National Aeronautics and
Space Administration

# Environmental Assessment for New 300 Area Test Stand at Johnson Space Center, White Sands Test Facility, New Mexico

March 2015

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NASA Johnson Space Center White Sands Test Facility
12600 NASA Road Las Cruces, New Mexico 88012

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| **Location:** | White Sands Test Facility is located in Doña Ana County, New Mexico. |
| **Lead Agency:** | National Aeronautics and Space Administration (NASA) Johnson Space Center, White Sands Test Facility |
| **Proposed Action:** | NASA proposes constructing a new engine test stand for flight testing of a new service module. |
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## Executive Summary

The National Aeronautics and Space Administration (NASA) continues to work with private companies to develop new vehicles and technology for space exploration. This Environmental Assessment (EA) addresses the potential impacts associated with the proposed actions at the White Sands Test Facility (WSTF) 300 Area, which includes the construction of a new test stand, testing the service module, and deconstruction of the test stand once testing is complete.

The two reasonable alternatives are 1) an alternative location in the WSTF 400 Area, and 2) the no action alternative. The alternative location would meet the same testing and safety requirements as the proposed location in the 300 Area. Due to the current configuration and testing schedule in the 400 Area, siting the new test stand and fitting the testing into the 400 Area schedule would require more effort at the alternative site. The no action alternative would include no new facilities, structures, or testing operations at WSTF and would have no environmental impacts associated with the construction of a new test stand and the service module testing.

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## Figures and Tables

## Acronyms and Abbreviations

| | |
|---|---|
| °C | Degrees Celsius |
| °F | Degrees Fahrenheit |
| APE | Area of Potential Effect |
| AQB | Air Quality Bureau |
| B.C. | Before Christ |
| BISON-M | Biota Information System of New Mexico |
| CCICap | Commercial Crew Integrated Capability |
| CCP | Commercial Crew Program |
| CCtCap | Commercial Crew Transportation Capability |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulation |
| CO | Carbon monoxide |
| dBA | Decibels (A-weighted) |
| EA | Environmental Assessment |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| GHG | Greenhouse Gases |
| HPWG | Historic Preservation Working Group |
| ISS | International Space Station |
| km | Kilometer |
| km² | Square kilometer |
| lbs | Pounds |
| mi | Mile |
| mph | Miles per hour |
| n.d. | No date |
| NAAQS | National Ambient Air Quality Standards |
| NASA | National Aeronautics and Space Administration |
| NEPA | National Environmental Policy Act |
| NMDGF | New Mexico Department of Game and Fish |
| NMED | New Mexico Environment Department |
| $NO_2$ | Nitrogen dioxide |
| NOx | Nitrous oxides |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Places |
| $O_3$ | Ozone |
| PM | Particulate matter |
| psid | Pounds per square inch differential |
| $SO_2$ | Sulfur dioxide |
| TES | Threatened and Endangered Species |
| TK | Tencee-Nickel Association, Steep |
| TS 301A | Test Stand 301A |
| U.S.C. | United States Code |
| US | United States |
| USCB | United States Census Bureau |
| USFWS | United States Fish and Wildlife Service |
| VOC | Volatile organic compounds |
| WSMR | White Sands Missile Range |
| WSTF | Johnson Space Center White Sands Test Facility |

# 1.0 Purpose and Need for the Proposed Action

This 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; Environmental Quality, 2012a, 2012b). The EA describes the purpose and need for the proposed test stand for a service module (also referred to as test article in this document) at the Johnson Space Center White Sands Test Facility (WSTF) 300 Area. Two reasonable alternatives are considered 1) construct at an alternative location at the WSTF 400 Area, or 2) the no action alternative. Existing environmental conditions at the proposed and alternative locations at WSTF are described and the potential environmental consequences for each action are analyzed.

## 1.1 Background

NASA's continued quest to explore space has led to the development of the Commercial Crew Program (CCP; NASA, 2014). The CCP is identifying private companies supporting safe and reliable United States (US) space transportation that would provide a connection to the International Space Station (ISS) and low-Earth orbit. The CCP allows NASA to invest in several American companies to develop future transportation for NASA astronauts and to open space travel to more people. The goal of the CCP is to launch astronauts from US soil by 2017.

NASA created public partnerships with The Boeing Company, Sierra Nevada Corporation Space Systems, and Space Exploration Technologies (Space X) through the Commercial Crew Integrated Capability (CCICap) Initiative. A space craft vehicle developed by one or more of the partners would require space transportation for at least four astronauts and equipment to and from the ISS at least twice a year; the vehicle builder must provide safety for the crew in an emergency, during launch and ascent into orbit; and the vehicle must be able to serve as a 24-hour safe haven during an emergency in space and remain docked to the ISS for at least 210 days (NASA, n.d., 2015a).

The current phase in NASA's CCP is the Commercial Crew Transportation Capability (CCtCap). NASA has contracted Boeing and SpaceX to develop transportation systems for space travel.

## 1.2 Need

Currently, there is not a test stand available to provide the needed testing to evaluate a CCP service module. There is currently no test stand available that provides the infrastructure, can withstand the thrust and overpressure loads, and provide the correct safety measures necessary to complete testing of the service module.

The testing of a service module would be used to gather data to support the flight and abort testing that will be performed at White Sands Missile Range (WSMR) LC-32. A new test stand would test and validate propulsion system performance.

## 1.3 Description of Proposed Action

NASA proposes to design, construct, and build a new test stand at WSTF's 300 Area (see Figure 1 and Figure 2). The design and construction of the new test stand would use existing test systems and infrastructure where possible and it would be constructed so that it could easily be removed once testing is completed.

### 1.3.1 Test Stand 301A

Currently, WSTF does not have a test stand that meets the requirements to test the service module. The test stand design considers the location relative to other test stands, overpressure analysis so the test article and test stands are safe during and after testing, and correct infrastructure to support the new test stand. Figure 3 and Figure 4 show the location of the blast wall based on a computer model. The computer model calculated the pounds per square inch differential (psid) of force that could damage the surrounding structures of the new test stand. The location of the blast wall would protect other structures in the 300 Area from potential damage during the system module testing. Table 1 shows the failure of different structure elements such as windows or concrete walls at the psid, if the element fails.

The design of the test stand would allow for the use of existing roads, utilities, cranes, and connections to remote test systems in the 300 Area blockhouse. Figure 5 shows the proposed layout of the new Test Stand 301A (TS 301A) in relation to the existing 300 Area. Preliminary soil testing determined that the area could support the weight of the new construction and the force of the thrust during module testing with the addition of a retaining wall. A small side road, perpendicular to Apollo Boulevard would need to be widened to allow for the delivery and unloading of the service module. A new access road to the flume would also need to be constructed. The site for TS 301A would include proper grading and drainage to allow rainwater runoff, a foundation with a secondary containment curb, the retaining wall, the blast wall, personnel access and fall protection, and easy access to the test article during testing. The design of the test stand would allow testing during most weather conditions at WSTF, except high winds above 40 mile per hour (mph). Figure 6 and Figure 7 show computer drawings of the proposed TS 301A. A temporary modular building system next to Building 310 would be used for support during testing and would be removed after the program is completed.

Construction of the new test stand is scheduled to begin in May 2015.

### 1.3.2 Testing

Testing is currently scheduled to take place in the summer months of 2016. The design of the service module limits the testing to one series of tests, as the service module cannot be refueled for additional testing. Series I and II tests would be performed in the Building 310 extension. Series I and II of testing would involve cold flow tests with water and operation checks to ensure the service module can complete the hot fire testing. The service module would be loaded with 3,276 pounds (lbs) of oxidizer and 1,966 lbs of monomethyl hydrazine fuel, followed by loading the helium vessels. Once Series I and II are completed, Series III would secure the service module on TS 301A for testing. The test systems would be verified again. Then, the hot fire testing would be completed until the service module runs out of fuel and oxidizer. The testing for the service module is currently scheduled to be completed by August 2016.

### 1.3.3 Future Use of Test Stand

Once testing is completed, TS 301A would be mothballed or dismantled, except for the steel test structure. At this time, there is no future use identified for TS 301A. The modular building extension to Building 310 would be removed.

## 2.0 Alternative Actions

## 2.1 Alternative Test Stand Site

An alternative test stand site at WSTF would be located in the 400 Area. At this time, a specific area has not been identified for the new test stand, but it would have to meet the same testing and safety

requirements of the test stand location in the 300 Area. The 400 area site would allow for use of existing infrastructure, operational support, and WSTF personnel.

## 2.2 No Action Alternative

The no action alternative would include no new test stand or new testing program at WSTF.

## 3.0 Affected Environment

WSTF operates as a separate unit of the NASA Lyndon B. Johnson Space Center in Houston, Texas with the primary purpose of providing testing services to NASA for the US 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. WSTF'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 kilometers [km]) northeast of Las Cruces, New Mexico, and 65 mi (104 km) north of El Paso, Texas. Geographic coordinates of WSTF are 32°30'30" north latitude and 106°36'30" west longitude. The installation occupies over 60,000 acres (250 $km^2$) along the western flank of the San Andres Mountains, a rugged north-south mountain range in southwestern New Mexico.

The following sections detail environmental information associated with the proposed action and alternatives. Neither the proposed action nor alternatives would be expected to produce any consequences related to ground or surface water sources, or to energy use at WSTF. The construction and operation of the facilities are not expected to affect the quality or use of water on site. Due to the area of land that would be disturbed (greater than one acre), a National Pollutant Discharge Elimination System (NPDES) construction general permit would be required during the construction and installation of TS 301A.

## 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, 2005) satisfies all foreseeable major functional requirements and relationships. For example, it protects off-site land usage from objectionable or hazardous influence, and incorporates flexibility to accommodate current long-range planning goals and objectives.

The proposed location for the project would be located throughout Section 36, T20S, R3E, where there is already land disturbance and human activity due to the site's existing propulsion testing area known as the 300 Area. Some desert vegetation would have to be removed from the area to install the new test stand next to the existing 301 and 310 test stands. Existing roads and utilities would be used but expanded to support test stand construction and testing activities.

## 3.2 Geology and Soils

The area topography consists of sloping alluvial fans with a few relatively flat areas west of the San Andres Mountains. The area soils are primarily the sandy, loamy soils of the Tencee-Nickel Association, Steep (TK; USDA, 1976). The TK soil consists approximately of 45% Tencee Very Gravelly Loam and 40% Nickel Fine Sandy Loam. The Tencee soil tend to have a moderate slope to steep soil in ridges and saddles, while the Nickel soil is a steep soil found in patches of the landscape. The soil has areas of

gravelly soils of less than 35% coarse fragments, stony rocky land, and arroyos (Seager, 1981 and Seager, Hawley, Kottlowski & Kelley, 1987).

## 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 centimeters), 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 degrees Fahrenheit (°F; 32 to 38 degrees Celsius [°C]) for the majority of the summer months. Mild daytime temperatures characterize winter, rising to 55 – 60 °F (12.8 – 15.6 °C) on average. The lowest temperatures occur in December and January, and night-time temperatures often drop below freezing (NASA, 2005).

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 – 40 mph (48 – 64 kilometers per hour) or may exceed these velocities when a pressure gradient and a thermal gradient lie in the same direction.

Presidential Executive Order (EO) 13514 requires federal agencies to keep track of and reduce greenhouse gas emissions (Executive Order No. 13,514, 2009). In October 2012, the White House Council on Environmental Quality (CEQ) provided final guidance for greenhouse gas (GHG) accounting and reporting for federal agency operations. WSTF is not a major source air pollutant (CEQ, 2010). The GHG contributions reported by the EO takes into account actual (direct) $CO_2$ emissions as well as indirect contributions such as emissions from electricity purchased to run the site. A 2010-2011 assessment of GHG emissions at WSTF concluded that approximately half of the overall GHG contributions at WSTF are from electricity purchased from El Paso Electric. Figure 8 is a pie chart showing GHG emissions for calendar year 2011. Calendar year 2011 is used as a conservative baseline estimate for GHG, 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.

## 3.4 Air Quality

The U.S. Environmental Protection Agency (EPA) regulates air quality through National Ambient Air Quality Standards (NAAQS). Air quality is assessed according to six criteria pollutants: Carbon monoxide (CO), ozone ($O_3$), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), respirable particulate matter (PM), and lead (EPA, 2014). WSTF is located in counties considered to be in attainment of NAAQS (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, 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 – 100 mi (80 – 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.

WSTF has an existing air permit for the 300 Area with the New Mexico Environment Department (NMED) Air Quality Bureau (AQB). For the proposed testing, a one-time notice to the ABQ may be required because the emission quantities would be so small and limited during the testing, which would only warrant a notification. The current air permit would not have to be modified. The emissions from testing the service module using hydrazines and nitrogen tetroxide would include: CO, volatile organic compounds (VOCs), nitrogen oxides ($NO_x$), $SO_2$, and particulate matter (PM-10 and PM-2.5).

## 3.5 Biological Resources

Threatened, endangered, and sensitive (TES) species lists developed by the U.S. Fish and Wildlife Service (USFWS) 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 2. TES species lists developed by the USFWS 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 location is a xeric, poorly drained, and vegetative homogenous area. Shrubs provide a microhabitat for warm season grasses and herptiles. Common plants, grasses, birds, mammals, lizards, snakes and amphibians are listed in Table 3. Migratory bird species frequent WSTF during the spring and fall. This is when the bird population is at its largest.

## 3.6 Cultural Resources and Section 106 Compliance

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 Paleo-Indian, 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. No archeological sites are located near the proposed TS 301A.

In 2012, an architectural survey was conducted of WSTF that included a field inspection of 55 Apollo-era facilities, interviews with current and past WSTF employees, and digital photographs of exterior elevations and representative interior spaces such as control rooms and work areas (Reed & Price, 2012). Background research was provided for each facility and a New Mexico Historic Cultural Properties Inventory form was prepared for each surveyed facility.

National Register of Historic Places (NRHP) evaluations were conducted according to Criteria A, B, and C in the context of the Apollo (1962-1972) and Space Shuttle (1969-2011) Programs in the area of space exploration. The criteria developed by the NASA Historic Preservation Working Group (HPWG) for Space Shuttle related structures was also used to evaluate WSTF properties. Based on background research, field surveys, and interviews, it was recommended that the 300 and 400 Propulsion Test Areas are eligible as historic districts, and Buildings 200, 201, and 203 (known as the 200 Preparation Area) are

eligible as individual buildings under Criteria A. When areas have achieved significance in less than 50 years, NRHP Criteria G applies as well (Reed and Price 2012). In a letter dated November 13, 2013, the New Mexico Historic Preservation Division concurred that the WSTF properties meet these criteria. Since the 200 Preparation Area was built in three phases, between 1964 and 1965, the buildings are treated as one building, but not a historic district. The proposed TS 301A location is adjacent to the 300 Area historic district. Figure 9, Figure 10, and Figure 11 show the cultural resources and area of potential effect (APE) for proposed TS 301A. The new test stand design would be sturdy and could be dismantled, except for the steel test structure.

## 3.7 Noise and Vibration

Noise and vibration during construction and testing is inevitable, and may at times reach levels harmful to field personnel. Proper ear protection would prevent hearing loss and tinnitus while using certain construction equipment and following test directions from blockhouse personnel. For individual protection, all personnel are required to use appropriate protective hearing devices if 84 decibels (dBA) are surpassed. Table 4 lists common noise sources and their dBA levels. The installation of the blast wall would also provide protection from noise and vibrations during testing. TS 301A would be designed to withstand the vibration and overpressure created during the hot fire testing of the service module.

## 3.8 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 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (Executive Order No. 12,898, 2014). 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 (EPA, 2015).

The EO directs federal agencies, including NASA, to develop environmental justice strategies as part of their mission (Executive Order No. 12,898, 2014). 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. WSTF has developed a plan to comply with the EO and NASA’s agency-wide strategy.

Based on the information from the 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 66.6% Hispanic. Caucasians who are not Hispanic were 29.1% of the population. Approximately 6% of the population is an ethnicity other than Hispanic or Caucasian. The population in poverty within the region of influence averages 27%. The general minority population in the state of New Mexico averages 47.3% Hispanic of any race, 14.7% of population other

minority groups, and 39.4% Caucasians who are not Hispanic. The statewide population has 20.4% of the population living in poverty (USCB, n.d.).

# 4.0 Environmental Consequences

## 4.1 Land Use

The proposed location for the proposed TS 301A is located where there is already disturbance and human activity due to the site's propulsion test areas. Existing roads, utilities, and test systems would be used and expanded when possible to access the new test stand. The proposed activities would result in no significant impact to land use at WSTF.

The alternative action would be the same as the proposed action since it would also be located in an existing propulsion test area. The no action alternative would result in no change to the existing land use at WSTF and the surrounding area.

## 4.2 Geology and Soils

There would be minimal soil disturbance at the new test stand site due to construction of new facilities. Construction activities would take place within areas where human activity already exists. Overall, the soil and soil quality would not be significantly affected by the proposed project. Design and construction of the test stand would include elements that reduce the potential for soil erosion. This would result in no significant impact to topography or soils.

The alternative action would be the same as the proposed location, since it would also be located in an existing propulsion test area. If the project were in the 400 Area, additional soil testing would need to be completed to ensure the site would support a new test stand and the hot fire tests. The no action alternative would result in no change to the existing topography at WSTF and the surrounding area.

## 4.3 Climate and Greenhouse Gases

The proposed action would not affect the climate at WSTF or the surrounding area. The testing emission would not increase the GHG levels at WSTF. The alternative action would be the same as the proposed action. The no action alternative would result in no construction at WSTF and would not affect the climate or GHG levels at WSTF or the surrounding area.

## 4.4 Air Quality

There would be minimal, short-term dust deposited in the air from the construction of the new test stand 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 test stand. Portable generators may also be used during the project. Depending on the final proposed test schedule, NMED would have to be notified of the one-time test emissions for CO, VOCs, $NO_x$, $SO_2$, PM-10 and PM-2.5. The existing air permit would not have to be modified. Overall, there would be no significant impacts on air quality.

The proposed action would not affect the air quality at WSTF or the surrounding area. The alternative action would be the same as the proposed action. The no action alternative would include no new test stand and would not affect the air quality at WSTF or the surrounding area.

## 4.5 Biological Resources

Construction activities would create vegetation disturbances. Construction and testing activities would take place within established areas with daily human activity. Proposed activities would stay in or adjacent to the propulsion test areas and would avoid disturbing most animals. No threatened or endangered plant or animal species occur in the proposed area. Overall, there would be no long-term significant impacts to the site's vegetation and animals (Larkin, 1996 and Brown, 2001). The alternative action would be the same as the proposed action. The no action alternative would include no new test stand at WSTF and would result in no change to the existing plant and animal communities at WSTF.

## 4.6 Cultural Resources and Section 106 Compliance

The proposed test stand location would be adjacent to the NRHP 300 Area historic district. The design of the test stand would be similar to existing structures in the 300 Area. The test stand would also be built with the ability to remove the test stand once the hot fire testing is complete. There is also the potential to strike a subsurface cultural resources 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 action would have no significant impact to the site's cultural resources. The alternative action would be the same as the proposed action.

The no action alternative would include no new test stand at WSTF and would result in no change to the existing cultural resources at WSTF.

## 4.7 Noise and Vibration

Vehicle traffic, construction, and maintenance activities would generate noise. For the safety of workers, proper protective equipment including hearing protection would be required (Occupational Safety and Health Standards, 2011). The blast wall would protect other structures in the 300 Area from the hot fire testing of the service module. The proposed test stand would have no significant impact on conditions that currently exist. The alternative action would be the same as the proposed action. The no action alternative would include no new test stand at WSTF and would result in no change to the existing environment at WSTF.

## 4.8 Socioeconomics

Minority and low-income populations 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 Las Cruces and other neighborhoods and communities further away from WSTF. Under the proposed action, there would be no significant impact or adverse effects on minority and low-income populations. The test location is remote to avoid direct contact with communities surrounding WSTF, and the test duration would be short enough to have no impacts on the nearby communities. The alternative action would be the same as the proposed action. The no action alternative would have no impact to the region's socioeconomics.

## 4.9 Cumulative Impacts

Cumulative impacts are those environmental impacts that result from the total effects of the proposed action when included with other past, present, or reasonably foreseeable future actions (Cumulative Impact, 2012). The remote location of the WSTF propulsion test areas reduces the potential impacts to neighboring properties. The new test stand would make minor contributions to impacts at WSTF. Overall,

air emissions and GHG for the site would remain similar to past year totals. The test stand would make minor contributions to noise during construction and operation. Reducing materials or recycling materials whenever possible during the project would help reduce the overall project cost and resources used. The alternative action would be the same as the proposed action. The no action alternative would have no cumulative impacts.

## 5.0 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.

### 5.1 Air

Portable generators would be used during the construction. Vehicle traffic would also increase during construction of the test stand, but to minimize dust during these activities, dust control measures such as water trucks or dust suppressants would be used if needed.

### 5.2 Cultural Resources

The New Mexico Historic Preservation Division would be consulted on the new test stand with a formal Section 106 review. All activities would require a dig permit.

### 5.3 Noise and Vibration

Noise levels during construction and testing may reach levels harmful to WSTF personnel. For individual protection, all personnel are required to use appropriate protective hearing devices if 84 dBA are surpassed. To protect other structures in the 300 Area from test activities, a new blast wall would be constructed.

## 6.0 Preparers, Contributors, and Contacts

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# Figures

**Figure 1** **WSTF Location Map**

(SEE NEXT PAGE)

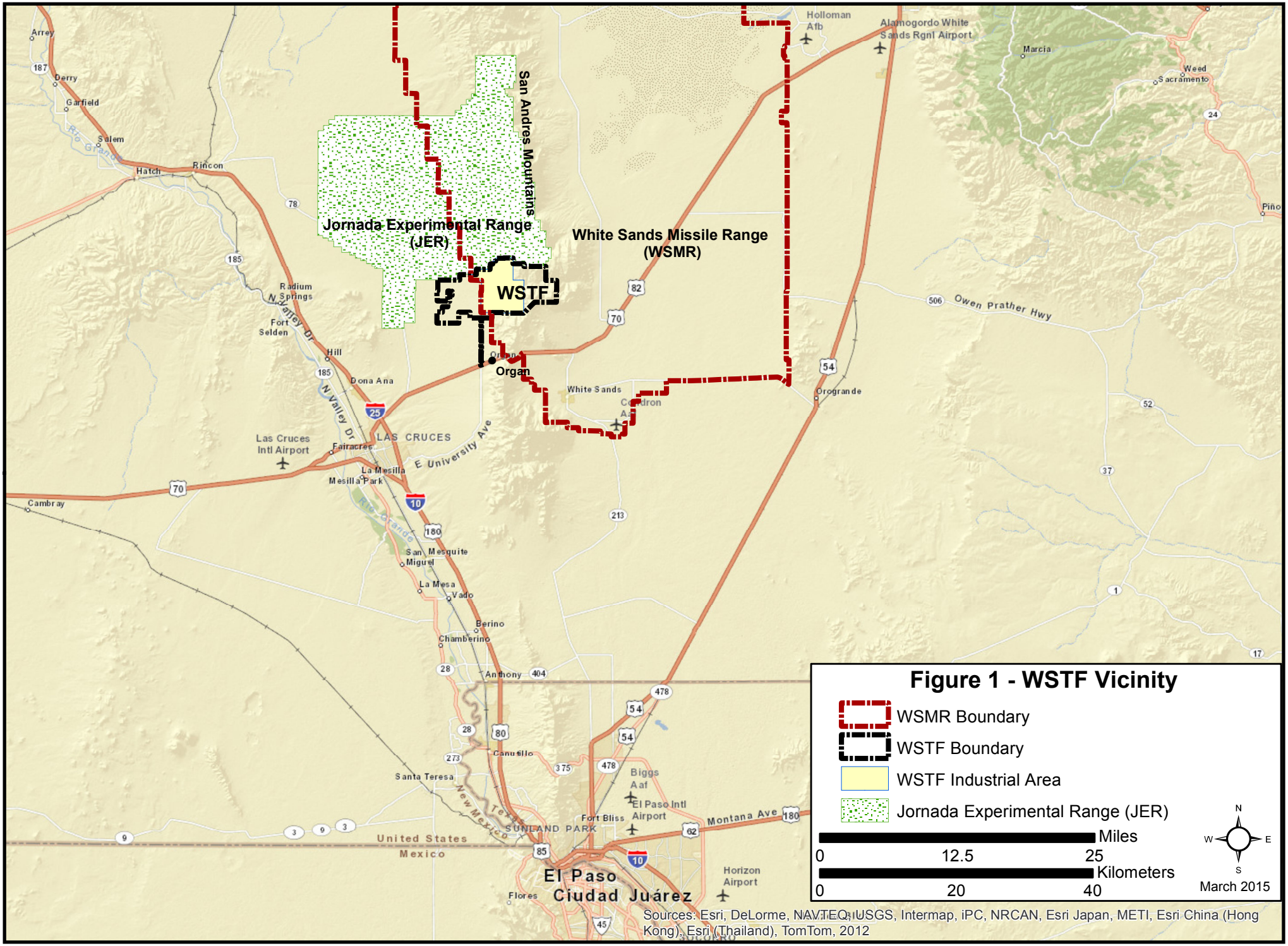

San Andres Mountains
Jornada Experimental Range (JER)
White Sands Missile Range (WSMR)
WSTF
Organ
Las Cruces Intl Airport
LAS CRUCES
El Paso
Ciudad Juárez
United States
Mexico
Fort Bliss
El Paso Intl Airport
Biggs Aaf
White Sands
Holloman Afb
Alamogordo White Sands Rgnl Airport
Owen Prather Hwy
Figure 1 - WSTF Vicinity
WSMR Boundary
WSTF Boundary
WSTF Industrial Area
Jornada Experimental Range (JER)
Miles
0 12.5 25
Kilometers
0 20 40
N
W
E
S
March 2015
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

**Figure 2** **300 Area Map**

(SEE NEXT PAGE)


310
301
312
350
328
326
327
302
315
322
320
303
300
362
364
363
White Sands Test Facility 300 Area
Feet
0
150
300
Meters
0
45
90
N
W
E
S
March 2015

**Figure 3** **Overpressure Map for Proposed Test**

(SEE NEXT PAGE)

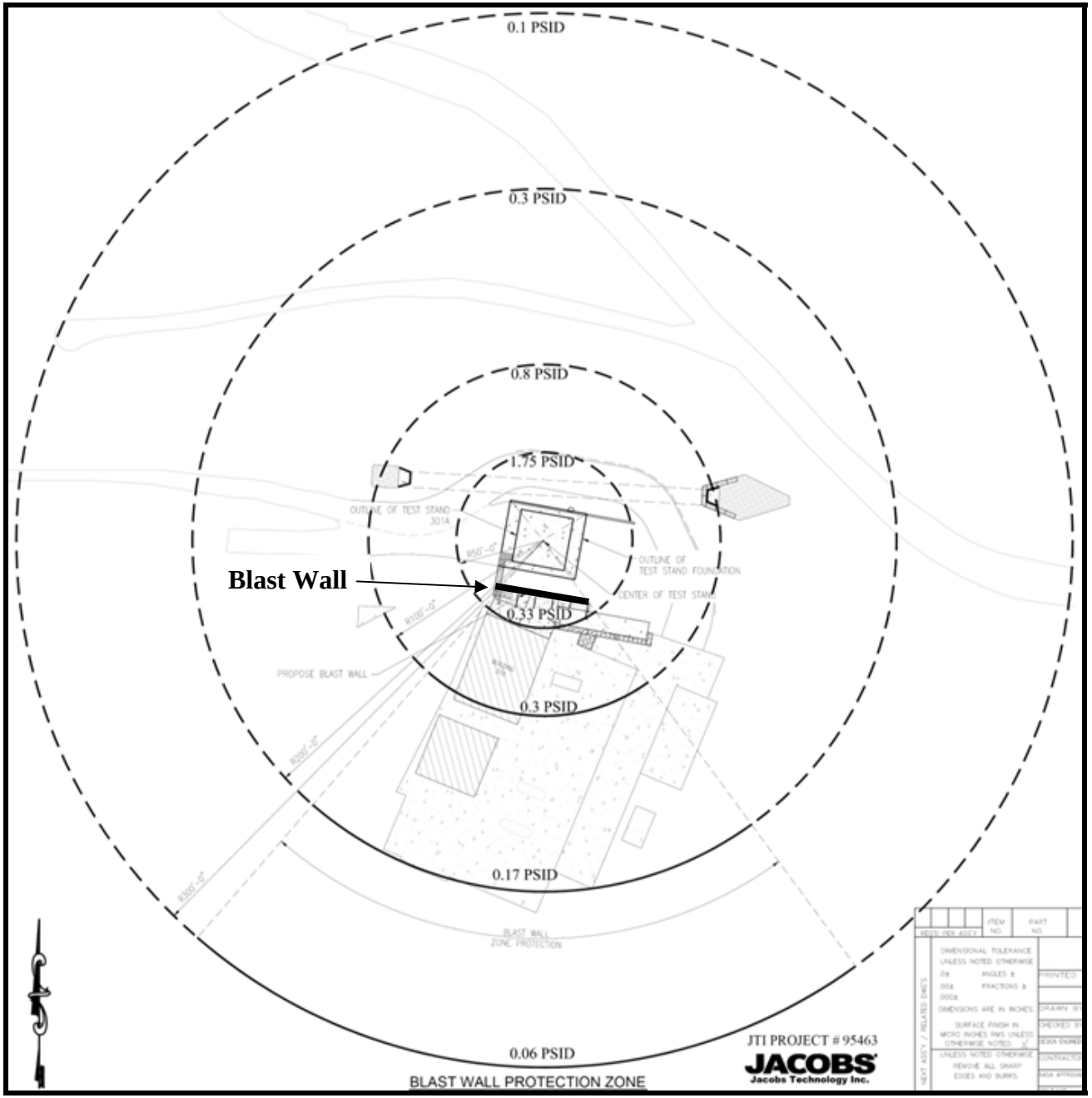



**Figure 3**

Overpressure Map for Proposed Test

**Figure 4** **300 Area Overpressure Protection**

(SEE NEXT PAGE)

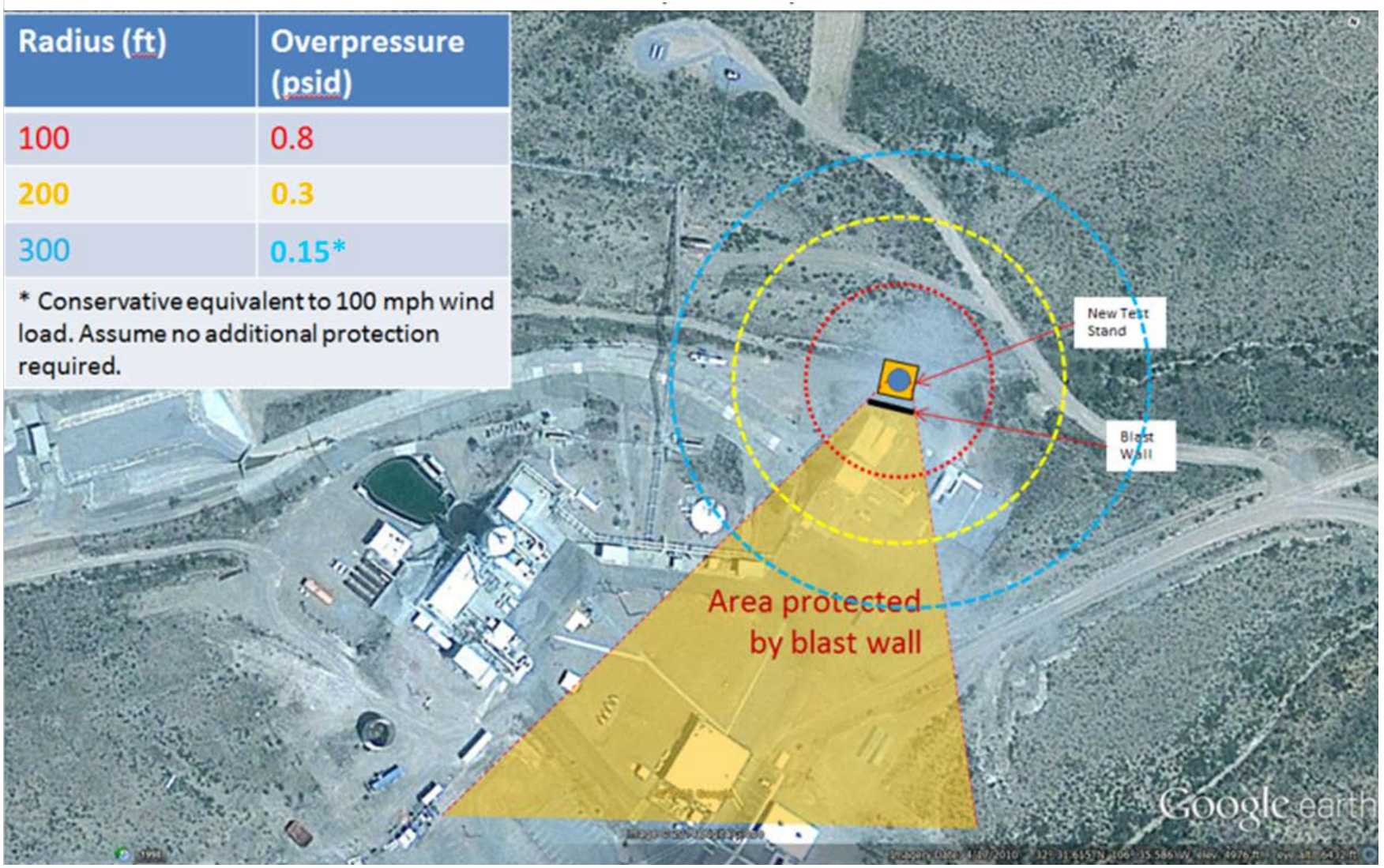



**Figure 4**

300 Area Overpressure Protection

**Figure 5 Proposed Location for Test Stand 301A**

(SEE NEXT PAGE)

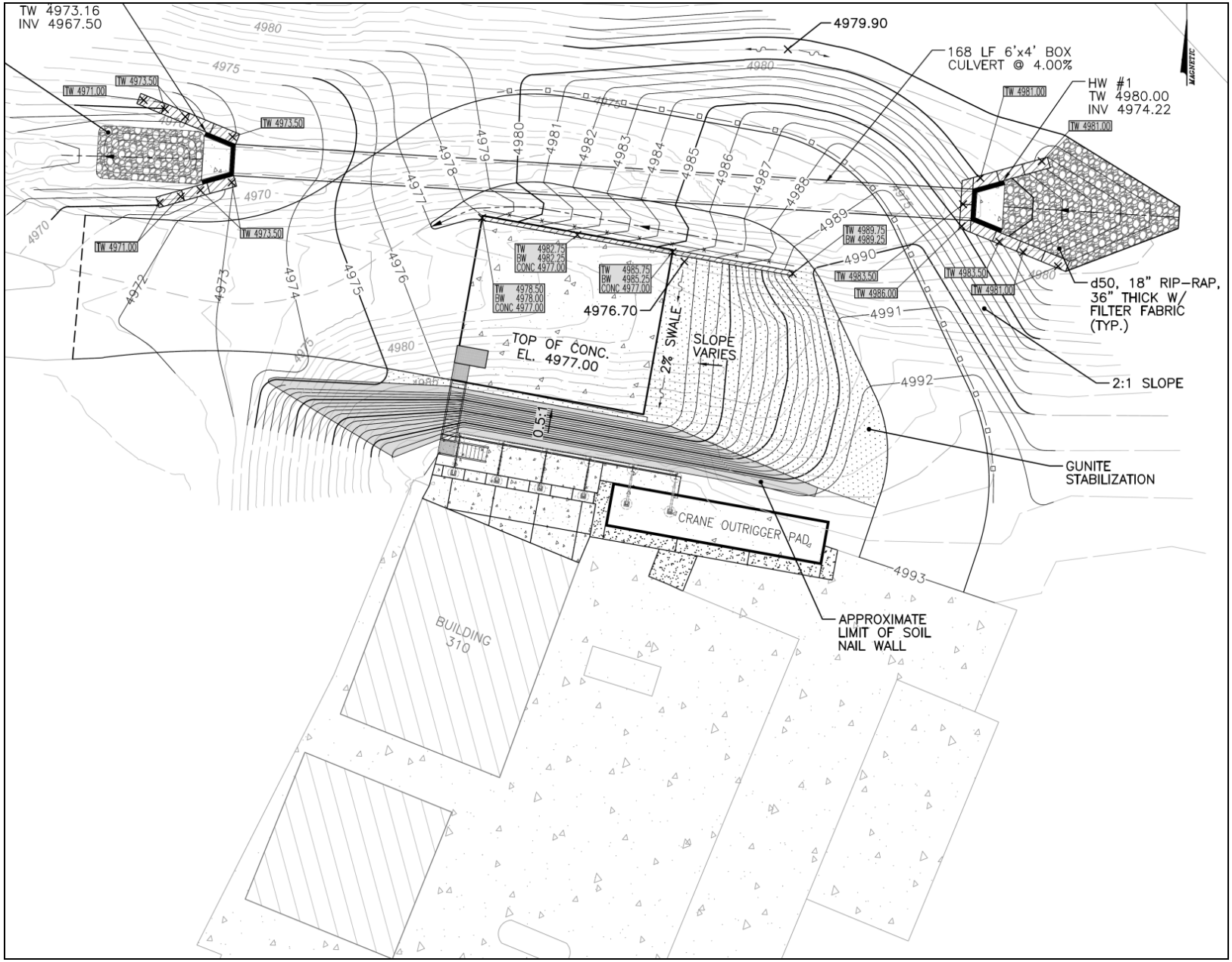



**Figure 5**

Proposed Location for Test Stand 301A

**Figure 6** **Proposed Design of Test Stand 301A**

(SEE NEXT PAGE)

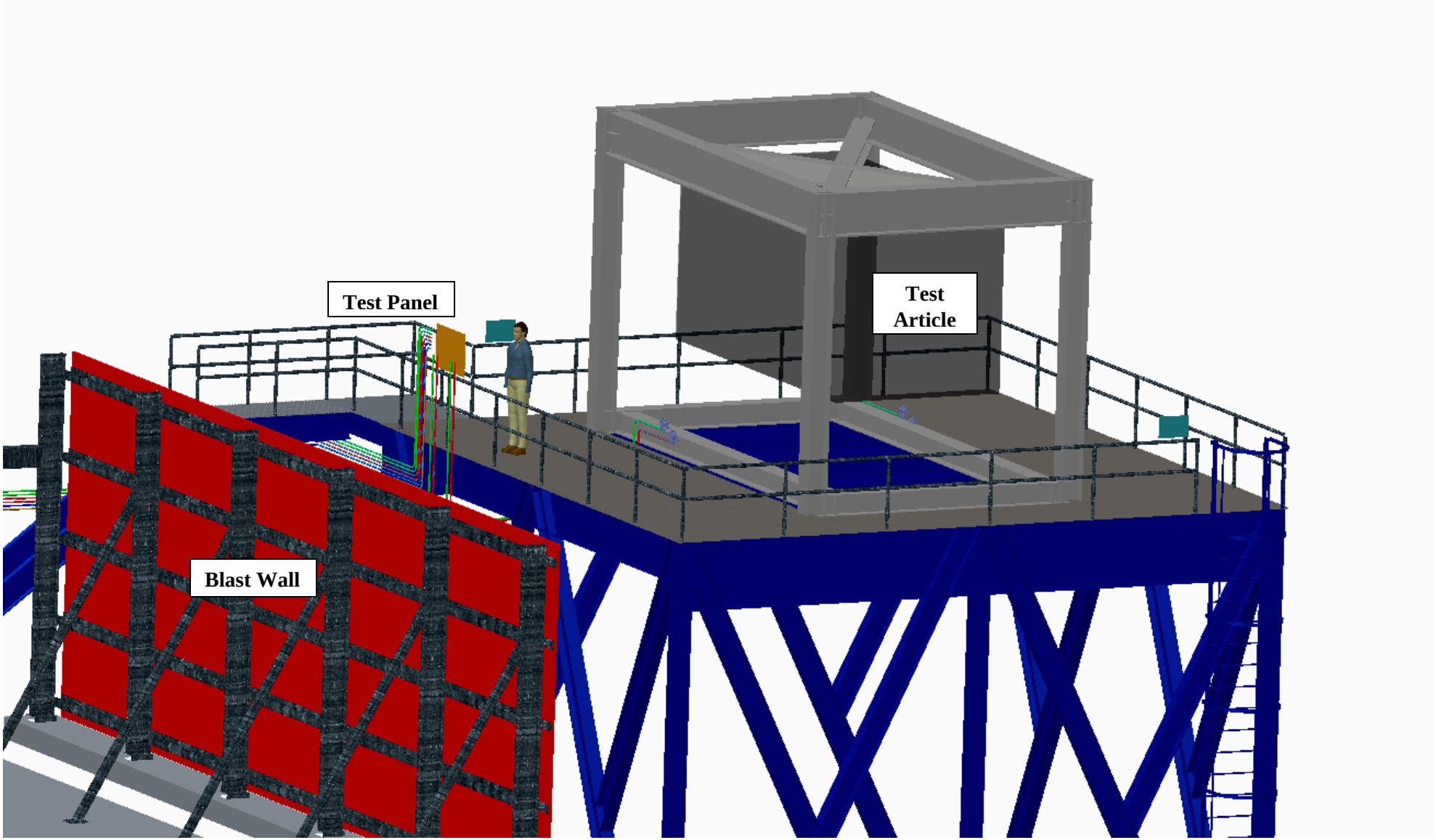



**Figure 6**

Proposed Design of TS 301A

**Figure 7 Proposed Design of Test Stand 301A and Surrounding Buildings**

(SEE NEXT PAGE)

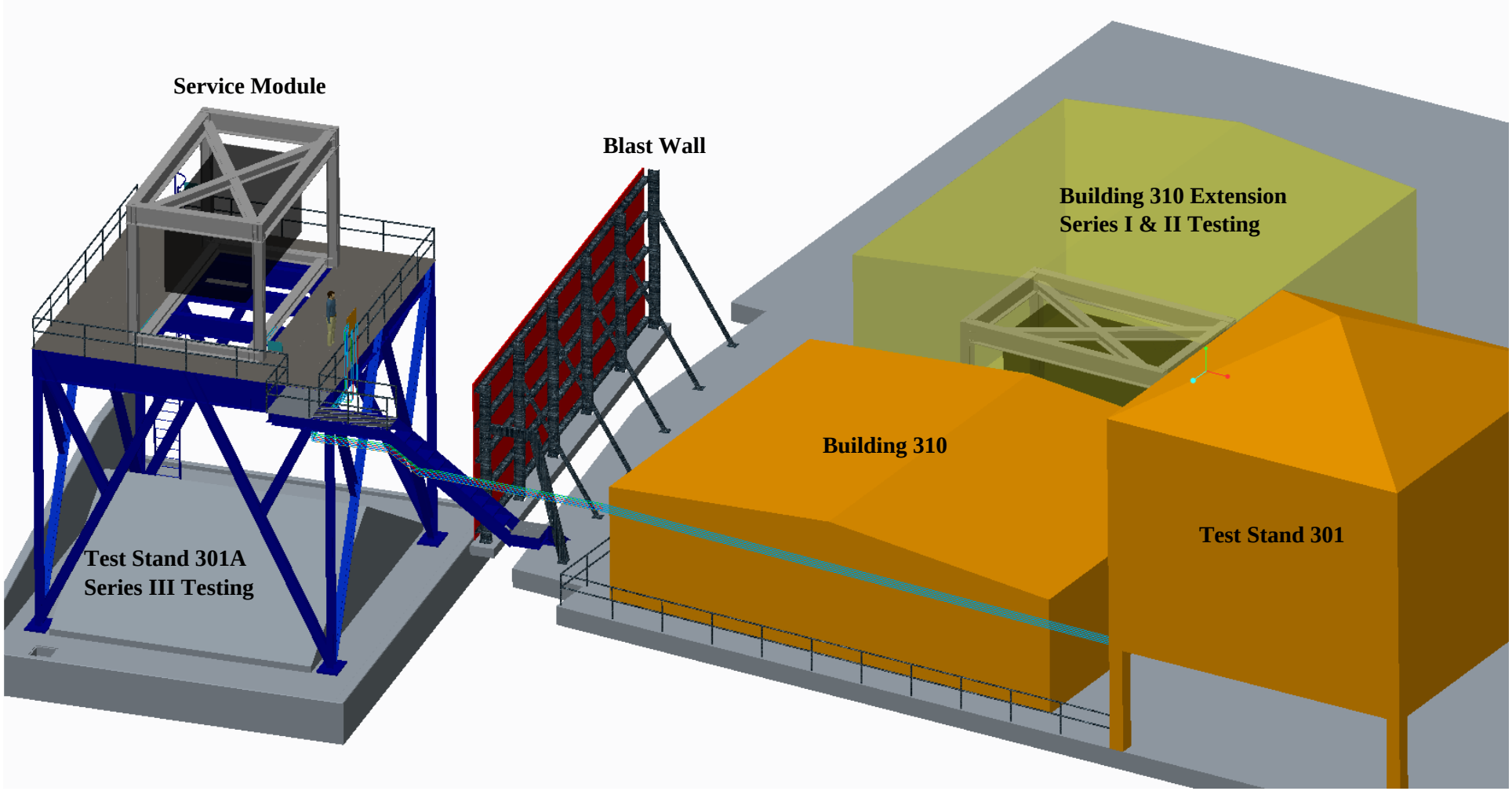



**Figure 7**

Proposed Design of TS 301A

**Figure 8 Estimated WSTF Greenhouse Gases Direct CO2 Emissions for Calendar Year 2011**

(SEE NEXT PAGE)

**Figure 8**
**Estimated WSTF Greenhouse Gases**
**Direct CO2e Emissions in Metric Tons (MT)**
**Calendar Year 2011 = 1238 MT**

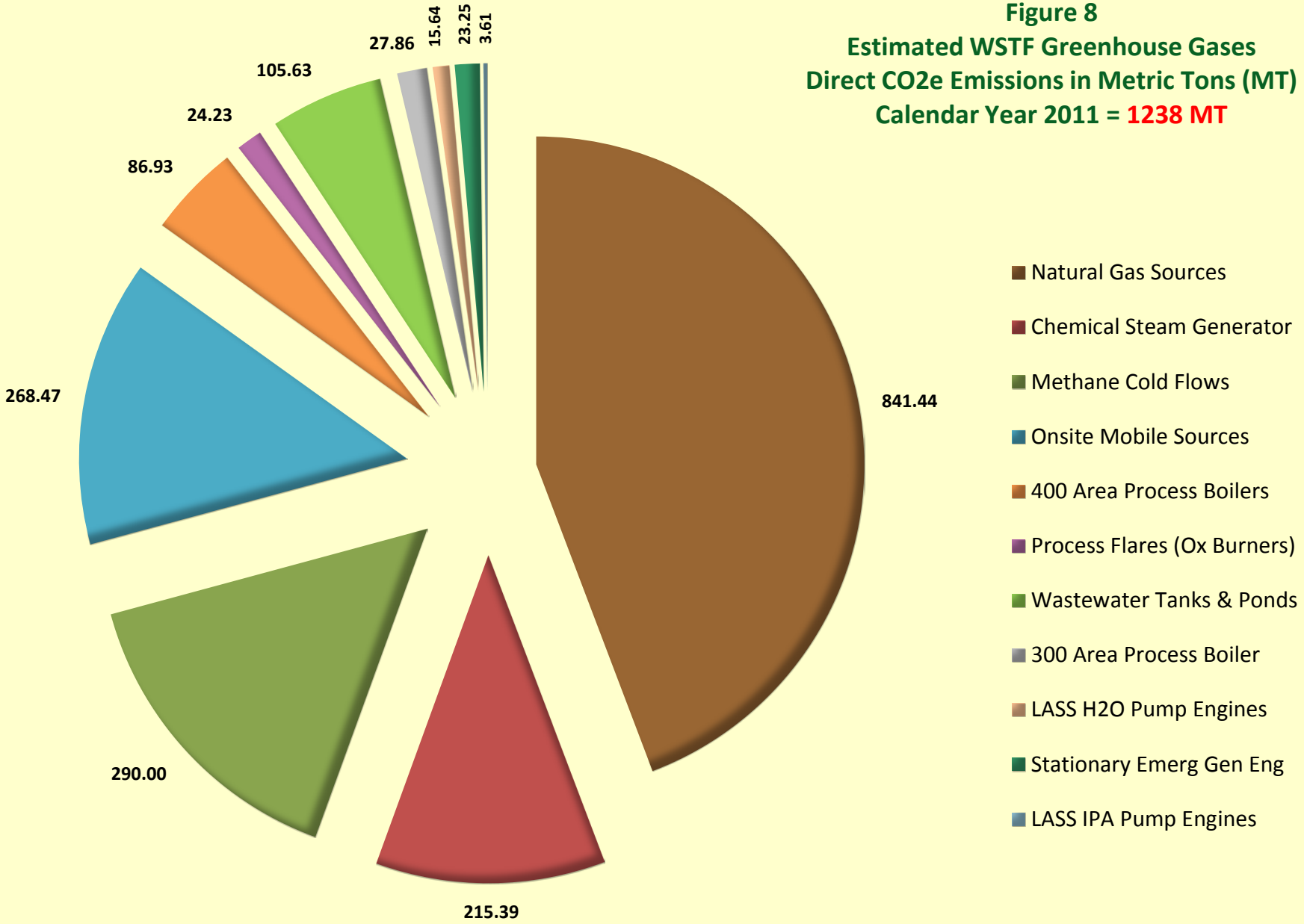


**Figure 9** **300 Area WSTF Cultural Resources**

(SEE NEXT PAGE)

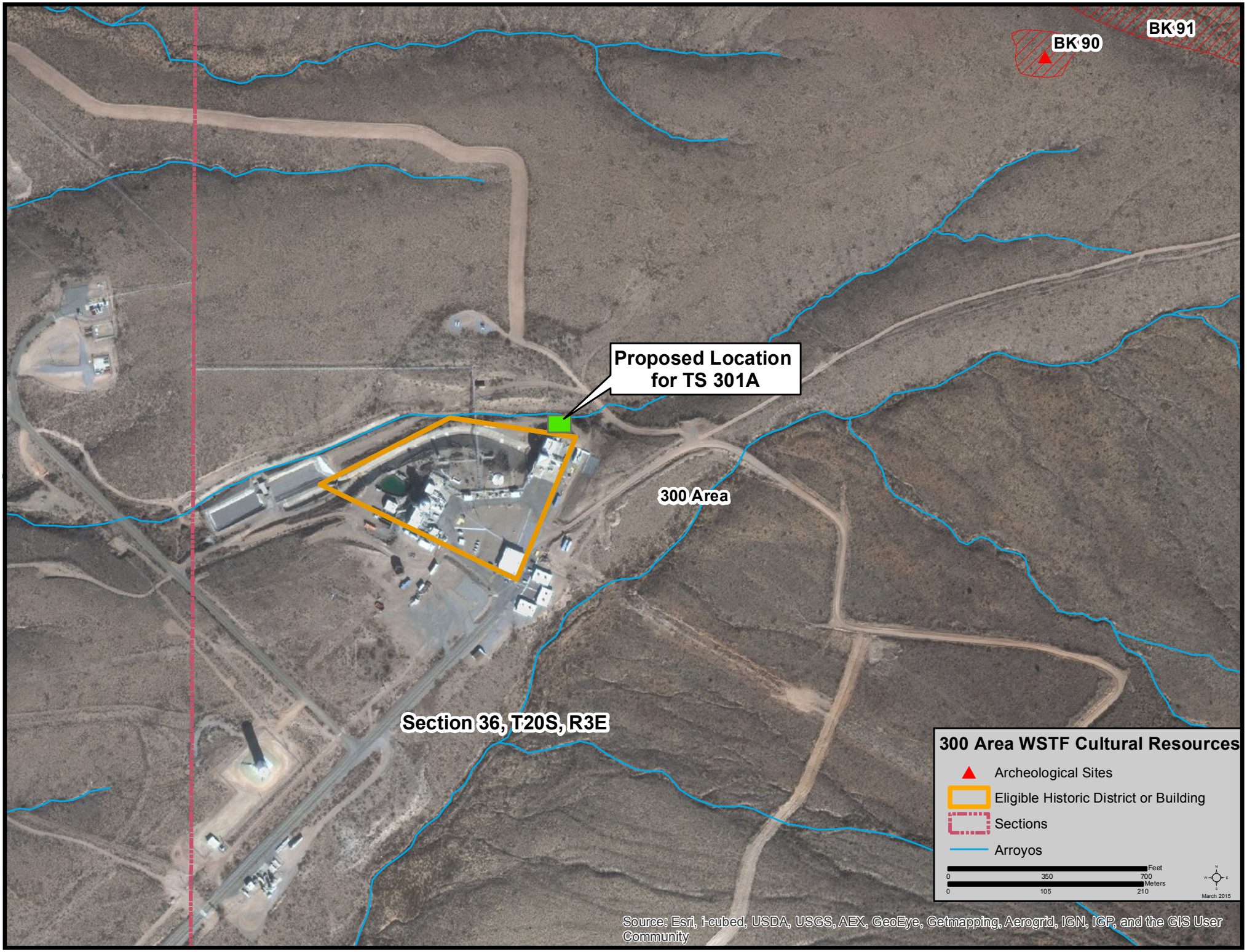

BK 91
BK 90
Proposed Location for TS 301A
300 Area
Section 36, T20S, R3E
300 Area WSTF Cultural Resources
Archeological Sites
Eligible Historic District or Building
Sections
Arroyos
Feet
0
350
700
Meters
0
105
210
March 2015
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

**Figure 10** **300 Area Proposed Test Stand 301A**

(SEE NEXT PAGE)

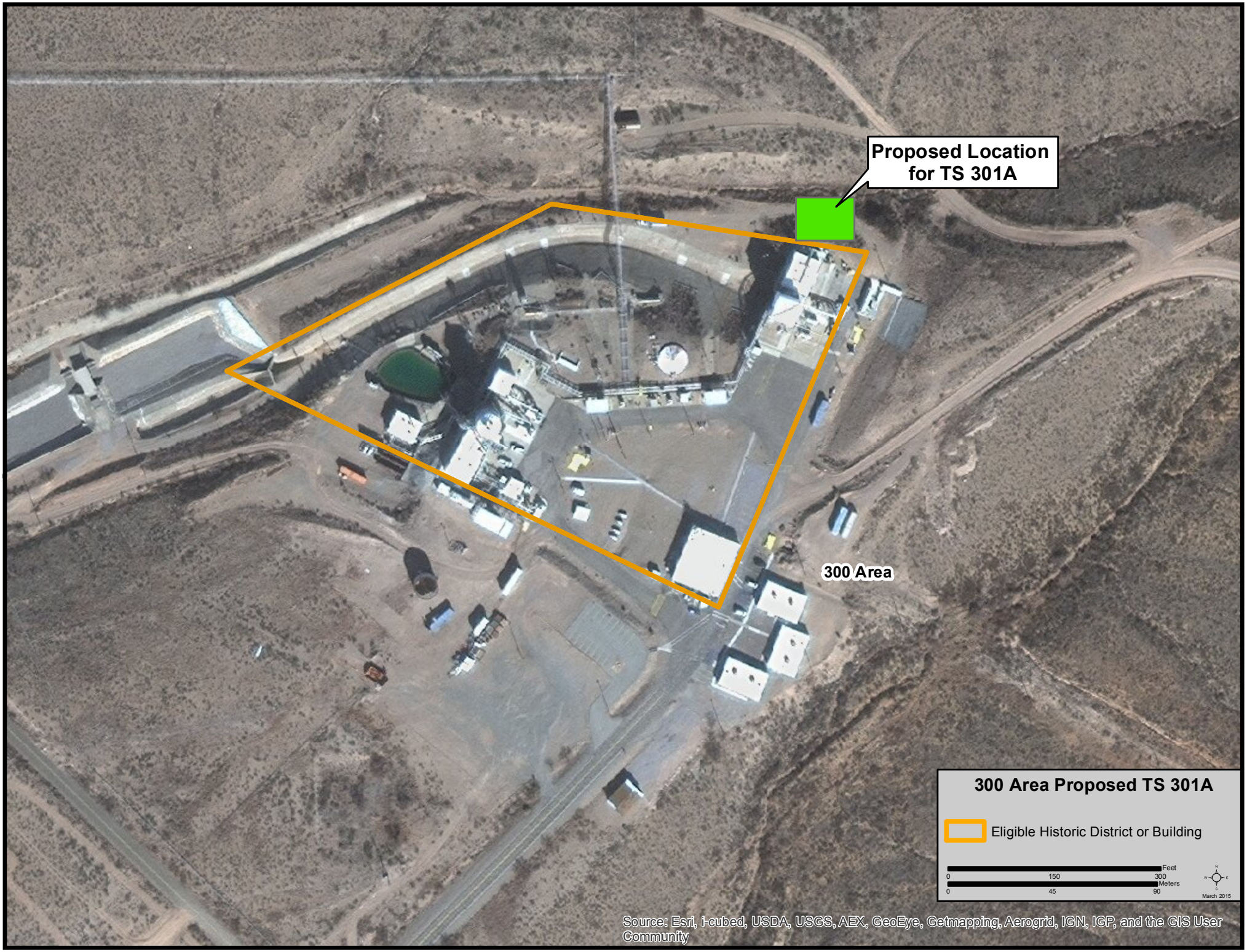
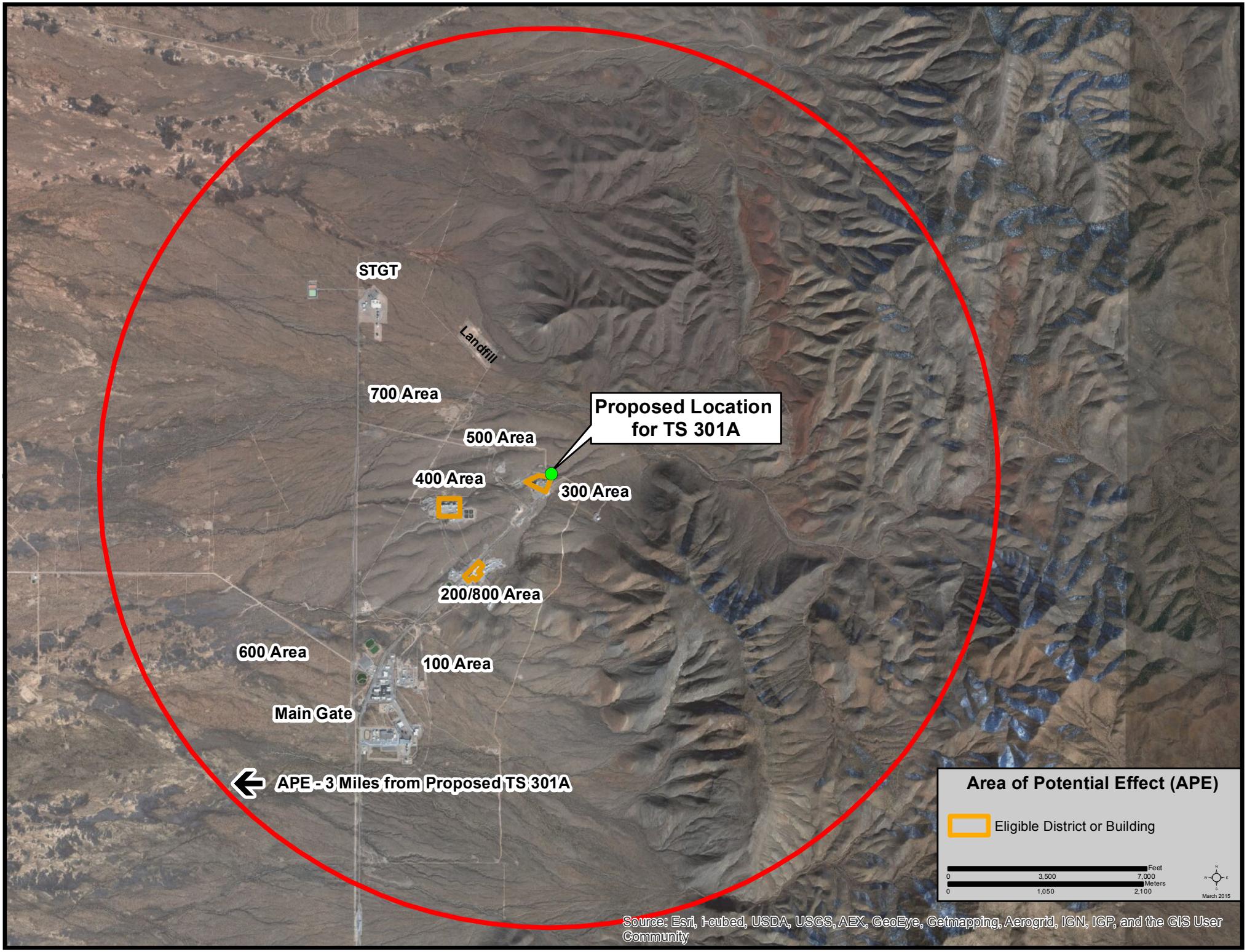

Proposed Location for TS 301A
300 Area
300 Area Proposed TS 301A
Eligible Historic District or Building
Feet
0
150
300
Meters
0
45
90
March 2015
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

**Figure 11** **Areas of Potential Impact (APE)**

(SEE NEXT PAGE)


STGT
Landfill
700 Area
Proposed Location for TS 301A
500 Area
400 Area
300 Area
200/800 Area
600 Area
100 Area
Main Gate
APE - 3 Miles from Proposed TS 301A
Area of Potential Effect (APE)
Eligible District or Building
Feet
0
3,500
7,000
Meters
0
1,050
2,100
March 2015
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

# Tables

**Table 1 Approximate Incident Blast**

| Structural Element | Failure | Overpressure (psid) |
|---|---|---|
| Windows | Shattering usually, occasionally from failure | 0.5-1 |
| Asbestos siding | Shattering | 1-2 |
| Corrugated siding | Connection failure, buckling | 1-2 |
| Wood siding | Usually failure at main connect points | 1-2 |
| Concrete and block wall | Shattering of wall | 2-3 |
| Self-framing steel panel | Collapse | 3-4 |
| Oil storage tanks | Rupture | 3-4 |
| Wooden utility poles | Snapping failure | 5 |
| Loaded rail cars | Overturning | 7 |
| Brick wall panel | Shearing and flexure failure | 7-8 |

(Standard Guidelines for Completion of Safe Separation Distance Analyses, NASA SSC, Unpublished Design Guide)

**Table 2 Federal and State Listed TES Fauna Known or With Potential to Occur at WSTF**

| Common Name | Scientific Name | Federal Status | State Status |
|---|---|---|---|
| | MAMMALS | | |
| Desert bighorn sheep | *Ovis canadensis mexicana* | | Delisted |
| Desert pocket gopher | *Geomys arenarius arenarius* | SOC | |
| Organ Mountains Colorado chipmunk | *Neotamias quadrivittatus australis* | SOC | T |
| Pecos River muskrat | *Ondatra zibethicus ripensis* | SOC | |
| Spotted bat | *Euderma maculatum* | | T |
| Townsend's pale big-eared bat | *Corynorhinus townsendii pallescens* | SOC | |
| Western red bat | *Lasiurus blossevillii* | SOC | |
| White Sands wood rat | *Neotoma micropus leucophaea* | SOC | |
| | 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 ridgwayi* | | E |
| Burrowing owl | *Athene cunicularia hypugaea* | SOC | |
| Common black hawk | *Buteogallus anthracinus 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 | |
| Mountain plover | *Charadrius montanus* | SOC | |
| Neotropic cormorant | *Phalacrocorax brasilianus* | | T |
| Northern goshawk | *Accipiter gentilis atricapillus* | SOC | |
| 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, 2015)

**Table 3 Common Species at White Sands Test Facility**

| Common Name | Scientific Name |
|---|---|
| **Plants and Grasses** | |
| Yucca | *Yucca* |
| Broom snakeweed | *Gutierrezia sarothrae* |
| Honey mesquite | *Prosopis glanulosa* |
| 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* |
| Desert Christmas cactus | *Cylindropuntia leptocaulis* |
| Sand dropseed | *Sporobolus cryptandrus* |
| Blue grama | *Bouteloua gracilis* |
| Bush muhly | *Muhlenbergia porter* |
| Bristlegrass | *Setaria* |
| **Birds** | |
| Quail | *Odontophoridae* |
| Mourning doves | *Zenaida macroura* |
| Roadrunners | *Geococcyx californianus* |
| Hawks | Various species |
| Owls | Various species |
| Ravens | Various species |
| Turkey vultures | *Cathartes aura* |
| Sparrows | Various species |
| Wrens | Various species |
| Flycatchers | Various species |
| **Lizards and Snakes** | |
| Horned lizards | *Phrynosoma* |
| Whiptails | *Aspidoscelis* |
| Collared lizards | *Crotaphytus collaris* |
| Coachwhips | *Masticophis flagellum* |
| Gopher snakes | *Pituophis catenifer* |
| Prairie rattlesnakes | *Crotalus viridis* |
| Western diamondback rattlesnakes | *Crotalus atrox* |
| True toads | *Bufo* |
| Spadefoot toads | *Spea and Scaphiopus* |
| **Fish** | |
| None | |
| **Large and Small Mammals** | |
| Mule deer | *Odocoileus hemionus* |
| Coyote | *Canis latrans* |
| Raccoons | *Procyon lotor* |
| Black-tailed jackrabbit | *Lepus californicus* |
| Desert cottontail | *Sylvilagus audubonii* |
| Wood rats | Various species |

| Common Name | Scientific Name |
|---|---|
| Mice | Various species |

Sullivan & Houde-Nethers, 1996

**Table 4 Common Noise Sources**

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

(NASA, 2015b)

# Appendix A
# Public Comments