections and catalog into the Interior Collections Management System	L	Conduct research to locate specimens from park lands and associated field records in nonfederal repositories. Catalog into the Interior Collections Management System all specimens (if existing) and associated field records resulting from studies and resource protection efforts.

The following additional data needs were generated during the workshop, but are considered lower priority or follow-up efforts to those data needs listed in the preceding table.

- Museum collection fire and security survey
- Parkwide LiDAR imagery and/or other high quality aerial imagery
- Cultural resource landscapes assessments
- Ethnographic overview and assessment
- Sound monitoring of impacts on cultural resources (historic district, historic and prehistoric sites)
- Impacts on wildlife movement patterns
- Long-term monitoring and cumulative impacts study of impacts on resources
- Scenic resources inventory (viewshed analysis)
- Analysis of search and rescue past reports
- Wetland restoration services and impact analysis
- GIS of groundwater modeling and mapping (3D models)

## Part 3: Contributors

### White Sands National Monument

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David Bustos, Chief of Research  
Jan Carpenter, Administrative Assistant  
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### Photo and Art Credits

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# Appendixes

## Appendix A: Enabling Legislation and Legislative Acts for White Sands National Monument

### Summary

#### Authorization:

- Proclamation No. 2025, January 18, 1933 (47 Stat. 2551) established White Sands National Monument.

#### Acquisition Authority:

- Act of June 6, 1942 (P.L. 77-539, 56 Stat. 327), authorized the addition to the national monument of lands acquired for the White Sands Recreational Demonstration Project Area.
- Presidential Proclamation No. 3024, June 24, 1953 (67 Stat. c53), withdrew certain public domain lands under the jurisdiction of the Department of the Army and directed that such lands be administered by the National Park Service as a part of White Sands National Monument.
- Act of November 10, 1978 (P.L. 95-625, 92 Stat. 3475), authorized acquisition by donation, purchase with donated or appropriated funds, exchange, or transfer from any other federal agency.

#### Boundary Revisions:

- Proclamation No. 2108, November 28, 1934 (49 Stat. 3426), authorized addition to the national monument of the area described.
- Proclamation No. 2295, August 29, 1938 (53 Stat. 2465), excluded from the boundary certain sections of the US Highway 70 right-of-way.
- Act of June 6, 1942, authorized the addition to the national monument of lands acquired for the White Sands Recreational Demonstration Project Area.
- Act of November 10, 1978, authorized the addition of approximately 320 acres and the deletion of approximately 1,157 acres.

PROCLAMATIONS, 1933.

2551

WHITE SANDS NATIONAL MONUMENT—NEW MEXICO

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

January 18, 1933.

A PROCLAMATION

WHEREAS it appears that the public interest would be promoted by including the lands hereinafter described within a national monument for the preservation of the white sands and additional features of scenic, scientific, and educational interest;

White Sands National Monument, N. Mex. Preamble.

NOW, THEREFORE, I, HERBERT HOOVER, President of the United States of America, by virtue of the power in me vested by sec. 2 of the act of Congress entitled "AN ACT For the preservation of American antiquities," approved June 8, 1906 (34 Stat. 225), do proclaim and establish the White Sands National Monument and that, subject to all valid existing rights, the following-described lands in New Mexico be, and the same are hereby, included within the said national monument:

National monument established.

Vol. 34, p. 225. U. S. C., p. 416.

Description.

NEW MEXICO PRINCIPAL MERIDIAN

- Tps. 17 S., Rs. 5, 6, and 7 E., all.
- T. 17 S., R. 8 E., secs. 6, 7, and 18.
- Tps. 18 S., Rs. 5 and 6 E., all.
- T. 18 S., R. 7 E., secs. 2 to 11, secs. 15 to 21, and secs. 29 and 30, inclusive;
  - sec. 1, exclusive of Federal Aid Project 176 right of way;
  - sec. 12, NE.  $\frac{1}{4}$  and N.  $\frac{1}{2}$  SE.  $\frac{1}{4}$  (both exclusive of Federal Aid Project 176 right of way), fractional W.  $\frac{1}{2}$  north and west of Federal Aid Project 176 right of way;
  - sec. 13, fractional NW.  $\frac{1}{4}$  north and west of Federal Aid Project 176 right of way;
  - sec. 14, fractional E.  $\frac{1}{2}$  north and west of Federal Aid Project 176 right of way, and W.  $\frac{1}{2}$ , exclusive of Federal Aid Project 176 right of way;
  - sec. 22, NW.  $\frac{1}{4}$ , N.  $\frac{1}{2}$  SW.  $\frac{1}{4}$ , SW.  $\frac{1}{4}$  SW.  $\frac{1}{4}$  and NE.  $\frac{1}{4}$  exclusive of Federal Aid Project 176 right of way;
  - sec. 23, NW.  $\frac{1}{4}$  exclusive of Federal Aid Project 176 right of way;
  - sec. 28, NE.  $\frac{1}{4}$  NE.  $\frac{1}{4}$ , W.  $\frac{1}{2}$  NE.  $\frac{1}{4}$ , NW.  $\frac{1}{4}$ .
- T. 19 S., R. 5 E., secs. 1 to 5 and secs. 9 to 12, inclusive;
  - sec. 13, N.  $\frac{1}{2}$ ;
  - sec. 14, N.  $\frac{1}{2}$ ;
  - sec. 15, N.  $\frac{1}{2}$ .
- T. 19 S., R. 6 E., secs. 2 to 8, inclusive;
  - sec. 1, N.  $\frac{1}{2}$ .

Warning is hereby expressly given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

Warning against unauthorized acts.

The Director of the National Park Service, under the direction of the Secretary of the Interior, shall have the supervision, management, and control of this monument as provided in the act of Congress entitled "AN ACT To establish a National Park Service, and for other purposes," approved August 25, 1916 (39 Stat. 535-536), and acts additional thereto or amendatory thereof.

Supervision.

Vol. 39, p. 535. U. S. C., p. 389.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this 18<sup>th</sup> day of January, in the year of our Lord nineteen hundred and thirty-three, and of [SEAL] the Independence of the United States of America the one hundred and fifty-seventh.

HERBERT HOOVER

By the President:  
HENRY L STIMSON  
*Secretary of State.*

[No. 2025]



## Appendix B: Inventory of Special Mandates, Administrative Commitments, and Other Relevant Policies and Regulations

### Special Mandates

*Public Law 104-201, 110 Stat. 2422 (1996)*

- “§2684. Cooperative agreements for management of cultural resources  
“(a) AUTHORITY. – The Secretary of Defense or the Secretary of a military department may enter into a cooperative agreement with a State or local government or other entity for the preservation, management, maintenance, and improvement of cultural resources on military installations and for the conduct of research regarding the cultural resources. Activities under the cooperative agreement shall be subject to the availability of funds to carry out the cooperative agreement.”

*From the Statement for Management (1987)*

- Public Land Order 833 of May 21, 1952, withdrew lands from absolute control of the National Park Service for military use by the Department of the Army and proposed developments and use by the National Park Service are limited until military needs are concluded.
- Legislative and Administrative Requirements



## Administrative Commitments

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Memorandums of Understanding</b>			
Agreement No. 09-01 memorandum of understanding between White Sands National Monument and the Otero County Sheriff's Department	To establish the terms and conditions under which the parties will provide mutual law enforcement assistance in and near White Sands National Monument. Updated version of Agreement No. 09-01.	January 7, 2015	White Sands National Monument / the Otero County Sheriff's Department
Agreement No. 03-01 memorandum of understanding between White Sands National Monument and the Otero County Sheriff's Department	To establish the terms and conditions under which the parties will provide mutual law enforcement assistance in and near White Sands National Monument.	February 26, 2009	White Sands National Monument / the Otero County Sheriff's Department
Memorandum of understanding between Retired and Senior Volunteer Program and White Sands National Monument	To establish the terms and conditions under which the Retired Senior Volunteer Program or the Volunteer Station will provide assistance to White Sands National Monument.	1994	Retired and Senior Volunteer Program / and White Sands National Monument
Memorandum of understanding between the United States Department of Interior, Guadalupe Mountains National Park, Carlsbad Caverns National Park, White Sands National Monument, and the Lincoln National Forest	To establish the terms and conditions under which efforts and exchanges of law enforcement personnel can provide increased protection for the public and of the natural and cultural resources on federal lands and promote the cost-effectiveness of the law enforcement programs administered by these agencies.	1997 – indefinite	United States Department of Interior, Guadalupe Mountains National Park, Carlsbad Caverns National Park, White Sands National Monument, and Lincoln National Forest

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Memorandums of Agreement</b>			
2009 revised Alamogordo interagency dispatch center annual operating plan	To document the agreement and commitment of fire suppression protection assistance and cooperation and to provide initial attack and expanded attack services for all areas of the units located in the Pecos Zone, as well as support to all risk incidents when requested. It provides a broad strategic planning guidance for Alamogordo interagency dispatch center; with more specific, technical guidance and procedures identified in the standard operating procedures manual of the Alamogordo Interagency Dispatch Center.	Five years from the signature date	Bureau of Indian Affairs, Bureau of Land Management, Las Cruces District Office, City of Alamogordo, Department of Defense, Holloman Air Force Base, Fort Bliss, McGregor Range, Mescalero Apache Tribe, National Park Service, Natural Resources Conservation Service, Alamogordo Field Office, New Mexico Department of Agriculture, New Mexico Department of Transportation, New Mexico Environmental Department, New Mexico Game & Fish, New Mexico State Land Office, New Mexico State University Cooperative to Extension Service, Otero County, Otero Soil Water Conservation District, South Central Mountain RC&D, US Department of Homeland Security, US Forest Service, US Fish and Wildlife Service, Village of Cloudcroft, Village the Tularosa
Emergency relocation of Chamizal National Monument information technology resources between the Chamizal National Monument and White Sands National Monument	To govern the relationship between Chamizal National Monument and White Sands National Monument, to provide support in the areas of space, telecommunications, and administrative support to the individuals with responsibility for essential activities and functions, including designated managerial and technical staff, in the absence of a common management authority.	Start 2013; may be renewed every year	White Sands National Monument/Chamizal National Monument
No. 7810-0001 Fire-fighting assistance relationship between: White Sands National Monument and Alamo West Fire and Rescue	To provide personal services and equipment required for prevention/ suppression of structural, vehicle, and wildfires, the protection of life and property from these fires, emergency medical services, search and rescue operations, and hazardous material incidents within White Sands National Monument. The park will respond in kind, within limits, to requests from nearby fire prevention agencies.	November 2009	White Sands National Monument and Alamo West Fire and Rescue

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Memorandums of Agreement</b>			
No. 7810-2011-0001 Fire-fighting assistance relationship between: White Sands National Monument and Alamo West Fire and Rescue	To provide personal services and equipment required for prevention/ suppression of structural, vehicle, and wildfires, the protection of life and property from these fires, emergency medical services, search and rescue operations, and hazardous material incidents within White Sands National Monument. The park will respond in kind, within limits, to requests from nearby fire prevention agencies.	January 7, 2016	White Sands National Monument and Alamo West Fire and Rescue
2008 Servicewide programmatic agreement	The National Park Service will continue to preserve and foster appreciation of the cultural resources in its custody through appropriate programs of protection, research, treatment, and interpretation.	None provided	National Park Service, Department of the Interior, Advisory Council on Historical Preservation, and the National Conference of State Historic Preservation Officers
Memorandum of agreement regarding compliance with section 106 National Historic Preservation Act for the oryx removal project between the New Mexico State Historic Preservation Division and White Sands National Monument	White Sands National Monument, in consultation with the New Mexico State Historic Preservation Division has determined that its oryx removal project may have an effect on properties listed in or eligible for inclusion in the National Register of Historic Places. Therefore they agree that the oryx removal project will be administered and implemented in accordance with stipulations to satisfy section 106 responsibilities by White Sands National Monument.	March 1, 2007	New Mexico State Historic Preservation Division and White Sands National Monument
<b>General Agreements</b>			
The National Park Service, New Mexico State Police, and Otero County Sheriff exercise concurrent law enforcement jurisdiction within the monument	Law enforcement rangers can enforce federal codes, as well as state codes in the absence of an applicable federal code. The New Mexico State Police and the Otero County Sheriff's Department can also exercise jurisdiction within the monument.	Continual	National Park Service, State of New Mexico State Police, and the Otero County Sheriff's Department
<b>Special Park Uses</b>			
Otero County Electric Cooperative, Inc. ROW#: RW780-02-001 (right-of-way)	Right of way to construct, operate, and maintain an underground electricity transmission cable within the boundaries of White Sands National Monument		



Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Special Park Uses</b>			
Special use permits	Commercial Film/Photography	Fiscal year 2013	29
	Other (including weddings, events, workshops, 1st amendment, military MWR events, recreational uses, non-commercial photography)	Fiscal year 2013	66
Commercial use authorizations	Monument currently has no commercial use authorization		
<b>Interagency Agreements</b>			
Interagency agreement between the National Park Service and the United States Border Patrol			National Park Service / US Border Patrol
Interagency Agreement No. 1443IA125098004 White Sands National Monument and White Sands Missile Range IA: #F1274100002 between National Park Service and US Army White Sands Missile Range IA Reimbursable Agreement: #P11AX10002	There is a mutual recognition of the respective missions of both agencies, and the mutual desire to continue the cooperative environment which has existed for nearly 50 years.  The National Park Service has determined that the limited activity proposed under this agreement will not unduly interfere with the purpose for which White Sands National Monument was established.  The Department of Army has determined that the limited activity proposed under this agreement will not unduly interfere with the purpose of which White Sands Missile Range was established.	Every five years it will be reviewed, modified, and renewed as needed. October 1, 2016	National Park Service / White Sands Missile Range / Department of the Army
Interagency Agreement No.1443-IA-7810-97-01/ DACA47-9-84-32 between the National Park Service and US Army Corps of Engineers	The purpose of this agreement is to revise the original agreement to include additional service protection requirements and incorporate the new interagency agreement for management and authorizing Holloman Air Force Base to use, maintain, improve, relocate, and repair a waterline, electric power transmission line, and roadway, all lying within the track FP, line 8, a strip of land 6001.25 feet in length and 50 feet in width. The location of the installation of the lands known as Dog Canyon track outside the boundaries of White Sands National Monument and this agreement is further expected to continue and increase the already substantial cooperation enjoyed between the National Park Service and Holloman Air Force Base.	December 11, 2001	National Park Service and Army Corps of Engineers

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Interagency Agreements</b>			
Interagency Agreement No. FI274100002 between White Sands National Monument National Park Service and US Army White Sands Missile Range	WSMR is granted permission to conduct technical tests over a portion of the land area of WHSA, in connection with the experimental and testing phases of national space and weapons (missile/materiel) development programs.	July 27, 2011 – September 30, 2016	National Park Service and US Army (Department of Defense)
<b>Cooperative Agreements</b>			
§2684 Cooperative agreements for management of cultural resources	“(a) AUTHORITY. – The Secretary of Defense or the Secretary of a military department may enter into a cooperative agreement with a state or local government or other entity for the preservation, management, maintenance, and improvement of cultural resources on military installations and for the conduct of research regarding the cultural resources. Activities under the cooperative agreement shall be subject to the availability of funds to carry out the cooperative agreement.”	None provided	Secretary of Defense or Secretary of a military department
Cooperative use agreement, White Sands Missile Range this master special use	The agreement restrains the National Park Service from development and use by visitors in that part of the monument termed the Zone of Cooperative Use. Agreement is supplemented by a memorandum of understanding which is updated yearly.	Yearly	National Park Service / White Sands Missile Range
CA# 7029-4-0023 Wildlife management and control project for White Sands National Monument	The purpose of this agreement is to allow for a cooperative relationship for the construction of a wildlife fence and for the removal of nonnative oryx from the monument.	1996–1999	National Park Service / New Mexico State Game and Fish
Otero County cooperative weed management area	To formalize the cooperative relationship necessary for the effective management of noxious weeds. All signatories agreed to be participants of Otero County cooperative weed management area. The purpose is to inventory, manage, prevent, and eradicate whenever possible plants designated as noxious weeds pursuant New Mexico noxious weed management act. The program’s intent is to manage noxious weeds with consensus of the responsible land management parties. Additionally, the workgroup will increase general awareness of noxious weeds issues within Otero County.	None provided	Bureau of Indian Affairs, City of Alamogordo, Bureau of Land Management, Department of Defense, Holloman Air Force Base, Fort Bliss, McGregor Range, Natural Resources Conservation Service, New Mexico Department of Agriculture, New Mexico Department of Transportation, New Mexico Environment Department, New Mexico State Land Office, Otero County, Otero County Soil Water Conservation District, US Forest Service, US Fish and Wildlife Service, Village of Cloudcroft, Village the Tularosa

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Cooperative Agreements</b>			
Protection and maintenance of white sands pupfish between US Army, US Air Force, National Park Service, US Fish and Wildlife Service, New Mexico Department of Game and Fish	The cooperative agreement delineates an effective and cooperative working relationship between its signatories and protecting and maintaining viable population of the white sands pupfish in the habitats on White Sands Missile Range, Holloman Air Force Base, and White Sands National Monument.	Five years from signature date of 2006	US Army, US Air Force, National Park Service, US Fish and Wildlife Service, New Mexico Department of Game and Fish
Joint declaration of sister park partnerships	The purpose of the sister park program between the participants is to work as partners in national parks and natural protected areas with similar resources of mutual interest and a common set of management issues, for the purpose of furthering the cause of natural and cultural resource conservation.	None provided	National Park Service / National Commission for Natural Protected Areas of the Secretariat of the Environment and Natural Resources of the United Mexican States
<b>Task Agreements</b>			
J781000026_NMSUDS43 Phase I: the ecology and conservation of mesocarnivores at White Sands National Monument	The main focus of this research is to gain valuable information on the distribution, density, and ecological role of the carnivore community inhabiting White Sands National Monument.	December 26, 2014	New Mexico State University / National Park Service
Phase 3.3: the ecology and conservation of mesocarnivores at White Sands National Monument	The main focus of this research is to gain insight into the distribution, density, and ecological role of the carnivore community inhabiting White Sands National Monument.	December 26, 2014	New Mexico State University / National Park Service
J7810090024 Phase I: hydrologic investigation	Collection, compilation, and preliminary interpretation of basic data (water levels, water chemistry, vadoze-zone properties) should facilitate better understanding and characterization of the shallow groundwater system beneath the dunefield.	December 15, 2013	New Mexico Tech / National Park Service
P13AC00970_Phase II: hydrologic modeling at White Sands National Monument	The primary objectives of this study is to 1) Identify recharge sources that contribute to the shallow aquifer in the gypsum sand dunes, and 2) Assess interactions between the shallow aquifer and the larger regional groundwater system.	September 1, 2015	New Mexico Tech / National Park Service

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Cooperative Agreements</b>			
P13AC01015_Shared hydrologic investigation of sister parks	A hydrologic investigation at Cuatrociénegas will provide important information about the shallow groundwater system with in the gypsum dunefield, This study will dovetail and complement current research on the hydrogeology at White Sands, furthering our understanding of threats and management priorities. For water resources. Both parks have listed a shared water study as the highest priority.		White Sands National Monument / Cuatrociénegas Flora and Fauna Protected Area
<b>Intergovernmental Agreements</b>			
1977, The White Sands master special use agreement	The National Park Service grants the US Army the right to conduct technical test over the monument with some excluded areas	Reviewed annually	National Park Service / US Army
1952, May 21: By Public Land Order 833, park lands were withdrawn from absolute control of the NPS for military use by the Department of the Army	Proposed developments and use by the National Park Service are then limited until military needs are concluded.	None	National Park Service / Department of the Army
1963, December 23: A 10-year co-use agreement dated with current extensions of this permit	Granted by the Department of the Interior to the Department of the Army, allowing continuing use of the western portion of the monument (74,849 acres) by the White Sands Missile Range.	Every 10 years	National Park Service / White Sands Missile Range
Support agreement FB 4801 – 09225 – 0018 P13PG00140	White Sands National Monument received support services from Holloman Air Force Base under a memorandum of agreement. Specifically, these services include refuse removal, recycling, fire protection, and utilities: water service bio-environmental engineering report: annual consumer confidence report. These services are handled through a reimbursable service agreement and are centrally built on a SF 1080.	This agreement was signed September 30, 2008 and can be extended every two years; renewed in 2012 expired; 2013	National Park Service / Holloman Air Force Base
Supplemental agreement No. 3 Permit USAF-ACC-KWRD-4-98-001 US Department of Interior, National Park Service Wildlife Fence, Holloman Air Force Base, NM	For the purpose of constructing and maintaining a wildlife fence.	May 26, 2018	National Park Service / Holloman Air Force Base
Support agreement FB 4801 – 06121 – 0003	Provide water service through White Sands National Monument for the US Border Patrol checkpoint facility	None provided	Holloman Air Force Base/ United States Border Patrol



Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Interpark Agreements</b>			
Safety zone 11 SNM agreement	Shared professional safety officer agreement – draft	None	White Sands National Monument, Carlsbad Caverns National Park, Guadalupe Mountains National Park, Chamizal National Memorial, Gila Cliff Dwellings National Monument
Wildland fire management	Fire management operations		White Sands National Monument, Carlsbad Caverns National Park, Guadalupe Mountains National Park, Gila Cliff Dwellings National Monument
Shared services agreement between Chamizal National Monument and White Sands National Monument	Chamizal National Monument to provide administrative oversight to White Sands National Monument regarding budget and finance and support for human resources management and information technology to assure accuracy necessary to justify, formulate and execute financial accounts, personnel management, and information management.	2008 effective; currently expired though information technology is still shared	Chamizal National Monument and White Sands National Monument
Facility Management Software System (FMSS) HUB 11 Agreement	The purpose of this FMSS support park agreement letter is to ensure the implementation of effective business practices and processes in the hub area with special regards to (1) using the additional funding for the intended purposes of FMSS support, and (2) monitoring and tracking the FMSS support through the use of work orders and other accounting systems. Host Parks: Carlsbad Caverns National Park and Big Bend National Park.		Big Bend National Park, Carlsbad Caverns National Park, Chamizal National Memorial, Fort Davis National Historic Site, Gila Cliff Dwellings National Monument, Guadalupe Mountains National Park, White Sands National Monument
<b>Resource Education</b>			
White Sands Institute	Series of field seminars taught at White Sands National Monument and offered through New Mexico State University, a community education program; seminars open to the public, and taught by subject matter experts.	None	New Mexico State University – Alamogordo and White Sands National Monument
<b>Cooperating Association</b>			
Cooperative Agreement Western National Parks Association (WNPA)	The Cooperating Association works with the National Park Service to provide visitors with valuable interpretive and educational materials to facilitate an expanded appreciation of the NPS and White Sands National Monument. WNPA operates a bookstore within the visitor center.		Western National Parks Association and National Park Service

Title / Agency / Organization	Purpose / Description	Timeframe	Responsible Party/ies
<b>Commercial Services</b>			
<p>Concession Contract CC-WHSA001-05 White Sands Trading, LLC</p>	<p>The concession contract provides for <i>required</i> and <i>authorized</i> visitor services within assigned areas of the park. Required services include:</p> <ul style="list-style-type: none"> <li>• <u>Food and Beverage</u>: limited prepackaged grab and go food and beverages.</li> <li>• <u>Retail</u>: gift shop that offers Native American handicrafts, packaged regional food, and souvenirs.</li> </ul> <p>Authorized services permitted under the contract include: fountain dispensed beverages, vended beverage service, and an ATM machine.</p> <p>The existing concessioner provides year-round operations. The concession facility is located in a portion of the monument’s visitor center complex. Approximately 2,882 square feet assigned to concessioner.</p> <p>The existing contract requires that the concessioner pay twelve and a quarter percent (12.25%) of gross receipts in franchise fees.</p> <p>The original contract term was September 12, 2005 through December 31, 2013. The National Park Service authorized a short-term (one year) extension to avoid interruption of visitor services, effective January 1, 2014. A prospectus soliciting proposals for a new 10-year contract was issued 5/30/2014.</p>	<p>December 31, 2014</p>	<p>White Sands Trading, LLC and National Park Service</p>
<p>Concession Contract CC-WHSA001-15 White Sands Trading, LLC</p>	<p>Same as above</p>	<p>January 1, 2015 – December 31, 2024</p>	<p>White Sands Trading, LLC and National Park Service</p>



## Other Relevant Policies and Regulations

### Holloman Air Force Base Directives

- HAFB (Holloman AFB). 2005. Holloman Air Force Base Environmental Restoration Program Management Plan.
- HAFB. 2008. Holloman Air Force Base General Plan. Holloman Air Force Base, New Mexico.
- HAFB. 2010. Holloman AFB Integrated Cultural Resources Management Plan (ICRMP). Holloman Air Force Base, New Mexico.
- HAFB. 2011a, July. Final Environmental Assessment Recapitalization of the 49th WG Combat Capabilities and Capacities, Holloman AFB, New Mexico.
- HAFB. 2011b, August. Categorical Exclusion/Record of Environmental Consideration for QF-16 Developmental Test/Operational Test (DT/OT) Beddown at Holloman AFB/White Sands Missile Range.
- HAFB. 2011c, February. Final Integrated Natural Resources Management Plan (INRMP). Holloman Air Force Base, New Mexico.
- HAFB. 2013. Hazardous Waste Management Plan. Holloman Air Force Base, New Mexico.
- Harris, C.M. 1979. Handbook of Noise Control. McGraw-Hill Book Company: New York, New York.
- USAF (U.S. Air Force). 2008. Infrastructure Energy Strategic Plan. Office of the Air Force Civil Engineer. Washington, D.C.
- USAF. 2009, February 9. Disposition Responsibilities for QF-4 Air Force Full Scale Aerial Target Systems.
- USAF. 2012, July. F-35.

### White Sands Missile Range Directive

- WSMR (White Sands Missile Range). 2009a, November. Final Environmental Impact Statement for Development and Implementation of Range-Wide Mission and Major Capabilities at White Sands Missile Range, New Mexico.
- Defense Appropriations Act of 1991 - Legacy Program

### Determinations of Eligibility for Inclusion in the National Register of Historic Places (36 CFR Part 63)

- National Defense Authorization Act for Fiscal Year 2003 (PL 107-314)
- National Defense Authorization Act for Fiscal Year 2004 (PL 108-136)
- Installation Management Command Pamphlet 385-90-1, *Wildlife Aircraft Strike Hazard Template*
- Army Directive 2014-02, *Net Zero Installations Policy*

### Department of Defense (DoD) Directives/Instructions

- DoD Instruction 1100.21, *Voluntary Services in the Department of Defense*
- DoD Directive 3200.11, *Major Range and Test Facility Base*
- DoD Directive 4150.07, *DoD Pest Management Program*
- DoD Directive 4700.4, *Natural Resources Management Program*
- DoD Instruction 4710.02, *DoD Interactions with Federally-Recognized Tribes*

## Department of Defense (DoD) Directives/Instructions (continued)

- DoD Directive 4710.1, *Archaeological and Historic Resources Management*
- DoD Instruction 4715.03, *Natural Resources Conservation Program*
- DoD Manual 4715.03, *Integrated Natural Resources Management Plan Implementation Manual*
- DoD Instruction 4715.1, *Environmental Security*
- DoD Directive 4715.1E, *Environment, Safety, and Occupational Health*
- DoD Instruction 4715.9, *Environmental Planning and Analysis*
- DoD Instruction 4715.16, *Cultural Resources Management*
- DoD Instruction 5000.13, *Natural Resources*
- DoD Regulation 5400.7-R, *DoD Freedom of Information Act Program*
- DoD Instruction 5525.17, *Conservation Law Enforcement Program*
- DoD Directive 6050.1, *Environmental Effects in the United States of DoD Actions*
- DoD Directive 6050.2, *Use of Off-Road Vehicles on DoD Lands*
- DoD Directive 6055.6-M, *Department of Defense Fire and Emergency Services Certification Program*, October 10, 2000
- Department of Defense, *American Indian and Alaska Native Policy*
- DoD Financial Management Regulation Volume 11A, Chapter 16, *Accounting for Production and Sale of Forest Products*, August 2002.

## US Department of the Army

- AR 15-13, *Military Construction, Army (MCA) Disposal of Structures*
- AR 190-31, *Crime Prevention Program, Department of the Army*
- AR 200-1, *Environmental Protection and Enhancement*
- AR 200-2, *Environmental Analysis of Army Actions*, 32 CFR Part 651
- AR 210-20, *Master Planning for Army Installations*
- AR 210-190, *Post Cemeteries*
- AR 215-1, *Morale, Welfare, and Recreation Activities and Nonappropriated Fund Instrumentalities*
- AR 350-19, *The Army Sustainable Range Program*
- AR 405-10, *Acquisition of Real Property and Interests Therein*
- AR 405-80, *Granting Use of Real Estate*
- AR 405-90, *Disposal of Real Estate*
- AR 415-15, *Military Construction, Army (MCA) Program Development*
- AR 415-35, *Minor Construction*
- AR 420-10, *Facilities Engineering: General Provisions, Organizations Functions and Personnel*
- AR 420-17, *Real Property and Resource Management*
- AR 420-22, *Preventative Maintenance and Self-Help*
- AR 870-20, *Historical Properties and Museums*



## Appendix C: Past and Ongoing Park Planning and Data Collection Efforts

Title	Date
Predicted surface water methylmercury concentrations in National Park Service Inventory and Monitoring Program Parks	2015
"Landbird Monitoring in the Chihuahuan Desert Network"	2014
White Sands National Monument: Cultural History of the Tularosa Basin	2014
Superintendent's Compendium of designations, closures, permit requirements and other restrictions, imposed under discretionary authority. Holloman Air Force Base, NM	2014
White Sands National Monument visitor study	2013
Impacts of visitor spending on the local economy: White Sands National Monument	2013
"Landbird Monitoring Protocol and Standard Operating Procedures for the Chihuahuan Desert, Northern Great Plains, Sonoran Desert, and Southern Plains Networks: Version 1.00"	2013
"Weather and Climate Inventory National Park Service Chihuahuan Desert Network"	2012
"LiDAR Surveys of Gypsum Dune Fields in White Sands National Monument, New Mexico"	2012
"White Sands National Monument: Geologic Resources Inventory Report"	2012
"Landbird Monitoring in the Chihuahuan Desert Network"	2012
Air Quality Conditions & Trends by NPS Units: White Sands National Monument, 2012 End Year	2012
"Hydrologic Investigation at White Sands National Monument: 2010 Annual Report"	2011
"Landbird Monitoring in the Chihuahuan Desert Network: Annual Report, 2010"	2011
"Evaluation of the Sensitivity of Inventory and Monitoring National Parks to Nutrient Enrichment Effects from Atmospheric Nitrogen Deposition: Chihuahuan Desert Network"	2011
"Joint Research on the Endemism of White Sands National Monument of Cuatrosiénegas Protected Area: Arthropods. Annual Progress Report 2010. Albuquerque, NM"	2011
"Evaluation of the Sensitivity of Inventory and Monitoring National Parks to Acidification Effects from Atmospheric Sulfur and Nitrogen Deposition: Chihuahuan Desert Network"	2011
"Evaluation of the Sensitivity of Inventory and Monitoring National Parks to Acidification Effects from Atmospheric Sulfur and Nitrogen Deposition: Main Report"	2011
New visitor center restroom construction environmental assessment	2011
"Chihuahuan Desert National Parks Reptile and Amphibian Inventory"	2011
"Chihuahuan Desert Network: Vital Signs Monitoring Plan"	2010
A map of saltcedar distribution on White Sands National Monument	2010

Title	Date
Preliminary prehistoric hearth maps for White Sands National Monument	2010
"Historical Perspectives of Surface Water and Groundwater Resources in the Chihuahuan Desert Network, National Park Service"	2009
"Management Strategy for White Sands National Monument"	2009
"Garton Lake and Well: White Sands National Monument"	2009
"Physical Resources Foundation Report: White Sands National Monument"	2009
"Intermountain Region New Deal Resources Research Findings for White Sands National Monument"	2008
"Paleontological Resource Inventory and Monitoring, Chihuahuan Desert Network"	2007
"Big Dune Nature Trail and Parking Area Relocation Environmental Assessment: White Sands National Monument"	2007
"Weather and Climate Inventory National Park Service Chihuahuan Desert Network"	2007
"Seasonal Inventory of Birds in Low Elevation Riparian Habitats at Chihuahuan Desert Network Parks: 2007 Final Report"	2007
Ozone risk assessment for Vital Signs Monitoring Networks, Appalachian National Scenic Trail, and Natchez Trace National Scenic Trail. NPS/NRPC/ARD/NRTR—2007/001	2007
"The Road Inventory of White Sands National Monument WHSA-7810. Cycle 3"	2006
Cooperative agreement for protection and management of White Sands pupfish between US Army – White Sands Missile Range, US Air Force – Holloman Air Force Base, National Park Service – White Sands National Monument, US Fish and Wildlife Service, New Mexico Department of Game and Fish	2006
"Chihuahuan Desert Network Water Resource Information and Assessment Report Phase II"	2006
Laboratory of anthropology investigation record: North Lucero Ranch	2005
"Coordinated Implementation Plan for Bird Conservation in Western New Mexico"	2005
"National Park Service – Cultural Landscapes Inventory: White Sands National Monument Historic District"	2005
Ozone risk assessment for Chihuahuan Desert Network	2004
"Herpetofauna of White Sands National Monument: Review of Species List"	2003
"National Park Service – Cultural Landscapes Inventory: White Sands National Monument Historic District"	2002
"White Sands National Monument – Mammals"	2002
"Full Study Plan for Vertebrate and Vascular Plant Inventory of the Chihuahuan Desert Network"	2001
"Annual Performance Report for White Sands National Monument, New Mexico"	2000
"Level I Water-Quality Inventory, White Sands National Monument, New Mexico"	2000
White Sands National Monument: GPRA strategic plan	1997

Title	Date
"Baseline Water Quality Data Inventory and Analysis White Sands National Monument"	1997
"Dunes and Dreams: A History of White Sands National Monument. Administrative History"	1995
"Resource Management Plan for White Sands National Monument"	1994
"Visitor Services Project: White Sands National Monument"	1991
National Register of Historic Places Inventory – Nomination Form: White Sands National Monument Historic District	1988
"Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program"	1988
"Statement for Management: White Sands National Monument"	1987
"Resources Management Plan and Environmental Assessment for White Sands National Monument"	1986
"National Historic Landmarks Program: White Sands V-2 Launching Site"	1985
"Preliminary Draft Resources Management Plan and Environmental Assessment for White Sands National Monument. Approved for Implementation"	1982
"Hydrologic Evaluation of Garton Lake: White Sands National Monument"	1980
Transportation Study for the White Sands National Monument: Final Report	1978
Final master plan: White Sands National Monument	1976
"Natural Resources Management Plan for White Sands National Monument"	1974
"Wilderness Recommendation: White Sands National Monument, New Mexico"	1972



## Appendix D: Selected References

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- 2014 “Hydrologic Investigation at White Sands National Monument.” New Mexico Bureau of Geology and Mineral Resources. Open-file Report 559.





## Appendix E: List of American Indian Tribes and Pueblos Traditionally Associated with White Sands National Monument

Traditionally associated tribes and pueblos refer to those groups that have had a significant connection to a place that has endured for two generations or more. This list of traditionally associated tribes and pueblos was generated and is maintained by the NPS Intermountain Region Office of American Indian Affairs.

- Piro-Manso-Tiwa Indian Tribe of the Pueblo of San Juan de Guadalupe
- Cheyenne and Arapaho Tribes, Oklahoma
- Pueblo of Cochiti, New Mexico
- Comanche Nation, Oklahoma
- Fort Sill Apache Tribe of Oklahoma
- Hopi Tribe of Arizona
- Kiowa Indian Tribe of Oklahoma
- Mescalero Apache Tribe of the Mescalero Reservation, New Mexico
- Navajo Nation, Arizona, New Mexico and Utah
- Pueblo of Picuris, New Mexico
- Pueblo of Acoma, New Mexico
- Pueblo of Isleta, New Mexico
- Pueblo of Pojoaque, New Mexico
- San Carlos Apache Tribe of the San Carlos Reservation, Arizona
- White Mountain Apache Tribe of the Fort Apache Reservation, Arizona
- Ysleta Del Sur Pueblo of Texas





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## Intermountain Region Foundation Document Recommendation White Sands National Monument

December 2015

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This Foundation Document has been prepared as a collaborative effort between park and regional staff and is recommended for approval by the Intermountain Regional Director.

*Marie Sauter*

*December 2, 2015*

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RECOMMENDED

Marie Sauter, Superintendent, White Sands National Monument

Date

*Sue E. Masica*

*1/22/16*

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APPROVED

Sue E. Masica, Regional Director, Intermountain Region

Date



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

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