National Aeronautics and Space Administration

Supplemental Environmental Assessment for NASA Renewable Energy Project at Johnson Space Center, White Sands Test Facility, New Mexico

October 2017

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Location:	White Sands Test Facility is located in Doña Ana County in New Mexico.
Lead Agency:	National Aeronautics and Space Administration (NASA) Johnson Space Center White Sands Test Facility
Proposed Action:	NASA proposes adding a test bed for energy storage to help provide sustainable renewable electricity to the site.
For Further Information:	Timothy J. Davis NASA Environmental Scientist NASA Johnson Space Center White Sands Test Facility 575.524.5024 Fax: 575.524.5798 Email: timothy.j.davis@nasa.gov
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Executive Summary

Knowing the peak and average demand of a power system is critical to proper planning. The power system must be designed to serve the peak load, which is usually the busiest part of the day when the majority of the workforce is present. The National Aeronautics and Space Administration (NASA) Johnson Space Center White Sands Test Facility (WSTF) has previously reviewed the purpose and need for a proposed solar array to help provide electricity to the site. Recently the site has decided to add the potential for energy storage. NASA intends to take an active role in converting WSTF from the present conventional power source usage to renewable energy sources. The Energy Policy Act of 2005 and Executive Order (EO) 13693 require federal facilities to adhere to a schedule of compliance for the use of renewable sources of energy.

This supplemental Environmental Assessment (EA) describes the additional proposed actions for the solar array at WSTF. Two reasonable alternatives are considered: 1) testing methods of energy storage to find the best solution for WSTF, implementing, and installing the selected energy storage solution, and 2) a "no action" alternative.

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List of Acronyms

°C	Degree(s) Celsius
°F	Degree(s) Fahrenheit
ac	Acre(s)
B.C.	Before Christ
BISON-M	Biota Information System of New Mexico
BOS	Balance-of-system
CES	cryogenic energy storage
CFR	Code of Federal Regulations
cm	Centimeter
dB(A)	Decibel(s)
dc	Direct current
DOT	U.S. Department of Transportation
EA	Environmental assessment
EC	Electrochemical capacitors
EIA	Energy Information Administration
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPEC	El Paso Electric Company
FESS	Flywheel energy storage systems
ft	Foot/feet
GHG	Greenhouse Gas
JSC	Johnson Space Center
km	kilometer(s)
kph	Kilometer(s) per hour
kV	Kilovolt
LAES	Liquid Air Energy Storage
m	Meter(s)
mi	Mile(s)
mph	Mile(s) per hour
MW	Megawatt
NaS	Sodium Sulfur
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
PHES	Pumped Heat Electrical Storage
R3E	Range 3 East
T21S	Township 21 South
TES	Threatened, endangered, and sensitive
U.S.C.	United States Code
USCB	U.S. Census Bureau
WSTF	NASA Johnson Space Center White Sands Test Facility

1.0 Purpose and Need for the Proposed Action

This supplemental environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code [U.S.C.] §§ 4321-4370d), and according to the Procedures of Implementation of NEPA for National Aeronautics and Space Administration (NASA) (Title 14, Code of Federal Regulations [CFR], part 1216 subparts 1216.1 and 1216.3, 2012). The EA describes the purpose and need for energy storage at a solar array at NASA Lyndon B. Johnson Space Center White Sands Test Facility (WSTF). Two reasonable alternatives are considered: 1) testing methods of energy storage to find the best solution for WSTF, implementing, and installing the selected energy storage solution, and 2) a "no action" alternative.

1.1 Background

There are guidelines and orders that federal agencies must follow. President Obama signed Executive Order (EO) 13693, "Planning for Federal Sustainability in the Next Decade," on March 19, 2015. This EO expanded the need for energy reduction and environmental performance requirements for federal agencies. The EO included guidance for reducing energy costs and finding alternative energy solutions.

The Energy Policy Act of 2005 set forth goals for federal facilities to start using renewable and sustainable sources of energy. The act established an energy research and development program covering: 1) energy efficiency; 2) renewable energy; 3) oil and gas; 4) coal; 5) Tribal energy; 6) nuclear matters and security; 7) vehicles and motor fuels, including ethanol; 8) hydrogen; 9) electricity; 10) energy tax incentives; 11) hydropower and geothermal energy; and 12) climate change technology.

Title I, Section 204 of the act sets forth procedural guidelines under which the Administrator of General Services is authorized to establish a photovoltaic energy commercialization program for the procurement and installation of photovoltaic solar electric systems for electric production in new and existing public buildings. Title IX allows federal agencies to acquire cost-effective technologies for new construction and retrofitting, and to improve the energy efficiency and environmental performance of buildings, using a whole-buildings approach, including onsite renewable energy generation. It also allows the use of advanced technologies to improve the energy efficiency, environmental performance, and process efficiency of energy-intensive and waste-intensive industries. Subtitle C, Section 931 directs the United States Secretary of State to conduct programs of renewable energy research, development, demonstration, and commercial application, including: 1) solar energy and photovoltaics; 2) wind energy; 3) geothermal energy; 4) hydropower; 5) ocean and wave energy; and 6) the combined use of renewable energy technologies and other energy technologies.

1.2 Purpose and Need

Knowing the peak and average demand of a power system is critical to proper planning. The power system must be designed to serve the peak load, which is usually the busiest part of the day when the majority of the workforce is present. The current WSTF power system demand is approximately 1 – 1.5 megawatt (MW) of energy continuously and reaches daytime peaks of energy use nearing 2.5 to 2.9 MW. It is estimated the WSTF need for energy could grow by 1.0 MW by the end of the decade, as additions to the facility (such as restoration treatment hardware, new test facilities, and new operations) are brought online.

NASA intends to take an active role in converting WSTF from the present use of conventional power sources to renewable energy sources. An initial solar array producing approximately 1.6 MW has been approved and construction will start in the summer of 2017. At this time, the agreement with El Paso Electric Company does not allow NASA to send unused energy into the regional grid. The initial solar array project did not consider options for energy storage. Energy storage is simply a way to contain useful energy for use at a later time.

1.3 Description of Proposed Action

The designed solar energy array will be located in the 600 Area, west of Building 650 in Township 21 South (T21S), Range 3 East (R3E), Section 5. This area (excluding private land, cultural resources, existing roads, existing utilities, and well pads) is equivalent to approximately 500 ac (acre; 2.02 km^2) with an estimated total capacity of up to 100 MW of installed power. The goal of the solar array will be to use the renewable energy to provide energy for the operation of activities at WSTF, such as the groundwater treatment system and general facility operations.

The installation of the initial 1.6 MW solar array is scheduled for the summer of 2017. The energy storage test area would be installed on site either next to the solar array or closer to existing electrical facilities (Figure 1.1). The energy storage test area would be installed after the construction of the initial 1.6 MW solar array is completed. The proposed action of this supplemental EA would set up test areas to determine which of the following energy storage options works best for WSTF, implement, and install the best option. Many different types of energy storage would be evaluated before selecting the one(s) that work best for WSTF. Depending on the type of energy storage being evaluated, a new or existing building could be used to house and protect the energy storage test area. Not all types of test storage need a protective structure or enclosure.

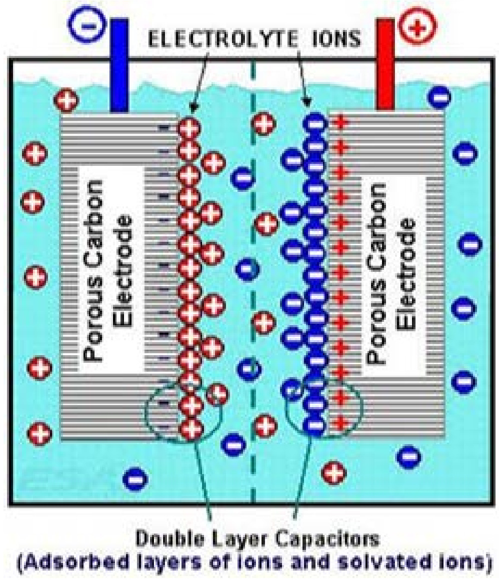
1.3.1 Batteries

Recent advances in battery technology can provide long-term energy storage and reliability. Batteries continue to increase their efficiency while the overall cost of the batteries continues to drop. The wide range of batteries also provides different options.

1.3.1.1 Electrochemical Capacitors

Electrochemical capacitors (ECs) are sometimes referred to as electric double-layer capacitors. The double-layer describes the way the batteries are built. There are two types of ECs, symmetric and asymmetric, which can be used for different applications. The use of ECs on an electrical grid are relatively new, but they can provide reliable energy storage and they have low life cycle costs (ESA, n.d.-a). Symmetric ECs can move energy in a short amount of time, where asymmetrical ECs work slowly, over a longer time period, providing a great option for charging at night to use the energy during the day. NASA would evaluate both symmetrical and asymmetrical ECs.

Figure 1.2 Double Layer Capacitors

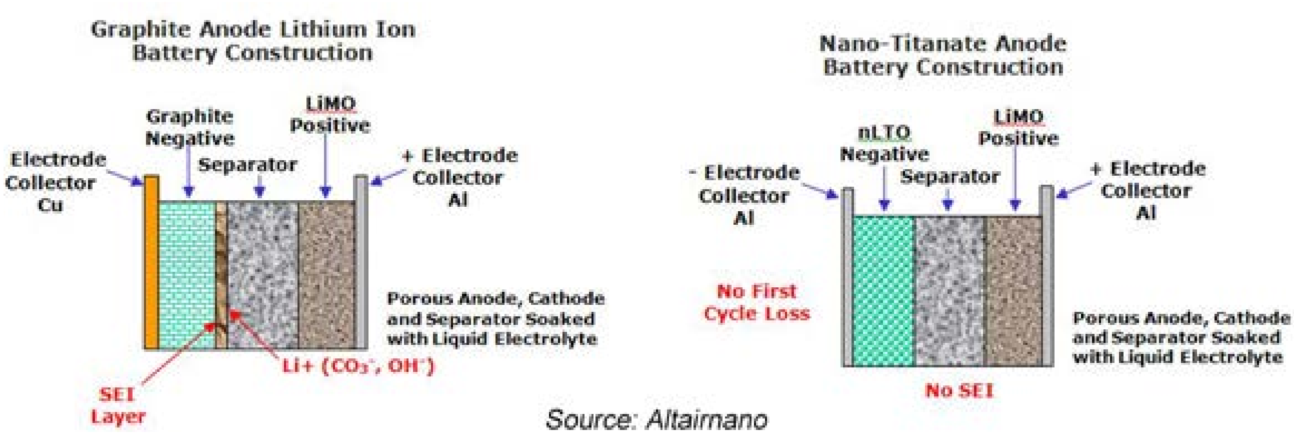


(Source: energystorage.org April 2017)

1.3.1.2 Lithium Ion Batteries

The lithium ion battery has been in existence for almost 30 years. They are used in several different daily applications from personal electronic devices to cars. The flexibility of this battery makes it suitable for solar array energy storage. It is currently used for energy storage on residential and commercial photovoltaic systems. This technology is attractive because of lower costs and the batteries can be configured in several different ways in order to provide energy storage. A safe system design would be important when considering using lithium ion batteries.

Figure 1.3 Lithium Ion Battery Construction



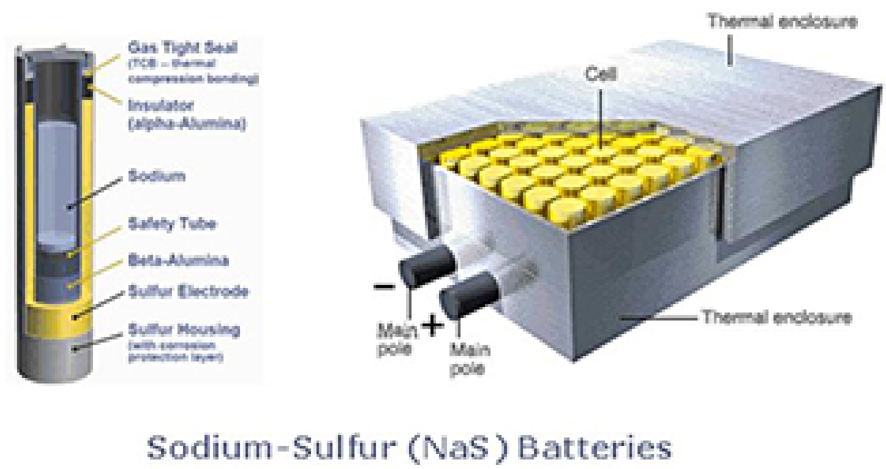
1.3.1.3 Nickel-Cadmium Batteries

Nickel-Cadmium batteries have been around since the early 1900s and are what people think of when they buy rechargeable batteries for their household devices. The flexibility of these batteries makes them an attractive choice. These batteries have been used in commercial energy storage.

1.3.1.4 Sodium Sulfur (NaS) Batteries

Ford Motor Company originally developed the sodium sulfur (NaS) battery and sold the technology to the Japanese company NGK. NaS systems operate at high temperatures, 572 to 662 degrees Fahrenheit (°F) (300 to 350 degrees Celsius [°C]), which can be an issue if the batteries are only used occasionally and not on a continuous basis. The batteries are very efficient, which is why U.S. utilities have started using the technology for backup power and peak shaving (ESA, n.d.-a).

Figure 1.4 **Sodium Sulfur Battery Construction**



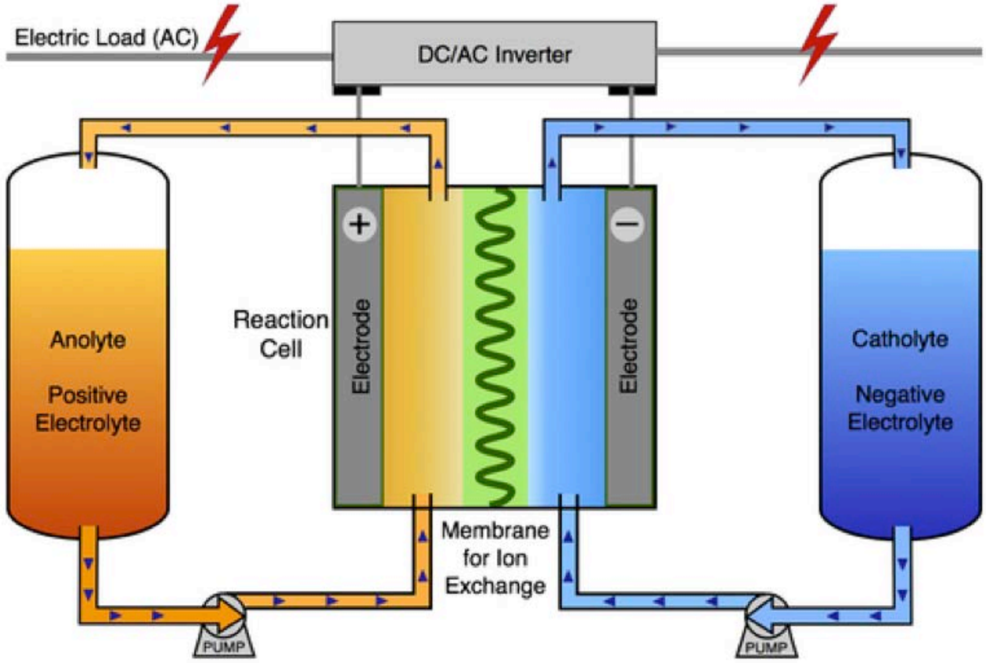
(Source: energystorage.org April 2017)

1.3.1.5 Flow Batteries

A flow battery is a type of rechargeable battery that combines technology similar to fuel cells and regular batteries. Flow batteries take liquid energy sources and use them to create electricity, and flow batteries can be recharged within the same system. The biggest advantage for using flow batteries is the system is able to recharge itself almost instantly. Studying and using this type of battery for energy storage at a solar array is fairly new.

There are several different types of flow batteries that would be considered for testing to use at WSTF's solar array: redox, iron-chromium, vanadium redox, and zinc-bromine.

Figure 1.5 Flow Battery Construction

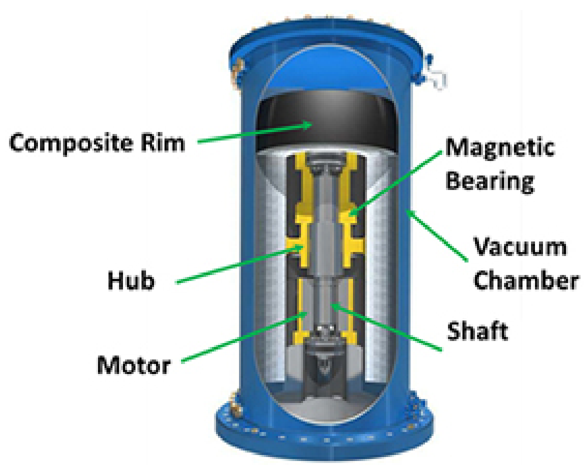


(Source: Professor Werner Antweiler, University of British Columbia, 2017)

1.3.2 Flywheel Energy Storage Systems (FESS)

Flywheel energy storage systems (FESS) take energy and store it the form of kinetic energy. Kinetic energy is defined as energy due to an object moving. Most FESS use a rotor to create the kinetic energy. FESS are low maintenance and have a long life. Flywheels can bridge the gap between short-term power and long-term energy storage and are currently used in aerospace and telecommunications applications (ESA, n.d.-a).

Figure 1.6 Flywheel Construction

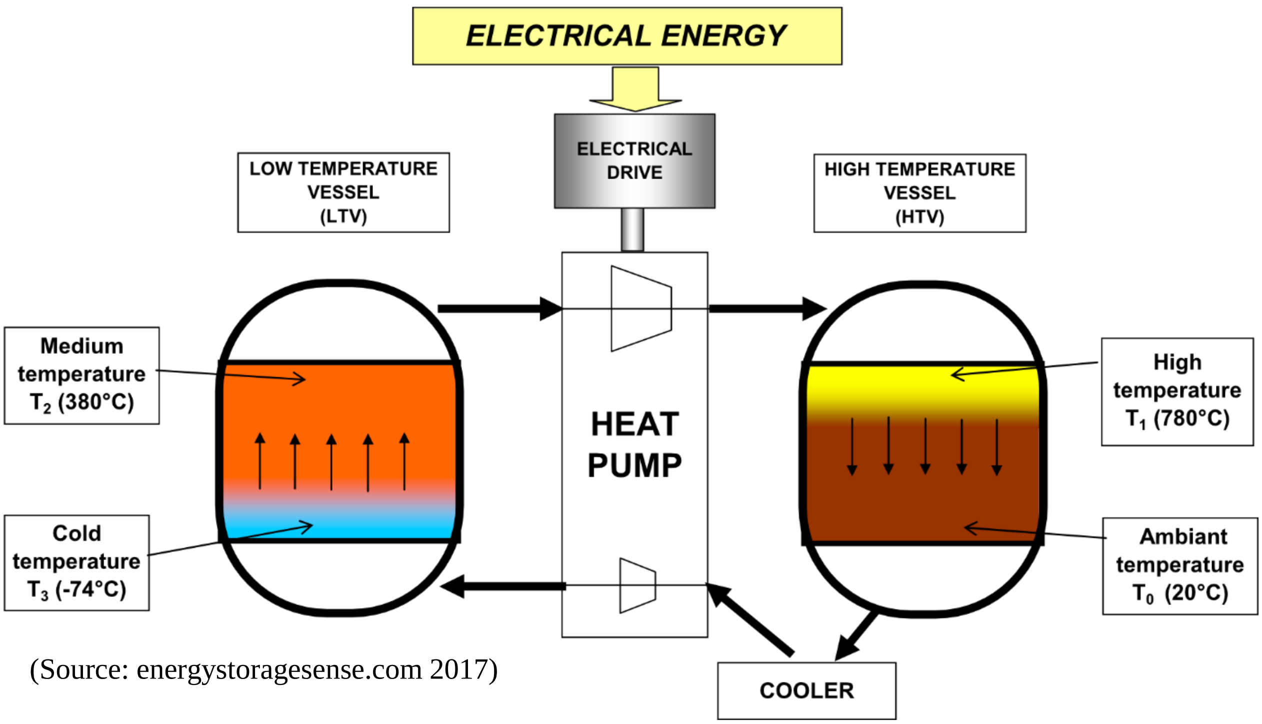


Source: Beacon Power, LLC

1.3.3 Pumped Heat Electrical Storage (PHES)

When using pumped heat electrical storage (PHES), the electrical energy drives a heat pump, which pumps heat from the “cold store” to the “hot store” (similar to the operation of a refrigerator). The pump is then reversed and becomes a heat engine that moves a motor or generator. The efficiency of this system is approximately 75 to 80% (ESA, n.d.-b). This is new technology with no known commercial uses at this time.

Figure 1.7 Pumped Heat Electrical Storage Process

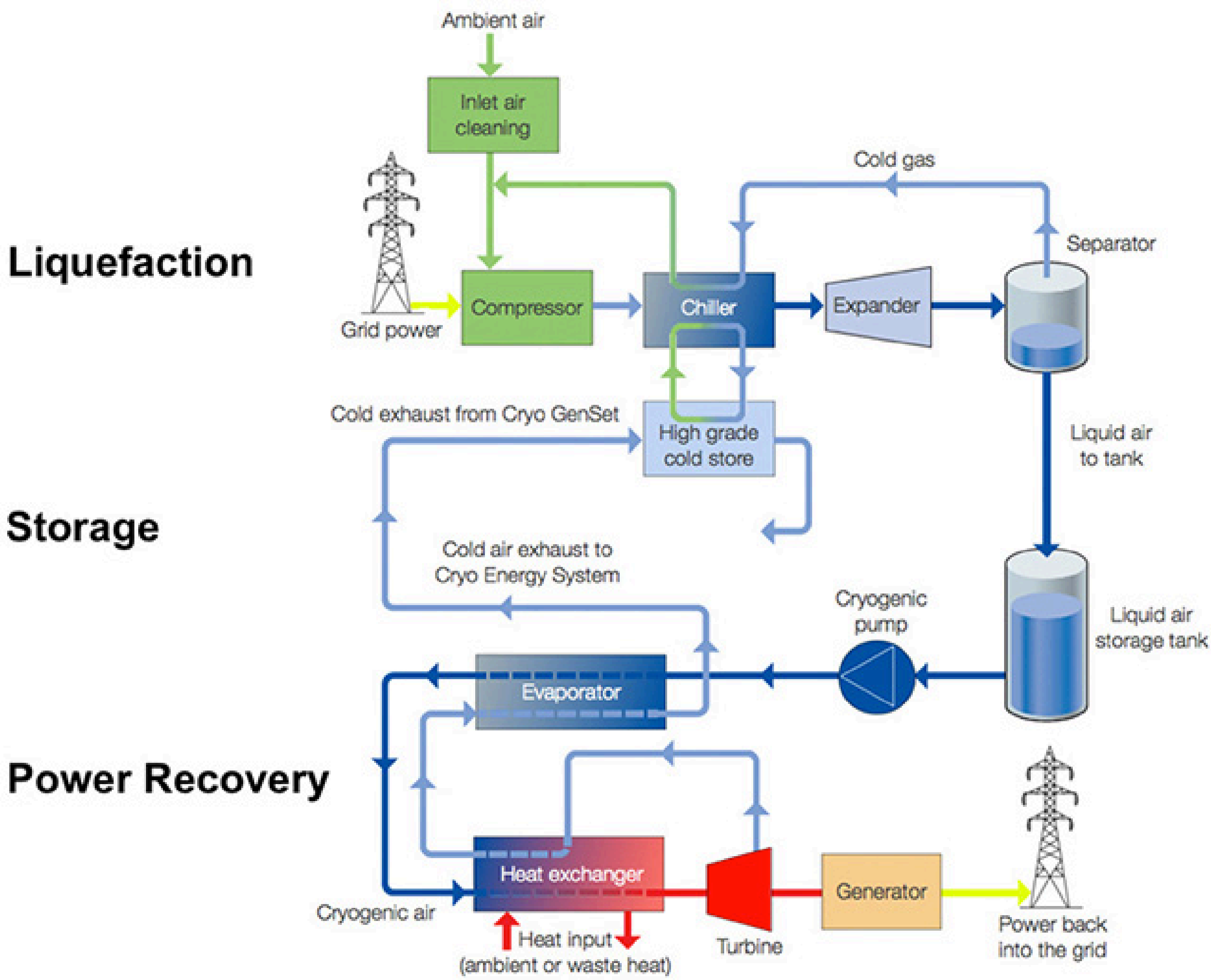


(Source: energystoragesense.com 2017)

1.3.4 Liquid Air Energy Storage (LAES)

Liquid air energy storage (LAES) uses well-known technologies and process to store energy. LAES uses electricity to cool air until it liquefies, stores the liquid air in a tank, brings the liquid air back to a gaseous state, and then uses that gas to turn a turbine and generate electricity. LAES is sometimes referred to as cryogenic energy storage because the process uses very low temperatures.

Figure 1.8 **Liquid Air Energy Storage Process**



(Source: energystoragesense.com 2017)

2.0 No Alternative Action

With the "no action" alternative, NASA would still proceed with construction of the solar array without testing or using energy storage on site.

3.0 Affected Environment and Environmental Consequences

WSTF operates as a component facility to the NASA Lyndon B. Johnson Space Center, Houston, TX, with the primary purpose of providing testing services to NASA for the United States space program. However, the facility also provides test services and support for the Department of Defense, Department of Energy, private industry, and foreign government agencies. NASA's mission is to provide the expertise and infrastructure to test and evaluate spacecraft materials, components, and propulsion systems to enable the safe human exploration and utilization of space.

WSTF is located 16 miles (mi; 26 km) northeast of Las Cruces, NM, and 65 mi (104 km) north of El Paso, TX. Geographic coordinates of WSTF are 32°30'30" north latitude and 106°36'30" west longitude.

The installation occupies over 60,000 ac (250 km^2) along the western flank of the San Andres Mountains, a prominent north-south range in southwestern New Mexico.

The following sections detail environmental information associated with the proposed action and "no action" alternative. Neither the proposed action nor no action alternative would be expected to produce any consequences related to ground or surface water sources. The construction and operation of the facilities are not expected to affect the quality or use of water on site.

3.1 Land Use

The general pattern of WSTF land use follows planning concepts and objectives that were established when the installation was initially conceived, designed, and constructed. The fundamental guideline for orderly growth and development at WSTF is to continually review, utilize, and/or extend these basic ideas with respect to frequently changing conditions. The current WSTF Facilities Master Plan (NASA, 2015) satisfies all foreseeable major functional requirements and relationships. For example, it protects off-site adjacent land usage from objectionable or hazardous influence, and incorporates flexibility to accommodate current long-range planning goals and objectives.

The proposed locations for energy storage test areas are already where there is disturbance and human activity due to the site's groundwater treatment system and daily utility operations. Existing roads would be used when possible to access the solar array. Areas to avoid would include existing private land, existing wells, existing groundwater treatment system structures, existing utility structures, and buildings that would not be used for test areas. At this time, the final locations for each energy storage test area is unknown, but general areas next to the solar array and existing electrical utility structures are a possibility (Figure 3.1). The proposed activities would result in no significant impact to land use at WSTF.

The "no action" alternative would include no energy storage test areas at WSTF and result in no change to existing land use.

3.2 Geology and Soils

The area topography consists of relatively flat plains west of the San Andres Mountains. The area soils are primarily the sandy to silty, loamy soils of the Doña Ana-Reagan association and Nickel-Tencee association (United States Department of Agriculture, Soil Conservation Service, 1976). The Doña Ana-Reagan association consists of gently rolling soils on broad fans. The association is about 35% Doña Ana fine sandy loam and 35% Reagan loam. The Doña Ana soil occurs on sloping alluvial fans, while the Reagan soil is on nearly level to gently sloping plains and alluvial fans. The soil is deep and well drained. Permeability is moderate and the water erosion hazard is moderate. The soil blowing hazard is high when more Doña Ana soil is present. The Nickel-Tencee soils tend to be more gravelly fine sand to gravelly loam. Nickel-Tencee soils are typically related with alluvial fan deposits. These soils are moderately alkaline and permeability is moderate but slow (Seager, 1981 and Seager et al., 1987).

There would be minimal soil disturbance at the energy storage test area sites due to construction of new facilities. Construction activities would take place within established roadways or areas with human activity wherever possible. Overall the soil and soil quality would not be significantly affected by the proposed project. Design and construction of the test areas would include elements that reduce the potential for soil erosion. This would result in no significant impact to topography or soils.

The "no action" alternative would result in no change to the existing topography at WSTF and the surrounding area.

3.3 Climate and Greenhouse Gases

Located in the northern portion of the Chihuahuan Desert, WSTF has an arid to semi-arid climate with abundant sunshine, relatively low humidity, modest rainfall, and a relatively mild winter season typical of low latitude arid areas. Rainfall through the year is light and insufficient for any growth except desert vegetation. The average annual rainfall at WSTF is around 10 inches (25 cm), with the most occurring in July and August. However, it varies across site with highest amounts on or near the mountains. Temperatures at WSTF are generally warm in the summer and mild during the winter. Temperatures during the day are often near 90 to 100 °F (32 to 38 °C) for the majority of the summer months. Mild daytime temperatures characterize winter, rising to 55 to 60 °F (12.8 to 15.6 °C) on average. The lowest temperatures occur in December and January, and night-time temperatures often drop below freezing (NASA, 2015).

Seasonal wind variations in the area are significant, with the strongest sustained winds occurring in late winter and spring months. This is primarily due to the surface winds colliding with the strong westerly winds and the natural terrain of the area. In the summer months, the surface winds are lighter except for the short-term variations caused by the thunderstorms and “dust devils.” Updrafts and downdrafts are always present with thunderstorms, adding to the surface wind variability by cooling the mountains and basins. Variability caused by frontal activity is generally confined to the winter and spring months, contributing to the stronger winds observed during these months. The winds may reach velocities as high as 30 to 40 miles per hour (mph) (48 to 64 kilometers per hour [kph]) or may exceed these velocities when a pressure gradient and a thermal gradient lie in the same direction.

On August 1, 2106, the White House Council on Environmental Quality provided guidance for greenhouse gas accounting and reporting for federal agency operations when complying with NEPA requirements. Greenhouse gas (GHG) contributions take into account direct and indirect emissions such as carbon dioxide. WSTF is not a major source of carbon dioxide emissions. Approximately half of the overall GHG contributions at WSTF are indirect from electricity purchased from the local electrical utility company. NASA uses calendar year 2011 as a conservative baseline for GHG emissions, since 2011 was the last year Space Shuttle activities were conducted at WSTF and recent testing has not reached the same GHG levels as 2011 (NASA, 2015).

The proposed action would not affect the climate at WSTF or the surrounding area. The proposed action could reduce the need for electricity generated in part by the use of fossil fuels, and would have an overall reduction in greenhouse gases and climate impacts. The “no action” alternative would result in no construction at WSTF and would not affect the climate at WSTF or the surrounding area.

3.4 Air Quality

The U.S. Environmental Protection Agency (EPA) regulates air quality through National Ambient Air Quality Standards. Air quality is assessed according to six criteria pollutants: carbon monoxide, ground level ozone, nitrogen oxides, sulfur dioxide, particulate matter, and lead (USEPA, 2017). WSTF is located in counties considered to be in attainment of National Ambient Air Quality Standards (NMED, n.d.). However, high levels of particulate matter from natural sources (such as blowing dust storms) may occur temporarily during periods of high winds.

The State of New Mexico, in accordance with federal clean air standards, has adopted a set of air quality control regulations that apply to stationary sources of air pollution. These regulations apply to stationary sources, such as diesel generators. They do not apply to mobile sources; such as trucks or aircraft.

The ambient air quality and weather conditions in the proposed areas are excellent. The atmospheric visibility “seeing” conditions are in the 50 to 100 mi (80 to 160 km) range. However, Doña Ana County, where the proposed project is located, has been designated as an Air Quality Maintenance Area for carbon monoxide and total suspended particulate matter. Although the county itself is lightly populated and relatively pollution-free, air quality is affected by the cities of El Paso, Texas and Juarez, Mexico.

There would be minimal or no dust deposited in the air from the construction of the energy storage test areas and support structures. There would also be mobile sources of air emission present during the construction. Ground vehicles would be used for the installation of the new systems. To minimize dust during these activities, dust control measures such as water trucks or dust suppressants would be employed before construction activities start, if necessary. Portable generators may also be used during the project. Depending on their proposed use, the New Mexico Environment Department (NMED) would have to be notified.

Overall, there would be no significant impacts on air quality. Positive impacts, however, do exist in association with providing energy storage at WSTF. There would be a regional reduction in emissions resulting from the lowered use of electricity from the electric power generating plants currently supporting WSTF.

The “no action” alternative would include no energy storage testing at WSTF and would not affect the air quality at WSTF or the surrounding area.

3.5 Energy

The local electric utility company provides electricity to WSTF through a 69 kilovolt (kV) transmission line that runs parallel to the site’s access road easement and terminates at the Apollo Substation located adjacent to the main entrance gate. The Apollo Substation supplies all loads to WSTF through one 30 Megavolt Ampere three-phase transformer, and three single-phase step voltage regulators. The feed into the WSTF switchyard is primary-metered at a pole structure located between the Apollo Substation and the WSTF switching station. The monthly peak load and annual usage are approximately 2,100 kW and 11 million kW hours, respectively. The Apollo Substation also provides power to three other customers.

Immediately adjacent to the Apollo Substation, WSTF receives one 3-phase 24.9/14.4 kV aerial feeder circuit at the NASA-owned switching station. The power is distributed throughout WSTF by a NASA-owned and operated overhead electrical distribution system. From the switching station, the power is delivered in three circuits, which are simple radial configurations. Circuit No. 1 supplies power to the 100 Area. Circuit No. 2 supplies power to water wells, two water booster stations, water treatment facilities, and the Fuel Fire Test Area. Circuit No. 3 supplies power to the remaining WSTF locations including the 200, 300, 400, 500, 700, 800 Areas and one water booster station.

The overhead distribution line construction is Grade B, as defined by the National Electrical Safety Code, suitable for service conditions of 5,000 feet (ft; 1,500 m) altitude, +15 °F (-9 °C) temperatures, and 80 mph (130 kph) winds. The various WSTF areas and buildings are supplied standard utilization voltages through substations located throughout the site.

WSTF would continue to consume the same amount of energy it currently uses, with an estimated need for at least 1.0 MW additional energy by the end of the decade. The difference would be in the fuel source of the electricity. Solar energy provides electrical energy without fossil fuel emissions. Capturing as much renewable energy as possible from the new solar array would help WSTF meet current and future energy demands while keeping the energy on site without having to solely rely on external energy sources. The “no action” alternative would include no energy storage at WSTF and would result in no change to the electrical source and use at WSTF on the solar array is in use.

3.6 Biological Resources

Threatened, endangered, and sensitive (TES) species lists developed by the U.S. Fish and Wildlife Service and New Mexico Department of Game and Fish (NMDGF) were reviewed to determine the potential for TES occurrences near the proposed sites. A list of TES faunal species known or expected to occur on WSTF is presented in Table 3.1. TES species lists developed by the U.S. Fish and Wildlife Service and NMDGF were reviewed by the county. The list was created using the NMDGF Biota Information System of New Mexico (BISON-M) database (n.d.). No habitat for federal or state listed threatened and endangered faunal species is present at the proposed locations.

Major vegetation within the area includes a combination of woody shrubs and grasses characteristic of the Chihuahuan Desert Scrub Biotic Community. The proposed project's locations are a xeric, poorly drained, and vegetative homogenous area. Shrubs provide a microhabitat for warm season grasses and herptiles.

The project area vegetation group contains yucca (*Yucca* spp.), broom snakeweed (*Gutierrezia sarothrae*), and honey mesquite (*Prosopis glanulosa*). Other plant species include tarbush (*Flourensia cernua*), creosotebush (*Larrea tridentata*), Russian thistle (*Salsola kali*), fourwing saltbush (*Atriplex canescens*), silverleaf nightshade (*Solanum eleagnifolium*), desert globemallow (*Sphaeralcea ambigua*), plains pricklypear (*Opuntia polyacantha*), and the desert Christmas cactus (*Cylindropuntia leptocaulis*). The most abundant species of grasses are sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), bush muhly (*Muhlenbergia porter*), and bristlegrass (*Setaria sp.*).

Common species of birds that could occur at or near the proposed areas include quail (Family *Odontophoridae*), mourning doves (*Zenaida macroura*), roadrunners (*Geococcyx californianus*), hawks, owls, ravens, turkey vultures (*Cathartes aura*), sparrows, wrens, flycatchers, and a variety of other songbirds. Migratory bird species frequent WSTF during the spring and fall. This is when the bird population is at its largest.

Common large and small mammals that are expected to occur at or near the proposed solar photovoltaic system include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), raccoons (*Procyon lotor*), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), woodrats, and mice.

The list of lizards and snakes includes horned lizards (*Phrynosoma* sp.), whiptails (*Aspidoscelis* sp.), collared lizards (*Crotaphytus collaris*), coachwhips (*Masticophis flagellum*), gopher snakes (*Pituophis catenifer*), prairie rattlesnakes (*Crotalus viridis*), and western diamondback rattlesnakes (*Crotalus atrox*). Amphibian species found in this area include true toads (*Bufo* sp.) and spadefoot toads (*Spea* and *Scaphiopus* sp.) (Sullivan & Houde-Nethers, 1996; Skarsgard, 2011). There are no habitats that contain fish in the proposed project area.

Table 3.1
Federal and State Listed TES Fauna Known or With Potential to Occur at WSTF*

Common Name	Scientific Name	Federal Status	State Status
	MAMMALS		
Organ Mountains Colorado chipmunk	*Neotamias quadrivittatus australis*	SOC	T
Spotted bat	*Euderma maculatum*		T
	MOLLUSK		
Dona Ana Talussnail	*Sonorella todseni*		T
	REPTILE		
Reticulate Gila Monster	*Heloderma suspectum suspectum*		E
	BIRDS		
Aplomado falcon	*Falco femoralis septentrionalis*	E	E
Arctic peregrine falcon	*Falco peregrines tundrius*	SOC	T
Baird's sparrow	*Ammodramus bairdii*	SOC	T
Bald eagle	*Haliaeetus leucocephalus alascanus*		T
Bell's vireo	*Vireo bellii*	SOC	T
Black tern	*Chlidonias niger surinamensis*	SOC	
Broad-billed hummingbird	*Cynanthus latirostris magicus*		T
Brown pelican	*Pelecanus occidentalis carolinensis*		E
Buff-collared nightjar	*Caprimulgus ridgwayi*		E
Common black hawk	*Buteogallus anthracinus*	SOC	T
Common ground-dove	*Columbina passerina pallescens*		E
Costa's hummingbird	*Calypte costae*		T
Gray vireo	*Vireo vicinior*		T
Least tern	*Sterna antillarum athalassos*	E	E
Mexican spotted owl	*Strix occidentalis lucida*	T	
Neotropic cormorant	*Phalacrocorax brasilianus*		T
Peregrine falcon	*Falco peregrinus anatum*	SOC	T
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E
Sprague’s Pipit	*Anthus spragueii*	C	
Varied bunting	*Passerina versicolor*		T
Violet-crowned hummingbird	*Amazilia violiceps ellioti*		T
Yellow-billed cuckoo	*Coccyzus americanus occidentalis*	T	

E=Endangered; T=Threatened; SOC=Species of Concern; C=Candidate
* (NMDGF BISON-M booklet accessed June 2017)

Construction and maintenance activities would create vegetation disturbances. Most construction activities would take place within established areas with human activity. Overall, there would be no long-term significant impacts to site’s vegetation. The “no action” alternative would include no energy storage at WSTF and would result in no change to the existing floral community at WSTF.

Fauna could be affected by construction activities, and operation and maintenance activities of the energy storage test areas. Noise from sources, such as vehicles, heavy machinery, and general human activities, related to construction and operation and maintenance activities would lead to species-specific faunal reactions. Factors influencing faunal responses may be time and length of the noise, seasonality, time of day, stress and physiological effects, life history, naturally occurring and background noise, and habituation (Larkin, 1996; Brown, 2001). Most small mammals would avoid excessive noise by retreating into burrows while larger species of mammals and birds would temporarily vacate the area. Reproductive activities of some small mammals and birds may be temporarily disrupted by noise and the presence of humans while other animals may become increasingly habituated and display little modification in behavior with ongoing exposure. Proposed activities would be in or adjacent to existing disturbed areas and would avoid disturbing migratory birds. No threatened or endangered floral or faunal species occur in the proposed areas. Overall, there would be no long-term significant impacts to the site’s faunal species.

The “no action” alternative would include no energy storage at WSTF and would result in no change to the existing floral and faunal populations at WSTF and the surrounding area.

3.7 Cultural Resources

Human habitation of the WSTF region represents an almost continuous occupational sequence encompassing a period from approximately 9,000 B.C. to the present and includes numerous Paleoindian, Archaic, Formative, Protohistoric, and Historic period cultural resources. Cultural resources include prehistoric or historic sites, structures, artifacts, or other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Several cultural resource surveys have been conducted in and around the proposed project areas. The previous renewable energy EA noted potential cultural resources. The proposed locations of the energy storage test areas are not located anywhere near any known cultural resources noted at WSTF.

There is also the potential to strike a subsurface site during construction. A dig permit describing the proposed location of construction would be required prior to any activities. In the event that a previously unknown resource is located, all activity would cease and the WSTF Environmental Department would be notified. The proposed project would have no significant impact to the site’s cultural resources.

The “no action” alternative would include no energy storage at WSTF and would result in no change to the existing cultural resources at WSTF.

3.8 Noise

There are expected to be the potential for noise during the construction phase. These noises would have minimal impacts. Noise levels during construction may at times reach levels harmful to field personnel. Proper ear protection would prevent hearing loss and tinnitus while using certain construction equipment. For individual protection, all personnel are required to use appropriate protective hearing devices if 84 decibels (dB [A]) are surpassed. The following table lists common noise sources and their dB (A) levels.

Table 3.2 Common Noise Sources

dB(A) Level	Source
60	Speech at 3 ft (0.9 m)
70	Normal street traffic
90	Operating a lawn mower
100	Operating a chain saw
140	Jet airplane takeoff at 50 ft (15 m)

Vehicle traffic, construction, and maintenance activities would generate noise. For the safety of workers, proper protective equipment including hearing protection would be required (29 CFR 1910 Occupational Safety and Health Administration, 2011). In relation to other activities at WSTF, the proposed addition of energy storage test areas would have no significant impact on conditions that currently exist. The “no action" alternative would include no energy storage at WSTF and would result in no change to the existing environment at WSTF.

3.9 Socioeconomics

Socioeconomics consists of the basic attributes and resources associated with the human environment especially in regard to population, economic activity, and environmental justice. The socioeconomic region of impact for the proposed action includes the areas surrounding Doña Ana County.

On February 11, 1994, the President of the U.S. signed EO 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The general purposes of the EO are to: 1) focus the attention of Federal agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster nondiscrimination in federal programs that substantially affect human health or the environment; and 3) give minority and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment (Executive Order No. 12,898, 1994).

The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA's mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Space Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and 5) consider both normal operations and accidents. NASA has developed a plan so that WSTF complies with the EO and NASA's agency-wide strategy.

Based on the information from the 2016 U.S. Census Bureau (USCB), minority and low income populations are believed to exist within the proposed action's region of influence. Statistics for minority populations in Doña Ana County indicate an average of 68% Hispanic. Caucasians who are not Hispanic were 27.8% of the population. Approximately 4% of the population is an ethnicity other than Hispanic or Caucasian. The population in poverty within the region of influence averages 25.7% (UCSB, 2015). The general minority population in the State of New Mexico averages 48.5% Hispanic of any race, 13.4% population other minority groups, and 38.1% Caucasians who are not Hispanic. The statewide population has 20.4% of the population living in poverty (USCB, 2015).

Minority and low-income populations are believed to exist within the proposed action's region of influence. Cities, towns, and block groups within the region of influence were not considered to have high minority and poverty populations compared to the general population of New Mexico. Under the proposed action, there would be no significant impact on, nor a potential for, disproportionately high and adverse effects on minority and low-income populations. The "no action" alternative would have no impact to the region's socioeconomics.

3.10 Cumulative Impacts

Cumulative impacts are those environmental impacts that result from the incremental effects of the proposed action when compounded by other past, present, or reasonably foreseeable future actions (40 CFR §1508.7, 2012). The addition of energy storage test areas to the WSTF solar energy project would make minor contributions to impacts at WSTF. Waste generated during this project would be managed and disposed of in accordance with applicable local, state, and federal regulations. Hazardous materials, such as lithium batteries, would be shipped in accordance with U.S. Department of Transportation (DOT) requirements and stored in accordance with manufacturer recommendations. In the unlikely event of release of hazardous constituents, such as anolyte and catholyte liquids, site specific spill remediation procedures would be implemented to immediately address the release and minimize environmental impacts. Overall greenhouse gas air emissions associated with power use at the site would be reduced by using onsite energy storage. Noise associated with construction activities would be localized to areas with existing human activity. Vehicle traffic associated with construction and maintenance activities would slightly increase but would not significantly increase traffic loads on the existing and future road network at WSTF. Reducing materials or recycling materials whenever possible during the project would help reduce the overall project cost and resources used.

4.0 Mitigation and Monitoring

To minimize potential environmental impacts associated with the proposed action as identified in the preceding analysis, the following mitigations would be adopted. These mitigations are central to the determination of no significant impact. Mitigation efforts would be implemented at the discretion of WSTF. Any unexpected adverse impacts to the environment would require additional mitigation measures.

4.1 Air

There would be mobile sources of air emission present during the construction. Ground vehicles would be used for the installation of the solar array. To minimize dust during these activities, dust control measures such as water trucks or dust suppressants would be used.

4.2 Biological Resources

Vehicles would use existing roads when available. If any species listed in Section 3.6 were found following the completion of this EA, NASA would determine if additional mitigation is necessary to prevent impact to the listed species’ populations.

4.3 Noise

Noise levels during construction may, at times, reach levels harmful to field personnel. For individual protection, all personnel are required to use appropriate protective hearing devices if 84 dB(A) are surpassed.

4.4 Hazardous Materials/Waste

The project would use several possible hazardous materials (i.e., lithium batteries). All hazardous materials would be received and shipped in accordance with U.S. DOT requirements. Hazardous materials would be stored and used in accordance with manufacturer recommendations to mitigate risks associated with their use on site. Hazardous materials and components reaching the end of their service life would be properly managed and disposed of in accordance with applicable local, state, and federal regulations. Any unplanned release of hazardous constituents would be immediately contained and addressed in accordance with WSTF procedures to minimize adverse impacts to the environment.

5.0 Preparers, Contributors, and Contacts

Agencies and Individuals Consulted

Juan Antonio Mujica-Kohler
Engineer
Jacobs Technology Inc.
NASA White Sands Test Facility

List of Preparers

Hennessey, J. R.
Compliance Supervisor
Navarro Research and Engineering, Inc.
NASA White Sands Test Facility

Skarsgard, Amanda
Primary Author
NASA Environmental Scientist
NASA White Sands Test Facility

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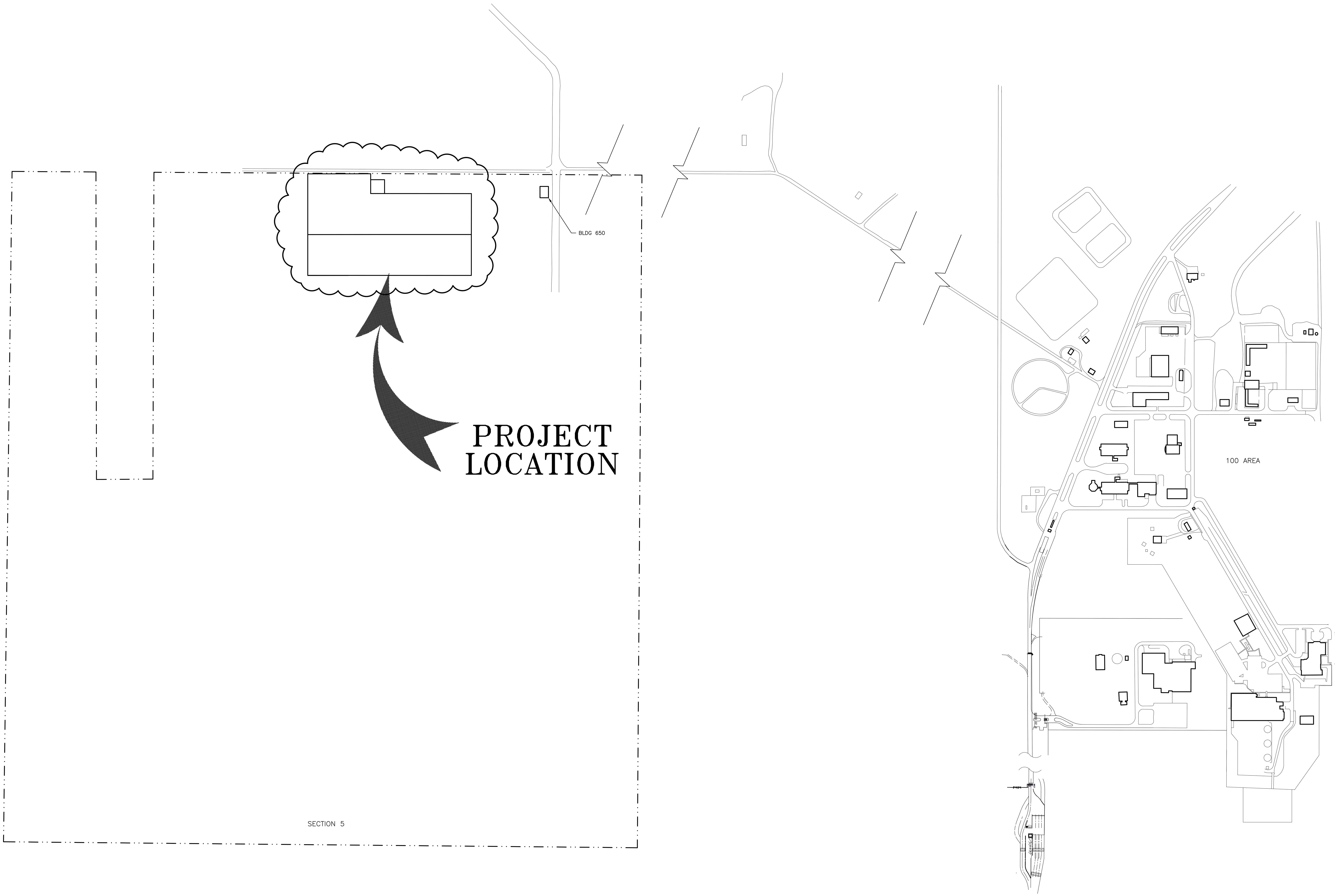
Figures

Figure 1.1 **WSTF Site Map**

(SEE NEXT PAGE)



National Aeronautics and Space Administration	600 AREA SOLAR ENERGY FARM PROJECT LOCATION
Lyndon B. Johnson Space Center White Sands Test Facility	A.B. DWG. NO. / SCALE NONE / SHEET 2 OF 2
	PROJ. NUM. / SIZE F / DWG. NO. 5301

NEXT ASS'Y / RELATED DWG'S

—x—x—x—	NEW BARBED WIRE FENCE PER DOT 607
—•—•—•—	NEW 8' CHAIN LINK FENCE W/ 3-STRAND BARBED WIRE OUT RIGGER
—·—··—	SECTION LINE
— — —	EXISTING 2' CONTOUR INTERVALS (ACCURATE TO ±1' HORIZONTAL AND VERTICAL)
— — —	EXISTING 10' CONTOUR INTERVALS (ACCURATE TO ±1' HORIZONTAL AND VERTICAL)
— — —	PROPOSED CONTOUR LINES
—E—E—E—	OVERHEAD ELECTRICAL LINES
—SS—SS—SS—	SANITARY SEWER LINE
—W—W—W—	WATER LINE
—FO—FO—FO—	UNDERGROUND FIBER OPTIC LINES (EXISTING)
—FO—FO—FO—	UNDERGROUND FIBER OPTIC LINES (FUTURE) (GOVERNMENT FURNISHED GFE)

KEYED NOTES:

- A 16' WIDE ROLLING GATE (PRELIMINARY LOCATION)
- B ACCESS ROAD (PRELIMINARY LOCATION), 24' WIDE GRAVEL ROAD
- C UNDERGROUND UTILITY CORRIDOR (PRELIMINARY LOCATION)
- D 24' WIDE SWING GATE
- E SDU [2 EA 18" CMP] (PRELIMINARY LOCATION)
- F 20' WIDE FIRE BREAK ROAD

NOTES:

MONITORING WELL PL-2: BRASS CAP LAT=106.654422W LONG=32.517494N ELEV=4510.02'

MONITORING WELL PL-5: BRASS CAP LAT=106.653398W LONG=32.515365N ELEV=4514.57'

REQ'D PER ASS'Y	ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	SHT. NO.

NEXT ASS'Y / RELATED DWG'S

PRINTED	SIGNATURE	DATE
DRAWN BY	K. DIRICKSON	11/13/14
CHECKED BY		
DESIGN ENGINEER	F. MATHIS	11/13/14
SAFETY OFFICER		
ENVIRONMENTAL		
INDUSTRIAL HYGIENIST		
PROJECT LEAD		
NASA MANAGER		
RELEASE		

National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
White Sands Test Facility

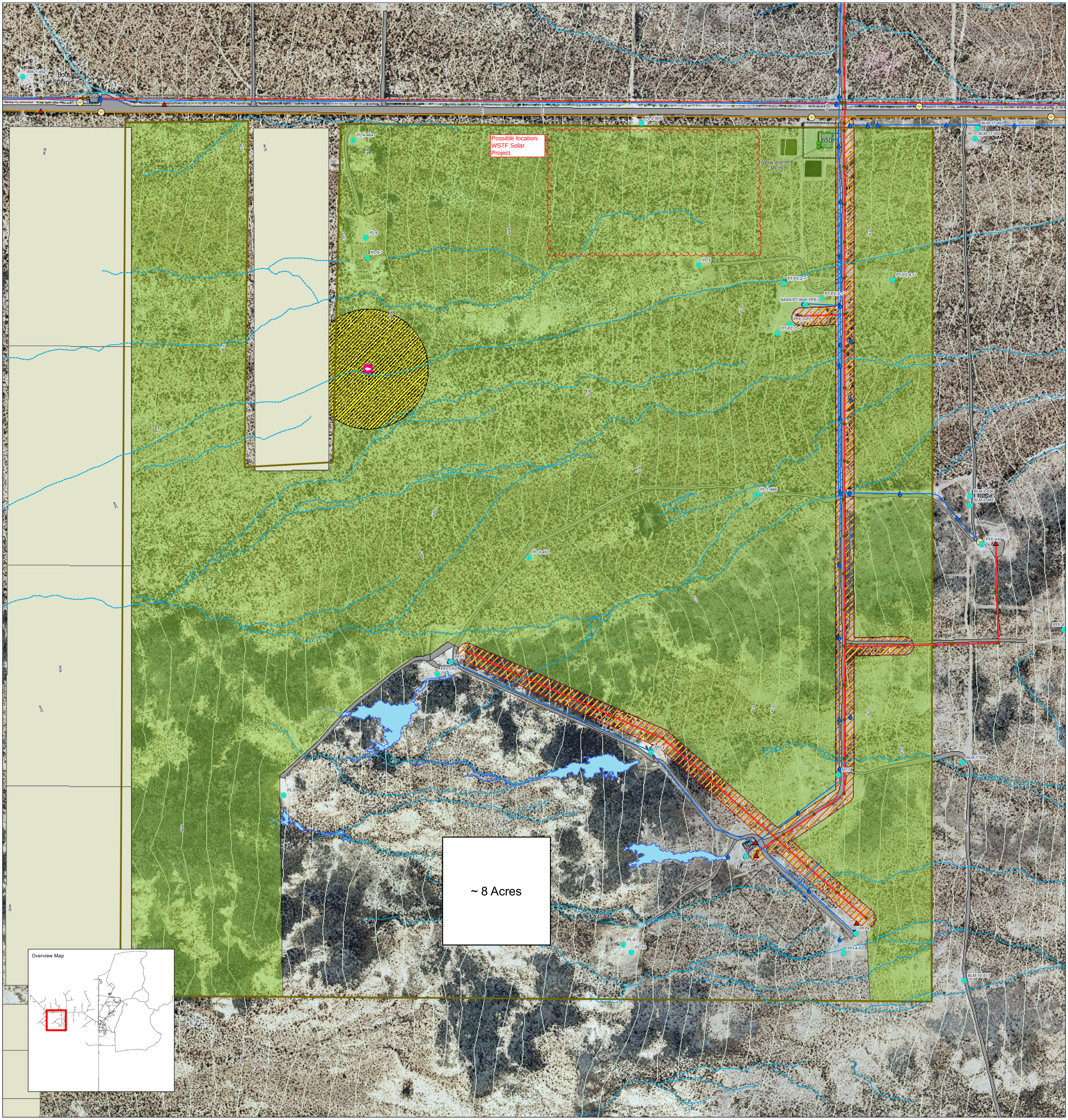
600 AREA
SOLAR ENERGY FARM
PRELIMINARY LOCATION & LAYOUT

A.B. DWG. NO. | SCALE 1"=40' | SHEET 1 OF 2

PROJ. NUM. | SIZE F | DWG. NO. 5301

Figure 3.1 **Solar Array Location Analysis**

(SEE NEXT PAGE)



Solar Array Location Analysis

The area of interest is approximately 336 acres.

Date: 11/9/2011

1 inch = 200 feet

0 250 500 1,000 1,500 2,000 Feet

WSTF Wells
Nightblooming Cereus
Archeological Sites
Electric Point
Power Poles
Sanitary Sewer Points
Telephone Points
Water Points
Ephemeral_Streams
Groundwater_flow
Water Pipe Lines
Fences
Gates
Electrical lines
Fiber Optic
Telephone Lines
BD NASA Owned
Area of Interest
Private Land
Archeological 100m buffer
Groundwater Extent
Buildings
Road
Electrical Line 50ft_buffer

Appendix A
Public Comment

NASA White Sands Test Facility

No public comments received.

No final comment from New Mexico State Historic Preservation Office. See following email correspondence.

From:	Estes, Bob, DCA
To:	Davis, Timothy J. (WSTF-RA111)
Subject:	Supplemental solar project EA
Date:	Tuesday, November 21, 2017 9:56:25 AM

Mornin' Tim,

I am looking at the EA for the energy storage test bed for the new solar array. I am reasonably sure that we have completed the Section 106 consultation for the undertaking. But our records show that the area of potential effect (APE) has not been surveyed and that I asked for more information on June 16, 2011 (HPD log 92087) with a request for follow-up to the EA on November 28, 2011 (HPD log 93239).

One of my comments was that the (APE) was not entered into the NMCRIS map server, and none of the surveys have NMCRIS activity numbers, which means I can't ask for a records search at the Archaeological Record Management Section (ARMS). And, we are beyond our record retention schedule for 2011.

Will you email me a copy of the survey area maps for the APE and copies of the SHPO responses for the previous consultations, so that I can complete the review?

Thanks,

Bob Estes Ph.D.
HPD Staff Archaeologist

From:	Davis, Timothy J. (WSTF-RA111)
To:	Estes, Bob, DCA
Cc:	Doherty, Antonette S (WSTF-RE111)
Subject:	RE: Supplemental solar project EA
Date:	Wednesday, December 6, 2017 5:02:00 PM
Attachments:	2011_01_26solarArray.pdf

Greetings:

Well, I finally had a chance to dig around for a long time in the electronic records system, including my personal action item tracking system. I cannot locate any documents, in any form (emails, memos, letters, etc.) that occurred after your letter of November 28th. Which is very odd for us, whenever we receive a letter from any agency we log it into our system and it electronically assigns response due date/deliverable requirement. For whatever reason (it was a long time ago), we don't see any evidence that anything like that actually happened.

That said, I did dig up the Northwind survey that was done back in 2011 and I was scrolling through it and see all the NMCRIS information in Appendix A. It does have a tracking number (119673) and there is a snapshot of the NMCRIS server map check as well. So not sure what all was going on, not sure what all the issues may be, and I'm especially not sure where to go from here. I've attached the Northwind survey again, appendix A with the NMCRIS info is in the very back.

Take a look and let me know what you think, and let me know any advice or recommendations on what we should do to move forward. I'm also going to cc: Antonette Doherty on this email. Antonette is taking over the cultural resource management work for my office.

Much appreciated.

Timothy J. Davis, Chief
Environmental Office, RE
NASA White Sands Test Facility
P.O. Box 20
Las Cruces, NM 88004
575.524.5024
timothy.j.davis@nasa.gov

From: Estes, Bob, DCA [mailto:Bob.Estes@state.nm.us]
Sent: Tuesday, November 21, 2017 9:56 AM
To: Davis, Timothy J. (WSTF-RA111) <timothy.j.davis@nasa.gov>
Subject: Supplemental solar project EA

Mornin' Tim,

I am looking at the EA for the energy storage test bed for the new solar array. I am reasonably sure that we have completed the Section 106 consultation for the undertaking. But our records show that the area of potential effect (APE) has not been surveyed and that I asked for more information on June 16, 2011 (HPD log 92087) with a request for follow-up to the EA on November 28, 2011

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Bob Estes Ph.D.
HPD Staff Archaeologist