Final
Ground Based Strategic Deterrent Test Program
Environmental Assessment / Overseas Environmental Assessment

June 2021

Volume II – Appendices

U.S. Air Force Nuclear Weapons Center
Kirtland Air Force Base, New Mexico

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Volume II

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Acronyms and Abbreviations

30 CES/CEIEA	Space Launch Delta 30, Installation Management Flight, Environmental Conservation
AADT	Annual Average Daily Traffic
ACAM	Air Conformity Applicability Model
ACM	Asbestos-Containing Material
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPAM	Air Force Pamphlet
AFSPC	Air Force Space Command
APCD	Air Pollution Control District
APE	Area of Potential Effects
AQCR	Air Quality Control Region
ARSTRAT	Army Forces Strategic Command
ARTCC	Air Route Traffic Control Center
BASH	Bird/Wildlife Air Strike Hazard
BCC	Birds of Conservation Concern
Be	Beryllium
BMP	Best Management Practice
BOA	Broad Ocean Area
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalRecycle	California Department of Resources Recycling and Recovery
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CBECS	Commercial Buildings Energy Consumption Survey
CBRE	Chemical, Biological, Radiological, and Explosives
CCC	California Coastal Commission
CCR	California Code of Regulations
CCWA	Central Coast Water Authority
Cd	Cadmium
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGP	Construction General Permit
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Equivalent
CPUC	California Public Utilities Commission
Cr	Chromium
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAF	Department of the Air Force
DAPTF	Declining Amphibian Populations Task Force
dB	Decibel(s)
dBA	A-weighted Decibels
DEP	Document of Environmental Protection
DESR	Defense Explosives Safety Regulation
DLA	Defense Logistics Agency
DNL	Day-Night Level
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOE	Department of Energy
DOT	Department of Transportation
DPG	Dugway Proving Ground
DPM	Diesel Particulate Matter
DPU	Division of Public Utilities
DU	Depleted Uranium
DWMRC	Division of Waste Management and Radiation Control
DWR	Department of Water Resources
EA	Environmental Assessment

EA/OEA	Environmental Assessment/ Overseas Environmental Assessment
eDASH	an Air Force Sharepoint electronic dashboard tool
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIA	Energy Information Administration
EIAP	Environmental Impact Analysis Process
EISA	Energy Independence and Security Act
EO	Executive Order
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
EUL	Enhanced Use Lease
FAA	Federal Aviation Administration
FDE	Force Development Evaluation
FONSI	Finding of No Significant Impact
FR	Federal Register
ft^2	Square Feet
ft^3	Cubic Feet
FTS	Flight Termination System
FTU	Formal Training Unit
FY	Fiscal Year
g	Gram(s)
GBSD	Ground Based Strategic Deterrent
GHG	Greenhouse Gas
gpd	gallons per day
GVWR	Gross Vehicle Weight Rating
HAFB	Hill Air Force Base
HAP	Hazardous Air Pollutants
HAPC	Habitat Areas of Particular Concern
HCl	Hydrogen Chloride
HMMP	Hazardous Materials Management Plan
HVAC	Heating, Ventilation, and Air Conditioning
HWMP	Hazardous Waste Management Plan
I-	Interstate Highway
ICAO	International Civil Aviation Organization
ICBM	Intercontinental Ballistic Missile
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
KMISS	Kwajalein Missile Impact Scoring System
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt Hour
LBP	Lead Based Paint
LCU	Landing Craft Utility
LF	Launch Facility
LLNL	Lawrence Livermore National Laboratory
LOA	Letter of Authorization
LOS	Level of Service
MAF	Missile Alert Facility
MBTA	Migratory Bird Treaty Act
mcf	Million Cubic Feet
MEC	Munitions and Explosives of Concern
MGS	Missile Guidance Set
mi	Mile(s)
MIF	Mission Integration Facility
mmBtu/hr	Million British Thermal Units per Hour
MMPA	Marine Mammal Protection Act
MMRP	Military Munitions Response Program
MOA	Memorandum of Agreement
mph	Miles per Hour
MRS	Munition Response Sites
MS4	Municipal Separate Storm Sewer System
MSA	Munitions Storage Area
MSGP	Multi-Sector General Permit
MSRS	ManTech SRS Technologies Inc

MW	Megawatt(s)
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NDSD	North Davis Sewer District
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
nm	Nautical Mile(s)
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NTM	Notice to Mariners
HWSF	Hazardous Waste Storage Facility
O_3	Ozone
OAQPS	Office of Air Quality Planning and Standards
OEA	Overseas Environmental Assessment
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Programmatic Agreement
Pb	Lead
PBACM	Post-Boost Altitude Control Module
PBPS	Post Boost Propulsion System
PBV	Post-Boost Vehicle
PCB	Polychlorinated Biphenyl
PFMC	Pacific Fisheries Management Council
PG&E	Pacific Gas and Electric
PK PLTF	Peacekeeper Proof Load Test Facility
PM	Particulate Matter Pollution
PM_{10}	Particulate Matter Less than or Equal to 10 Microns
$PM_{2.5}$	Particulate Matter Less than or Equal to 2.5 Microns
PNNL	Pacific Northwest National Laboratory
ppb	Parts per Billion
ppm	Parts Per Million
PRS	Payload Re-entry System
PSC	Public Service Commission of Utah
PSD	Prevention of Significant Deterioration
PSRE	Propulsion System Rocket Engine
PSS	Physical Security System
PSSTF	Physical Security System Test Facility
PV	Photovoltaic
QRP	Qualified Recycling Program
RCC	Range Commanders Council
RMI	Republic of the Marshall Islands
RMI EPA	Republic of the Marshall Islands Environmental Protection Authority
ROI	Region of Influence
RS	Reentry System
RSL	Regional Screening Level
RSLP	Rocket System Launch Program
RTS	Ronald Reagan Ballistic Missile Defense Test Site
RV	Reentry Vehicle
SBCAPCD	Santa Barbara County Air Pollution Control District
SDZ	Surface Danger Zone
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLC	Space Launch Complex

SLD	Space Launch Delta 30
SMAC	Software Mission Assurance Center
SMIC	Strategic Missile Integration Center
SO_2	Sulfur Dioxide
SO_x	Oxides of Sulfur
SR-	State Route
SSC	Species of Special Concern
SWI	Space Wing Instruction
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACC	Training and Collaboration Center
TAZ	Traffic Analysis Zone
TCLP	Toxicity Characteristic Leaching Procedure
TIF	Temporary Integration Facility
TP	Test Pad
tpy	Tons Per Year
TT	Thrust Termination
U	Uranium
U.S.	United States
UCAR	University Corporation for Atmospheric Research
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UES	USAKA Environmental Standards
UFC	Unified Facilities Criteria
ULA	United Launch Alliance
UOSH	Utah Occupational Safety and Health
UPDES	Utah Pollutant Discharge Elimination System
US-	U.S. Highway
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USAFGSC	United States Air Force Global Strike Command
USAG-KA	United States Army Garrison – Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USAPHC	United States Army Public Health Center
USASMDC	United States Army Space and Missile Defense Command
USASSDC/TBE	United States Army Space and Strategic Defense Command and Teledyne Brown Engineering
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UXO	Unexploded Ordnance
VAFB	Vandenberg Air Force Base
VLC	Vandenberg Launch Center
VOC	Volatile Organic Compound
VSFB	Vandenberg Space Force Base
WAP	Waste Analysis Plan
WFRC	Wasatch Front Regional Council
WPRFMC	Western Pacific Regional Fishery Management Council
WSC	Water Systems Consulting, Inc.
WWTP	Wastewater Treatment Plant
yd^3	Cubic Yard(s)
$\mu g/m^3$	Microgram per cubic meter

A

Agency Correspondence

From: PORTECK, KEVIN G GS-14 USAF AFMC AFCEC/CZTQ <kevin.porteck@us.af.mil>
Sent: Monday, November 16, 2020 10:16 AM
To: steve.kolinski@noaa.gov
Cc: dan_polhemus@fws.gov; McCarroll.John@epa.gov; kanalei.shun@usace.army.mil; morianaphillip.rmiepa@gmail.com; Karen Hoksbergen; NEWCOMER, STEPHANIE H GS-13 USAF AFMC AFCEC/CZN; JURENA, PAUL N GS-13 USAF AFMC AFCEC/CZTQ; ACKERMAN, MICHAEL D CIV USAF AFMC AFCEC/CZN
Subject: Request for Formal Consultation & Biological Assessment for GBSD at Kwajalein Atoll, RMI
Attachments: GBSD Kwajalein Final BA 20201105.pdf

Follow Up Flag:
Flag Status:

Dr. Steve Kolinski, PhD
National Marine Fisheries Service
Pacific Islands Regional Office
1845 Wasp Boulevard, Building 176
Honolulu, HI 96818

Dear Dr. Kolinski,

The United States Air Force (USAF), Air Force Civil Engineering Center (AFCEC), in coordination with the Air Force Nuclear Weapons Center, and with the assistance of the U.S. Army Space and Missile Defense Command, submits the attached Biological Assessment (BA) and request initiation of formal consultation in accordance with Section 3-4 of the U.S. Army Kwajalein Atoll Environmental Standards (UES). The attached BA evaluates the effects of the proposed Ground Based Strategic Deterrent (GBSD) Test Program on protected biological resources on Kwajalein Atoll and adjacent near shore environment.

The Ground Based Strategic Deterrent system represents a modernization of the United States' land-based nuclear arsenal, and is expected to eventually replace the aging Minuteman III intercontinental ballistic missile system. The GBSD Test Program will require booster development and flight testing of the proposed GBSD weapon system. Implementation of the test program would include facility construction or modifications at Hill Air Force Base, Vandenberg Air Force Base (VAFB), and Dugway Proving Ground. GBSD missile flight test activities would be launched from VAFB and include target impacts at United States Army Garrison – Kwajalein Atoll sites in the Republic of the Marshall Islands (RMI). GBSD Test Program activities at Kwajalein Atoll (Proposed Action) would include pre-flight preparation activities, impact of test reentry vehicles, and post-flight operations. The proposed action would occur between Fiscal Years 2024 and 2029.

The USAF prepared the attached Biological Assessment (BA) to evaluate the effects of the Proposed Action on species listed as consultation species under Section 3-4 of the U.S. Army Kwajalein Atoll Environmental Standards (UES). As described in the enclosed Biological Assessment for GBSD Test Program Activities at Kwajalein Atoll, a number of UES protected species occur or have the potential to occur in the Action Area, and the USAF has evaluated the effects of the Proposed Action on these species and their habitats. The proposed GBSD Test Program activities would be very similar to past and ongoing Minuteman III flight testing in the RMI covered in previous consultations with NOAA Fisheries (PIR-2015-9650) and with the U.S.

Fish and Wildlife Service (2015 with NOAA/NMFS and 2020 with USFWS; details in Section 1.3.1 of enclosed GBSD Test Program Activities at Kwajalein Atoll BA).

Based on analyses of all of the potential stressors resulting from the Proposed Action, the USAF has determined that the Proposed Action would have "no effect" on 15 coral species (*Acanthastrea brevis*, *Acropora aculeius*, *Acropora aspera*, *Acropora dendrum*, *Acropora listeri*, *Acropora speciosa*, *Acropora tenella*, *Acropora vaughani*, *Alveopora verrilliana*, *Leptoseris incrustans*, *Montipora caliculata*, *Pavona cactus*, *Pavona decussata*, *Turbinaria mesenterina*, and *Turbinaria stellulata*) and two mollusk species (*Pinctada margaritifera* and *Tridacna gigas*) that are listed as consultation species under the U.S. Army Kwajalein Atoll Environmental Standards (UES). These species are not known to occur in the portion of the Action Area where they might be exposed to stressors resulting from the Proposed Action.

The USAF has determined that the Proposed Action "may affect but is not likely to adversely affect" 16 cetacean species, two sea turtle species, and seven fish species listed as consultation species under the UES in the Action Area. The species not likely to be adversely affected by the Proposed Action are the cetaceans *Balaenoptera musculus*, *Balaenoptera physalus*, *Delphinus delphis*, *Feresa attenuata*, *Globicephala macrorhynchus*, *Grampus griseus*, *Kogia breviceps*, the Western North Pacific DPS of *Megaptera novaeangliae*, *Mesoplodon densirostris*, *Orcinus orca*, *Peponocephala electra*, *Physeter macrocephalus*, *Stenella attenuata*, *Stenella. coeruleoalba*, *Stenella longirostris*, and *Tursiops truncatus*; the Central West Pacific DPS of green turtle (*Chelonia mydas*); the hawksbill turtle (*Eretmochelys imbricata*); and the fish *Alopias superciliosus*, *Carcharhinus longimanus*, *Cheilinus undulatus*, *Manta alfredi*, *Manta birostris*, *Sphyrna lewini*, and *Thunnus orientalis*. Based on the analysis in the enclosed BA, the effects of the Proposed Action on these species would be insignificant or discountable.

The USAF has determined that the Proposed Action "may affect and is likely to adversely affect" seven coral species and three mollusk species. The species likely to be adversely affected by the Proposed Action are the corals *Acropora microclados*, *Acropora polystoma*, *Cyphastrea agassizi*, *Heliopora coerulea*, *Pavona cactus*, *Pocillopora meandrina*, and *Turbinaria reniformis*; and the mollusks *Hippopus hippopus*, *Tectus niloticus*, and *Tridacna squamosa*. Based on the analysis presented in the enclosed BA, the Proposed Action may adversely affect up to 13,827 coral colonies and 71 individual mollusks.

Because of the potential for adverse effects to UES protected species, the USAF requests initiation of formal consultation with the National Marine Fisheries Service under Section 3-4.5 of the UES for potential effects in the RMI to *Acropora microclados*, *Acropora. polystoma*, *Cyphastrea agassizi*, *Heliopora coerulea*, *Pavona cactus*, *Pocillopora meandrina*, *Turbinaria reniformis*, *Hippopus hippopus*, *Tectus niloticus*, and *Tridacna squamosa*. The USAF also requests your written concurrence with our determinations for those species the U.S. Army has determined as may affect but is not likely to be adversely affected by the Proposed Action.

In accordance with 50 CFR 402.14(l), the USAF requests that NOAA Fisheries agree to expedited consultation by mutual agreement to complete consultation with receipt of the Biological Opinion by 26 February 2021. We request expedited consultation based upon two factors: (1) the GBSD is a high-priority project for the Department of Defense to meet national security objectives, and (2) effects of the proposed GBSD Test Program activities would be very similar to past and ongoing Minuteman III flight testing evaluated in previous ESA Section 7 consultations. As indicated in the attached BA, ongoing avoidance, minimization, and mitigation measures implemented for the Minuteman III program would be continued with the GBSD Test Program.

We would greatly appreciate your acknowledgement in writing (electronic mail will be sufficient) that all necessary information has been received and that the consultation has been initiated, and acceptance of the proposed expedited consultation conclusion date. As with most consultations under Section 3-4.5 of the UES, we would greatly appreciate an opportunity to review a draft of your Biological Opinion before it is finalized. The USAF will prioritize our review and response to that document in order to meet the project schedule.

Copies of this letter and Biological Assessment shall be sent to Ms. Moriana Phillip, Republic of the Marshall Islands Environmental Protection Authority – Majuro; Kanalei Shun, U.S. Army Corps of Engineers; Mr. John McCarroll, U.S. Environmental Protection Agency; and Dr. Dan Polhemus, Pacific Islands Fish and Wildlife Office.

Primary Air Force contacts for this consultation request are Mr. Kevin Porteck, phone: 210-382-6591, email: kevin.porteck@us.af.mil, and Dr. Paul Jurena, phone: 210-478-6073, email: paul.jurena.1@us.af.mil.

Sincerely,

KEVIN PORTECK, GS-14, DAF
Natural Resources SME
AFCEC/CZTQ

Attachment:
Biological Assessment for GBSD Test Program Activities

cc:
Ms. Moriana Phillip, RMI EPA
Ms. Kanalei Shun, USACE
Mr. John McCarroll, U.S. EPA
Dr. Dan Polhemus, USFWS PIFWO

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
30TH SPACE WING

19 November, 2020

Mr. Stephen Henry
United States Fish and Wildlife Service
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, CA 93003

Dear Mr. Henry,

The United States Air Force (USAF) 30th Space Wing, Installation Management Flight, Environmental Conservation Branch (30 CES/CEIEA) is assisting the USAF Nuclear Weapons Center, the aetion proponent. in evaluating the effects of proposed Ground Based Strategic Deterrent (GBSD) Test Program activities at Vandenberg Air Force Base (VAFB) California. The GBSD system represents a modernization of the United States' land-based nuelear arsenal and is expected to eventually replace the aging Minuteman III intercontinental ballistic missile system. The GBSD Test Program would implement booster development and flight testing of the proposed GBSD weapon system. Implementation of the test program would include facility construction and modifications at VAFB, as well as at Hill Air Force Base and Dugway Proving Ground in northern Utah (there are no anticipated effects to listed species at either of those two locations). At VAFB, a combination of new and existing facilities would be used in support of the GBSD Test Program. A total of eight new GBSD facilities and infrastructure elements (new utility and communications infrastructure) are proposed for construetion on VAFB.

The USAF has prepared a Biological Assessment (BA, enclosed) to evaluate the effects of the proposed construction of new GBSD facilities and infrastructure at VAFB on species listed as endangered or threatened under the Endangered Species Act (ESA) and on designated Critical Habitat. We would like to emphasize that this BA discusses impacts of construction and utility extensions; upon completion of construction, all flight test operations would be authorized under our existing Programmatic Biological Opinion.

As described in the enclosed BA, four ESA-listed species occur or have the potential to occur in the new construction Action Area at VAFB. Based on analyses of the potential effects of the Proposed Action, including the proposed avoidance, minimization, and monitoring measures, the USAF has determined that the Proposed Action "May affect and is likely to adversely affect" vernal pool fairy shrimp (*Branchinecta lynchi*), California red-legged frog (*Rana draytonii*), and Gaviota tarplant (*Deinandra increscens villosa*). The USAF has also determined that the Proposed Action "May affect but is not likely to adversely affect" Lompoc yerba santa (*Eriodictyon capitatum*). Our determination on this species is "Discountable" considering extensive proposed monitoring measures; we request your concurrence with this determination. The project will not effect designated Critical Habitat for any species.

Because of the potential for adverse effects to ESA protected species, the USAF would like to initiate formal consultation with the United States Fish and Wildlife Service under section 7 of the ESA for the effects of the Proposed Action at VAFB. We would greatly appreciate acknowledgement in writing (electronic mail will be sufficient) that all necessary information has been received and that the consultation has been initiated.

As with most section 7 consultations, we would greatly appreciate an opportunity to review a draft of your Biological Opinion before it is finalized. My staff will prioritize their review and response to that document in order to meet the project schedule. Additionally, as discussed between Mr. York and your staff prior to our submitting this BA, we request "expedited consulation," as GBSD is a high-priority project for VAFB. To meet the Air Force's accelerated schedule for this important national defense project we respectfully request a draft BO by 6 January and a final BO no later than 11 January 2021. We will gladly discuss reprioritization of existing VAFB consultations to meet this timeline.

Please contact Rhys Evans if you have any questions or concerns regarding this consultation request at (805) 606-4198 or via electronic mail at rhys.evans@spaceforce.mil.

Sincerely,

BEATRICE L. KEPHART
Chief, Installation Management Flight

Enclosure:
Biological Assessment

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
JOINT BASE SAN ANTONIO LACKLAND TEXAS

November 16, 2020

Mr. Kevin G Porteck, AFCEC/CZTQ
Air Force Civil Engineer Center
2261 Hughes Ave, Ste 155
JBSA Lackland, TX 78236-9853

Kasia Mullett
Field Supervisor, Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service, Ecological Services
300 Ala Moana Blvd Rm 3-122
Honolulu, HI 96850

Dear Ms. Mullet,

The United States Air Force (USAF), Air Force Civil Engineering Center (AFCEC), in coordination with the Air Force Nuclear Weapons Center, and with the assistance of the U.S. Army Space and Missile Defense Command, submits the attached Biological Assessment (BA) and request informal consultation in accordance with Section 3-4 of the U.S. Army Kwajalein Atoll Environmental Standards (UES). The attached BA evaluates the effects of the proposed Ground Based Strategic Deterrent (GBSD) Test Program on protected biological resources on Kwajalein Atoll and adjacent near shore environment.

The GBSD system represents a modernization of the United States' land-based nuclear arsenal and is expected to eventually replace the aging Minuteman III intercontinental ballistic missile system. The GBSD Test Program would implement booster development and flight testing of the proposed GBSD weapon system. Implementation of the test program would include facility construction or modifications at Hill Air Force Base, Vandenberg Air Force Base (VAFB), and Dugway Proving Ground. GBSD flight test activities would be conducted from VAFB in California and include target impacts at United States Army Garrison – Kwajalein Atoll sites in the Republic of the Marshall Islands (RMI). GBSD Test Program activities at Kwajalein Atoll (Proposed Action) would include pre-flight activities, flight and impact of reentry vehicles, and post-flight recovery operations. Operations would occur between Fiscal Year 2024 and 2029, and would be very similar to past and ongoing Minuteman III flight testing in the RMI.

The USAF has prepared a Biological Assessment (BA) to evaluate the effects of the Proposed Action on species listed as consultation species under Section 3-4 of the U.S. Army Kwajalein Atoll Environmental Standards (UES). As described in the enclosed GBSD Test Program Activities at Kwajalein Atoll BA, a number of UES protected species occur or have the potential to occur in the Action Area and the USAF has evaluated the effects of the Proposed Action on these species and their habitats.

Based on analyses of all of the potential stressors resulting from the Proposed Action, the USAF has determined that the Proposed Action "may affect but is not likely to adversely affect" nesting or hauled-out sea turtles protected under Section 3-4 of the UES, specifically the Central West Pacific DPS of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*). Based on the analysis in the enclosed BA, the effects of the Proposed Action on these species would be insignificant or discountable as no sea turtle nests or nesting activity have been observed on Illeginni Islet in over 20 years.

The USAF requests initiation of informal consultation with the U.S. Fish and Wildlife Service under Section 3-4.5 of the UES, and requests your written concurrence if you agree with our determinations. We would greatly appreciate acknowledgement in writing (electronic mail will be sufficient) that all necessary information has been received and sufficient to initiate informal consultation.

I am also providing copies of this letter and the BA to Ms. Moriana Phillip, Republic of the Marshall Islands Environmental Protection Authority – Majuro; Kanalei Shun, U.S. Army Corps of Engineers; Mr. John McCarroll, U.S. Environmental Protection Agency; and Dr. Steve Kolinski, National Marine Fisheries Service, Pacific Islands Regional Office.

Primary Air Force contacts for this consultation request are Mr. Kevin Porteck, phone: 210-382-6591, email: kevin.porteck@us.af.mil, and Dr. Paul Jurena, phone: 210-478-6073, email: paul.jurena.1@us.af.mil.

Sincerely,

PORTECK.KEVIN.G.1231035490 Digitally signed by PORTECK.KEVIN.G.1231035490 Date: 2020.11.16 21:18:18 -06'00'

KEVIN PORTECK, GS-14, DAF
Natural Resources SME
AFCEC/CZTQ

Attachment:
Biological Assessment

cc:
Ms. Moriana Phillip, RMI EPA
Ms. Kanalei Shun, USACE
Mr. John McCarroll, U.S. EPA
Dr. Steve Kolinski, NOAA/NMFS
Dr. Dan Polhemus, USFWS
Mr. Darren LeBlanc, USFWS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

In Reply Refer To:
01EPIF00-2021-I-0058

January 7, 2021

Mr. Kevin Porteck
Natural Resources, AFCEC/CZTQ
U.S. Air Force Civil Engineer Center
2261 Hughes Ave, Ste 155
JBSA Lackland, TX 78236-9853

Subject: U.S. Air Force Ground Based Strategic Defense Test Program at Kwajalein Atoll

Dear Mr. Porteck:

The U.S. Fish and Wildlife Service (USFWS) received your November 16, 2020 letter, requesting consultation for the Ground Based Strategic Defense Test Program (GBSD) at Kawajalein Atoll. You requested our concurrence with your "may affect, but not likely to adversely affect" determination for the Central West Pacific Distinct Population Segment of green sea turtle, or honu (*Chelonia mydas*) and the Hawskbill sea turtle, or honu'ea (*Eretmochelys imbricata*). We based our analysis and decisions on the Biological Assessment for this project and other pertinent data. A complete record of the consultation is on file at our office. Our response is in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq*.).

Project Description

The proposed activities include missile flight tests that are launched from Vandenberg Air Force Base, in California, and impact land or water near Illeginni Islet or the water near the Kwajalein Missile Impact Scoring System (KMISS) area, both on Kwajalein Atoll, in the Republic of the Marshall Islands (Figure 1). The maximum area of effect from a test missile at Illeginni Islet would be where the crater and debris field occur from the test missile impact with land. The craters may be as wide as approximately 9 m and as deep as 3 m. The debris field around the craters may extend approximately 91 m from the location of impact. The maximum area of effect in the water extends approximately 800 m from the location of impact. Because USFWS jurisdiction for sea turtles only applies to their use of land, this consultation only addresses effect to sea turtles on land.

Activities occuring at Kwajalein Atoll include pre-flight preparations, flight test impact, and post-flight operations. The USAF proposes to conduct up to nine flight tests per year that would affect Kwajalein Atoll. These tests will occur between Fiscal Year 2024 and 2029, each containing up to three test missiles during each flight test, for a total of 27 missile impacts

potentially affecting Kwajalein Atoll. Some of these flight tests may instead impact areas other than Kwajalein Atoll; however, the USAF assumes all the flights may impact the Atoll for the purposes of this consultation. Most of these nine flight tests would be targeted for the KMISS area, which extends three nautical miles offshore, just east of Gagan Islet or in deep water near Illeginni Islet. However, at least one flight test would make impact on the land area at Illeginni Islet, with up to three test missile impacts to the Islet through Fiscal Year 2029.

Figure 1. Test missile impact areas at Kwajalein Atoll.

The test missiles contain fuel, ignition assemblies, ordnance, generators, and a destruct package for the flight termination system. Test missiles do not contain any fissile (nuclear) materials, but do contain some hazardous materials, including batteries, asbestos, depleted uranium, and other heavy metals. Uranium is radioactive, is nearly twice as dense as lead, and small amounts occur naturally in the environment. Depleted uranium is a non-fissile (nuclear) byproduct of the enrichment process used to make weapons grade U-235. Depleted uranium retains the natural toxicological properties of Uranium, but approximately half the radiological activity. Each test missile may contain aproximately 1,000 grams of silver and zinc battery, 623 grams of asbestos,

10 grams of beryllium, cadmium, and chromium (combined), 136 grams of lead, and 84,000 grams of depleted uranium.

Pre-flight activities include transporting personnel and equipment to the test missile impact areas using vessels and helicopters. Up to 17 sensor rafts are deployed in water deeper than 3 m by vessels near the anticipated impact locations. Rafts are 2.7 by 4.6 m, contain sensors, detectors, cameras, hydrophones, and video equipment, and are kept in place by battery-powered trolling motors; anchors are not used. Portable camera stands will be set up on the western side of Illeginni Islet prior to testing. Equipment is transported to Illeginni Islet by barges or boats.

Flight tests include test-missile impact on the land of Illeginni Islet, where resulting craters and debris fields may form around the impact location. When the test missile strikes land, the soil, rubble, and test missile fragments are ejected outward from the impact site. Most of the test missile debris and displaced earth would remain close to the edge of the crater (based on former observations); however, crater formation may eject materials 60 to 91 m from the crater. Test missile impact on the shoreline can disperse soil and rubble onto shallow nearshore reef flats. Test missile impact in shallow water (depths 3 meters or less) of the reef could create a crater 3 to 4.6 m wide and 0.6 to 1.2 m deep. Prior testing shows that craters are not formed in water deeper than 3 m. The USAF estimates the probability of a test missile impact in shallow-water or reef is between 0.10 and 0.20.

Post-flight activities occur only at Illeginni Islet, and include equipment recovery and clean up on land, in shallow and reef flats, and deeper waters within the lagoon; test missiles that land in deeper water are not recovered. No post-test recovery and clean up occur at the KMISS site. At Illeginni Islet, post-test activities include human activity and vessel use to clean up and recover debris. Backhoes and graders excavate material from craters, where the excavated materials are screened for debris and then the crater is backfilled with the surrounding ejected material. On land, visible debris are collected by hand, including hazardous materials. Debris collection occurs in shallow, nearshore areas when tides and depths allow it. Debris recovery in lagoon or ocean reef flats are coordinated with the National Marine Fisheries Service (NMFS) or the USFWS to identify and use access corridors that avoid adverse effects to protected species and habitats. Debris collection occurs on reefs within 152 to 305 m of the shoreline on the lagoon side of Illeginni Islet. Debris in deeper waters around Illeginni Islet occurs using divers with scuba gear that collect debris by hand (out to 15 to 30 m depths). All recovered debris are packed and shipped back to Kwajalein Islet or the U.S. Pre- and post-flight activities will increase human activity on Illeginni Islet over a 3-month period.

Conservation Measures

The measures described in this section are based on several years of coordination with NMFS and USFWS associated with previous flight testing activities. These conservation measures are part of the proposed action and are included for all activities at Kwajalein Atoll. The conservation measures include the following:

- Sea turtle presence in the impact areas are recorded by helicopter or fixed-wing aircraft overflight surveys that occur three times over the week preceding the flight test, and as close to launch as safely possible. Sightings are reported to the Environmental Engineer,

who maintains records and reports them to NMFS and USFWS. When sea turtle observations occur during post-flight activities, the debris collection is delayed in those areas until the species leaves of their own volition.

- When missile components or debris may affect sensitive areas or biological resources (i.e., sea turtle nesting habitat or coral reef), USFWS or NMFS biologist are consulted for guidance on minimizing impacts to the resources. Protected species may be relocated outside the test missile impact areas.
- Any injured sea turtles (and birds) found at Illeginni Islet will be reported to USFWS and NMFS and the agencies will be consulted on how to best care for, recover, and rehabilitate these animals. Any dead sea turtles are reported to the Environmental Office, who informs NMFS and USFWS.
- Contamination of water and land from vessels and equipment are prevented by properly containing fuel, toxic waste, plastic, and other solid-wastes, inspecting equipment prior to use, and avoiding discharge of these materials.
- All spills are contained, cleaned up, and transported to Kwajalein Atoll for proper disposal. All hazardous wastes are handled in compliance with the Kwajalein Environmental Emergency Management Plan and in compliance with Kwajalein Systems Management Procedures.
- Soil and groundwater sampling occurs at various locations around the impact sites to test for beryllium, depleted uranium, and other metals. Test results that exceed criteria detailed in the U.S. Army Kwajalein Atoll Environmental Standards require subsequent investigation, soil removal, or other remediation (U.S. Army Garrison-Kwajalein Atoll 2017, pp. 1-2).
- Surveys of the impact site at Illeginni Islet occur within one day (when feasible) after impact to locate any injured or dead wildlife, damaged coral, or damaged habitats in the nearshore and land areas. Any impacts are reported to the appropriate agency and the agencies are invited to inspect and offer mitigation guidance.
- When reefs, reef flats, or shallow waters less than 3 m deep are impacted, these areas are inspected within 24 hours of the impact and the appropriate agencies are invited to inspect and offer mitigation guidance.

Effects of the Proposed Action

Sea Turtles

Suitable nesting and haulout habitat for sea turtles occurs on Illeginni Islet and throughout the Kwajalein Atoll (Figure 2). The honu and honu'ea are known to nest on beaches throughout the Kwajalein Atoll, and may be present on the beaches, nesting or hauling out on Illeginni Islet. The suitable nesting habitat on the shoreline of Illeginni Islet is mostly submerged during high tides; however, there is suitable nesting habitat present there during lower tides. The proposed activities would result in elevated sound pressure levels in the air and underwater from sonic booms, test missile impact, vessel operation, human activity, and equipment operation. The

maximum sound pressure levels resulting from the activities are those of the sonic booms, which are 150 dB (re 20 microPascals [µPa]) in the air, near the point of impact. Human presence and pre-flight preparations nearby the testing areas would disturb turtles and deter them from using these areas. Surveys have not detected sea turtle nesting on Illeginni Islet since 1996. Additionally, the conservation measures implemented would detect and take action to avoid the sea turtles on land for pre-flight and post-flight activities. It is extremely unlikely that nesting or basking turtles would be exposed to the proposed activities because of low likelihood of presence. Therefore, effects to nesting and basking honu and honu'ea are extremely unlikely to occur and effects are discountable.

Figure 2. Suitable habitat for sea turtles at Illeginni Islet.

The proposed project would result in release of hazardous materials (i.e., depleted uranium, beryllium, cadmium, chromium, silver, zinc, and lead). Benthic invertebrates accumulate heavy metals (Greig et al. 1976; Eisler et al. 1978), which sea turtles consume, and exposure to heavy metals has caused bioaccumulation in turtle species (Sakai et al. 2000; Stoneburner et al. 1980, p.

172). Turtles are long-lived and mobile, which allows for integration of exposure over time and space and makes them sensitive to long-term, low-dose contamination (Meyers-Shone and Watson 1990). Sea turtles are particularly vulnerable to both acute and chronic exposure to marine contaminants (Rudrud et al. 2007, p. 4).

Metal concentrations within eggs predominantly reflect maternal exposure (Guirlet et al. 2008). Sea turtles transfer trace metals, including cadmium, copper, zinc, and nickel via excretion when laying eggs (Paez-Osuna et al. 2010, p. 632). Metals may be transferred to the embryo during incubation, either from the eggshell or the nest environment (Marco et al. 2004; Guirlet et al. 2008; du Preez et al. 2018). Sea turtle eggs also receive metal contamination from sand (i.e., cadmium, nickel, and zinc) (Vazquez et al 1997, p. 6); however, the egg yolk contains the highest concentrations of heavy metals (Sakai et al. 1995, p. 347). Certain metals in particular, including cadmium and lead, are suspected endocrine disrupting chemicals to which reptiles may be particularly vulnerable (Grillitsch and Schiesari 2010). While copper and zinc positively correlate with hatch success (Souza et al. 2018) as eggs contain some essential micronutrients, including metals such as copper, iron, selenium, and zinc (Roe et al. 2004; Guirlet et al. 2008; du Preez et al. 2018).

Sea turtle exposure to these hazardous materials would occur on the beaches from the turtles basking, digging, laying eggs, incubating, and hatching. Sea turtles do not eat while on land and most exposure to contaminants occurs from ingesting contaminated sources of food in marine areas. The Marshall Islands were heavily bombed during World War II, followed by nuclear testing there in 1945. Additionally, the USAF performs soil and groundwater testing and removes contaminants from the environment (U.S. Army Garrison-Kwajalein Atoll 2017, pp. 1-2). Therefore, measurable effects to adult sea turtles from exposure to hazardous materials on land assocated with this activity are extremely unlikely to occur.

Summary

We have reviewed our data and conducted an effects analysis of your project. By incorporating the conservation measures listed above, adverse effects to listed species are extremely unlikely to occur, and are therefore discountable. Because the effects from the proposed project are discountable, we concur with your determination that the proposed action may affect, but is not likely to adversely affect the honu and honu'ea.

Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this letter; or (3) if a new species is listed or critical habitat designated that may be affected by the identified action.

We appreciate your efforts to conserve endangered species. If you have any questions concerning this consultation, please contact Lindsy Asman, Fish and Wildlife Biologist, at 808-792-9490 or

by email at lindsy_asman@fws.gov. When referring to this project, please include this reference number: 01EPIF00-2021-I-0058.

Sincerely,

DARREN LEBLANC Digitally signed by DARREN LEBLANC Date: 2021.01.07 13:26:02 -10'00'

Darren LeBlanc
Planning and Consultation Team Manager

Literature Cited

Aguirre, A.A., G.H. Balazs, B. Zimmerman, and F.D. Galey. 1994. Organic contaminants and trace metals in the tissues of green turtles (*Chelonia mydas*) afflicted with fibropapillomas in the Hawaiian Islands. Marine Pollution Bulletin 28(2):109-114.

Du Preez, M., R. Nel, and H. Bouwman. 2018. First report of metallic elements in loggerhead and leatherback turtle eggs from the Indian Ocean. Chemosphere 197:716-728.

Eisler, R., M. Barry, R.L. Lapan, G. Telek, E.W. Davey, and A.E. Soper. 1978. Metal survey of the marine clam *Pitar morrhuana* Collected near a Rhode Island (USA) Electroplating Plant. Mar. Biol. 45:311-317.

Greig, R.A., D.R. Wenzloff, and J.B. Pearce. 1976. Distribution and abundance of heavy metals in finfish, invertebrates, and sediments collected at a deepwater disposal site. Marine Pollution Bulletin 7(10):185-187.

Grillitsch, B. and L. Schiesari. 2010. The ecotoxicity of metals in reptiles. In: Sparling, D.W., G. Linder, C.A. Bishop, and S.K. Krest (Eds.), Ecotoxicity of amphibians and reptiles, 2nd ed. CRC Press, New York, pp. 337-448.

Guirlet, E., K. Das, J.P. Thome, and M. Girondot. 2010. Maternal transfer of chlorinated contaminants in the leatherback turtles, *Demochelys coriacea*, nesting in French Guiana. Chemosphere 79:720-726.

Marco, A. M. Lopez-Vicente, and V. Perez-Mellado. Arsenic uptake by reptile flexible-shelled eggs from contaminated nest substrates and toxic effect on embryos. Bulletin of Environmental Contamination and Toxicology 72:983-990.

Meyers-Shone, L. and B.T. Watson. 1990. Comparison of two freshwater turtle species as monitors of environmental contamination. Environmental Sciences Division Publication No. 3454. The National Technical Information Service, US Department of Commerce, 5285 Port Royal Rd., Springfiled, VA 22161. Available from: http://www.ornl.gov/~webworks/cppr/y2001/rpt/39017.pdf

Paez-Osuna, F., M.F. Calderon-Campuzano, M.F. Soto-Jimenez, and J.R. Ruelas-Inzunza. 2010. Arch Environ Contam Toxicol 59:632-641.

Roe, J.H., W.A. Hopkins, J.A. Baionno, B.P. Staub, C.L. Rowe, and B.P. Jackson. 2004. Maternal transfer of selenium in *Alligator mississippiensis* nesting downstream from a coal-burning power plant. Environ. Toxicol. Chem. 23, 1969–1972.

Rudrud, R.W., J.W. Kroeker, H.Y. Leslie, and S.S. Finney. 2007. The sea turtle wars: Culture, war and sea turtles in The Republic of the Marshall Islands. SPC Traditional Marine Resource Management and Knowledge Information Bulletin #21 – October 2007. 27 pp.

Sakai, H., H. Ichihashi, H. Suganama, and R. Tatsukawa. 1995. Heavy metal monitoring in sea turtles using eggs. Marine Pollution Bulletin 30(5):347-353.

Sakai, H., K. Saeki, H. Ichihashi, N. Kamezaki, S. Tanabe, and R. Tatsukawa. 2000. Growth-related changes in heavy metal accumulation in green turtle (*Chelonia mydas*) from Yaeyama Islands, Okinawa, Japan. Archives of Environmental Contamination and Toxicology 39(3):378-385.

Stoneburner, D.L., M.N. Nicora, and E.R. Blood. 1980. Heavy metals in loggerhead sea turtle eggs (*Caretta caretta*) evidence to support the hypothesis that demes exist in the western Atlantic population. Journal of Herpetology 14(2)171-175.

Souza, N.L.N., M.T.W.D. Carneiro, E.F Pimentel, A. Frossard, J.B. Freire, D.C. Endringer, and P.D. Ferreira Junior. 2018. Trace elements influence the hatching success and emergence of *Caretta caretta* and *Chelonia mydas*. J. Trace Elem. Med. Biol. 50, 117–122.

U.S. Army Garrison-Kwajalein Atoll. 2017. Notice of Continuing Activity for Minuteman III Modification and Fuze Modernization Flight Tests. Control Number NCA-14-003.0. September 2014, Revised December 2015, January 2017. 143 pp.

Vazquez, G.F., M.C. Reyes, G. Fernandez, J.E.C. Aguayo, and V.K. Sharma. 1997. Contamination in marine turtle (*Dermochelys coriaca*) egg shells of Playon de Mexiquillo, Michoacan, Mexico. Bulletin of Environmental Contamination and Toxicology 58:326-333.

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
30TH SPACE WING

12 February 2021

Beatrice L. Kephart
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1028 Iceland Avenue
Vandenberg AFB, CA 93437

Mr. John Weber
Senior Environmental Scientist
California Coastal Commission
45 Fremont Street, Suites 1900 & 2000
San Francisco CA 94105-2219

Dear Mr. Weber

In accordance with Section 307(c)(l) of the Federal Coastal Zone Management Act of 1972 as amended, the U.S. Air Force (USAF) has determined that the proposed facility construction, operations, and flight test activities for the Ground Based Strategic Deterrent (GBSD) Test Program at Vandenberg Air Force Base (VAFB), California do not require a consistency determination. We respectfully request that the Coastal Commission concur with our Negative Determination.

The findings of the draft GBSD Test Program Environmental Assessment/Overseas Environmental Assessment (EA/OEA), as summarized in the Attachment to this letter, serve as the analytical basis for the Negative Determination. USAF is preparing the GBSD Test Program EA/OEA in accordance with the National Environmental Policy Act (NEPA) and its implementing regulations. Please note that release of the draft GBSD Test Program EA/OEA for public comment under NEPA is expected to occur in February 2021.

If you need additional information or have questions, please call me at (805) 605-7924 or email me at beatrice.kephart@spaceforce.mil. You can also call Samantha Kaisersatt at (805) 605-0392 or email her at samantha.kaisersatt@spaceforce.mil.

Sincerely

2/12/2021

X Beatrice L Kephart

Signed by: KEPHART.BEATRICE.LINDA.1166122291
BEATRICE L. KEPHART
Chief, Installation Management Flight

Enclosure 1:
Summary of Proposed Action and Anticipated Environmental Effects

1. PROPOSED FEDERAL AGENCY ACTION

The United States Air Force (USAF) proposes to implement elements of the Ground Based Strategic Deterrent (GBSD) Test Program at Vandenberg Air Force Base (VAFB), California. GBSD represents the modernization of the United States (U.S.) land-based nuclear arsenal, eventually replacing the aging Minuteman III intercontinental ballistic missile (ICBM) system. Before USAF can make future decisions to transition the Minuteman III weapon system from active status to the GBSD weapon system, developmental and operational program testing of the new system must occur. Test program-related actions would occur primarily at Hill Air Force Base and Dugway Proving Ground in Utah, as well as VAFB. Such tests would include conducting missile launches from VAFB with flights over the Pacific Ocean within the Western Test Range in a manner similar to that of the current Minuteman III program.

The Proposed Action would implement booster development and flight testing of the proposed GBSD weapon system. The purpose of this testing is to assess attainment of technical design parameters; verify and validate system performance capabilities (baseline requirements); and determine whether the system is operationally effective, suitable, survivable, and safe for its intended use in support of the U.S. nuclear triad. This type of testing is required as part of Department of Defense (DoD) and USAF weapon system acquisition processes and the information generated is essential to decision makers.

Before the USAF can make future decisions to remove the Minuteman III weapon system from active status and deploy the new GBSD weapon system, system development and successful testing under the proposed GBSD Test Program must first occur. Such developmental and operational testing is needed to ensure the GBSD weapon system can function and achieve operational status to replace the Minuteman III system and support the nuclear triad. Without the GBSD Test Program, the development and later deployment of the GBSD weapon system, which is vital to the long-term defense and security of the United States and its allies, could be impaired or delayed.

GBSD Weapon System Description. Design of the proposed GBSD weapon system has not yet been determined, but plans are for it to be sized to fit within existing Minuteman III launch facilities (LFs). The booster would use a solid propellant composition with similar properties to that of the Minuteman III booster. Similar to the Minuteman III flight test missile, the GBSD flight test missile would carry a Post-Boost Altitude Control Module (PBACM) on top of the booster that includes a Post Boost Propulsion System (with liquid hypergolic propellants) and Payload Re-entry System (PRS). For electrical power, the GBSD weapon system also would contain multiple batteries similar to the Minuteman III. Although the PRS may be of a new design, test reentry vehicles (RVs) used for flight testing would be the same or similar to those used for Minuteman III flight testing.

Like the Minuteman III weapon system, the GBSD weapon system design also is expected to use other ordnance, including motor igniter assemblies, shroud ejection motor initiator, gas generators, and a Flight Termination System (FTS) destruct package. Should a launch anomaly occur during flight, the destruct devices, in the form of linear explosive assemblies, would separate the stages, split the motor casings, and stop forward thrust.

VAFB GBSD Facilities and Infrastructure Description. At VAFB, a combination of existing and new facilities would be used in support of the GBSD Test Program, primarily for missile flight testing. As shown in **Figure 1**, existing test launch and support facilities to be used are located towards the northern end of the installation, most of which are within the designated coastal zone. Other existing and new

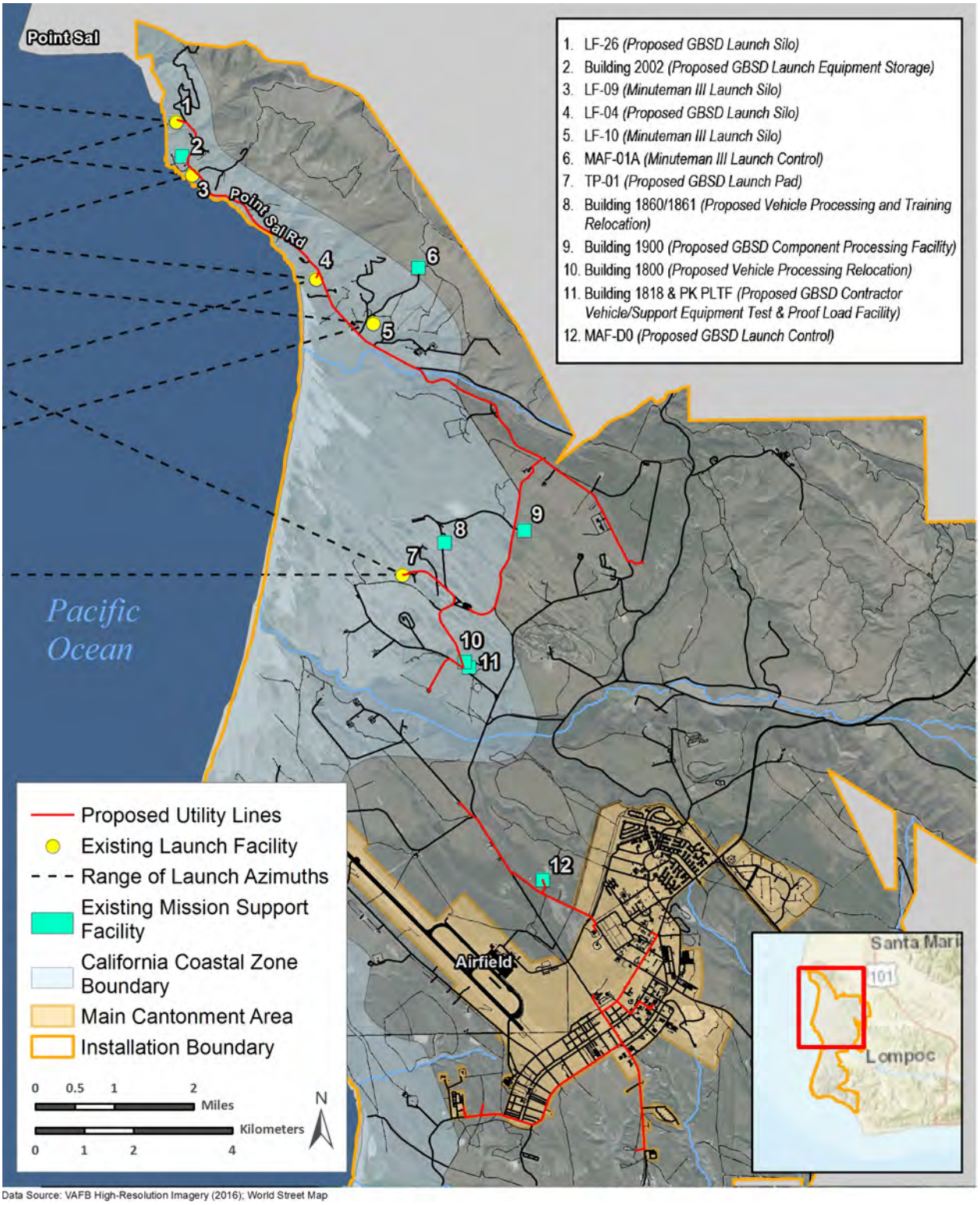


Figure 1. Proposed GBSD Test Program and Related Facilities on VAFB North Base with Coastal Zone Boundary Shown

facilities proposed for program use would be located outside of the coastal zone, primarily within the Main Cantonment Area. Nearly all of the proposed GBSD facilities would be in proximity to existing Minuteman III flight test and system support facilities. All of the existing and new facilities, and related construction areas, are shown on **Figures 1 through 4**.

Table 1 lists only the new facilities to be constructed at VAFB in support of the GBSD Test Program, all of which are located outside of the designated coastal zone. Included in the table is the distance of each new facility from the coastal zone inland boundary. The closest proposed new facility to the coastal zone is the GBSD Component Operations Facility, located approximately 0.25 mile outside of the coastal zone on the east side of the existing Munitions Storage Area (MSA) (see **Figure 4**, lower right image). All other new facilities are between 1.6 and 2.6 miles from the nearest coastal zone inland boundary.

Table 2 lists all of the other existing facilities at VAFB to be used and modified in support the GBSD Test Program. Also included are the temporary laydown (staging) areas, access roads and utilities. Refurbished facilities for GBSD use would consist of two LFs; a launch pad; Missile Alert Facility (MAF) for launch control; office and administrative space; laboratory areas and workrooms; high bays for missile hardware fitting, testing, and integration; and storage for boosters and other equipment. Existing facilities would require some level of restoration, reconstruction, or modifications.

Implementation of the GBSD Test Program would require the Minuteman III test program to stop using LF-04 for flight tests beyond the 4th quarter of fiscal year (FY) 2021, limiting that program to only two LFs (i.e., LF-09 and LF-10) instead of three (see **Figure 1**). Losing LF-04, however, would not impact the Minuteman III launch schedule because ongoing launches would rotate between the two remaining LFs in the launch cycle. LF-26 has previously supported multiple Minuteman III launches, but has not been used since 2006.

Because the GBSD Test Program would acquire existing Buildings 1900 and 8337, current operations by the 2nd Space Launch Squadron, Rocket System Launch Program, 30th Logistics Readiness Squadron, and United Launch Alliance (ULA) in those two buildings would require relocation to other facilities at VAFB, including Buildings 1800 and 1860/1861 located within the designated coastal zone. The mission relocations are also listed in **Table 2** and shown on **Figures 1 and 2**.

VAFB GBSD Site Preparation and Construction. At VAFB, construction and modification of proposed GBSD facilities would begin in FY 2021 with planned completion of all facilities by FY 2025. Temporary site preparation and construction activities are expected to require up to approximately 200 workers on the installation. Workers would be expected to have or find housing and related amenities/services in the local communities.

Only some of the proposed construction areas have been previously disturbed. Some areas are covered with low, maintained vegetation, while others are covered in brush and sparse trees. Prior to construction, facility project areas would be cleared of vegetation, which would be converted to firewood, mulch, or composted. Site excavation and grading plans would be designed to balance cuts and fills as much as possible, with minimal import or export of earth material. Any imported earth material would be obtained from already permitted sources not containing rubbish or contaminants. For any GBSD-related project areas with potential soil or groundwater contamination, or potential presence of munitions and explosives of concern, appropriate coordination, investigations, and mitigations would occur or be implemented prior to any ground disturbance. For some new facility building sites, pile driving may be needed in order to create deep, structurally stable foundations. The number and depth of the pile foundations would depend on the depth to stable soils or bedrock.

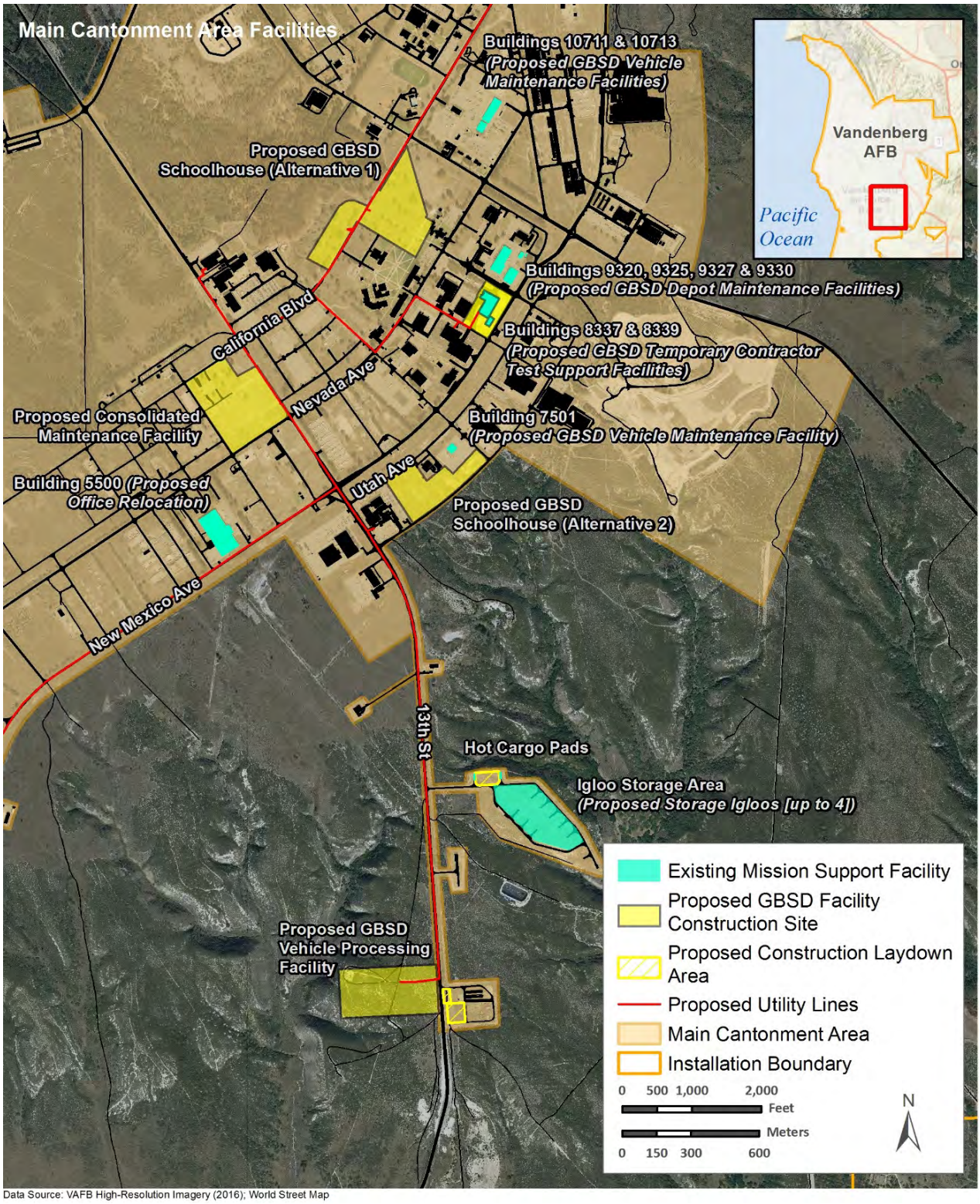


Figure 2. Proposed GBSD Test Program Facilities and Construction Laydown Areas Within or Near the VAFB Main Cantonment Area

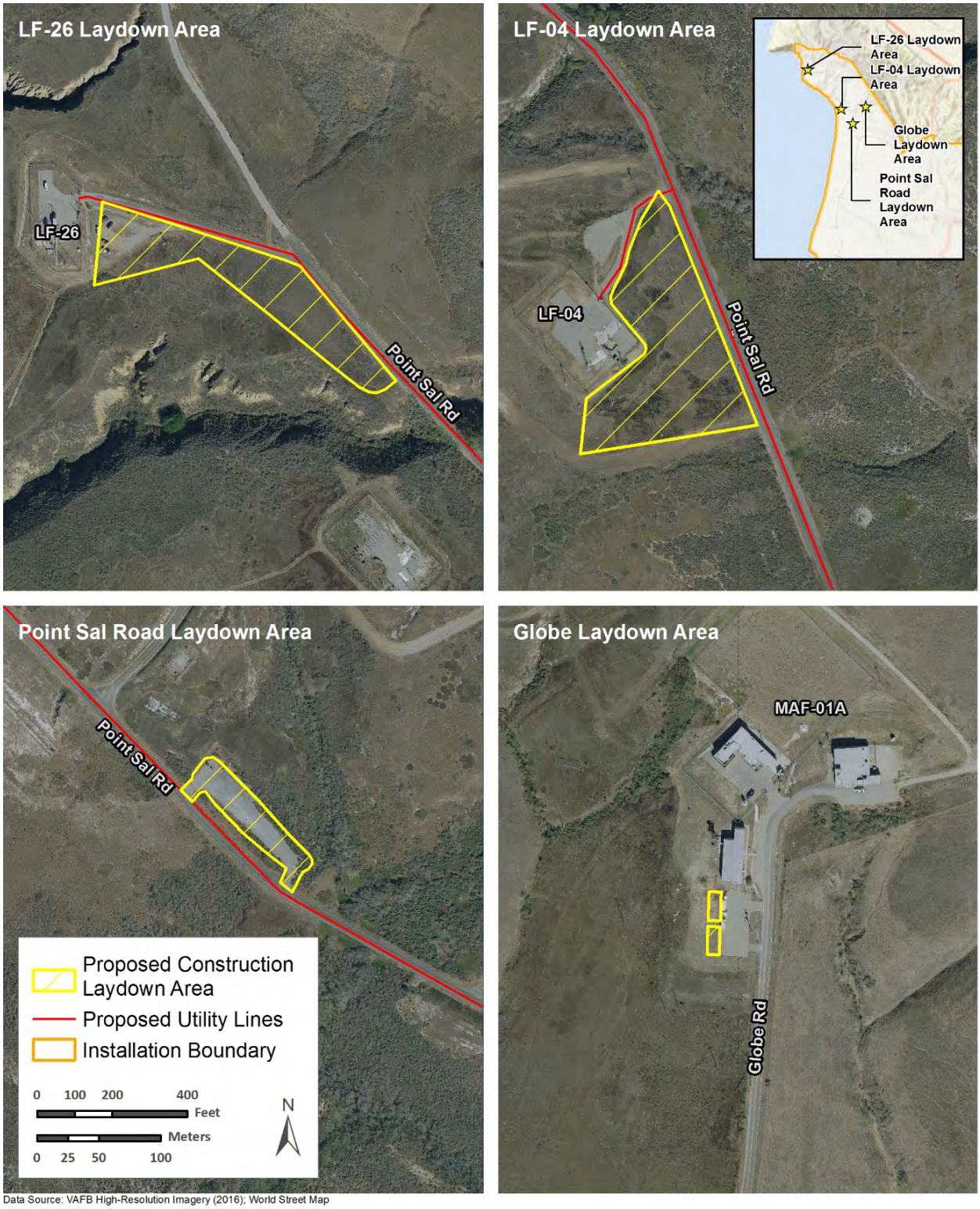
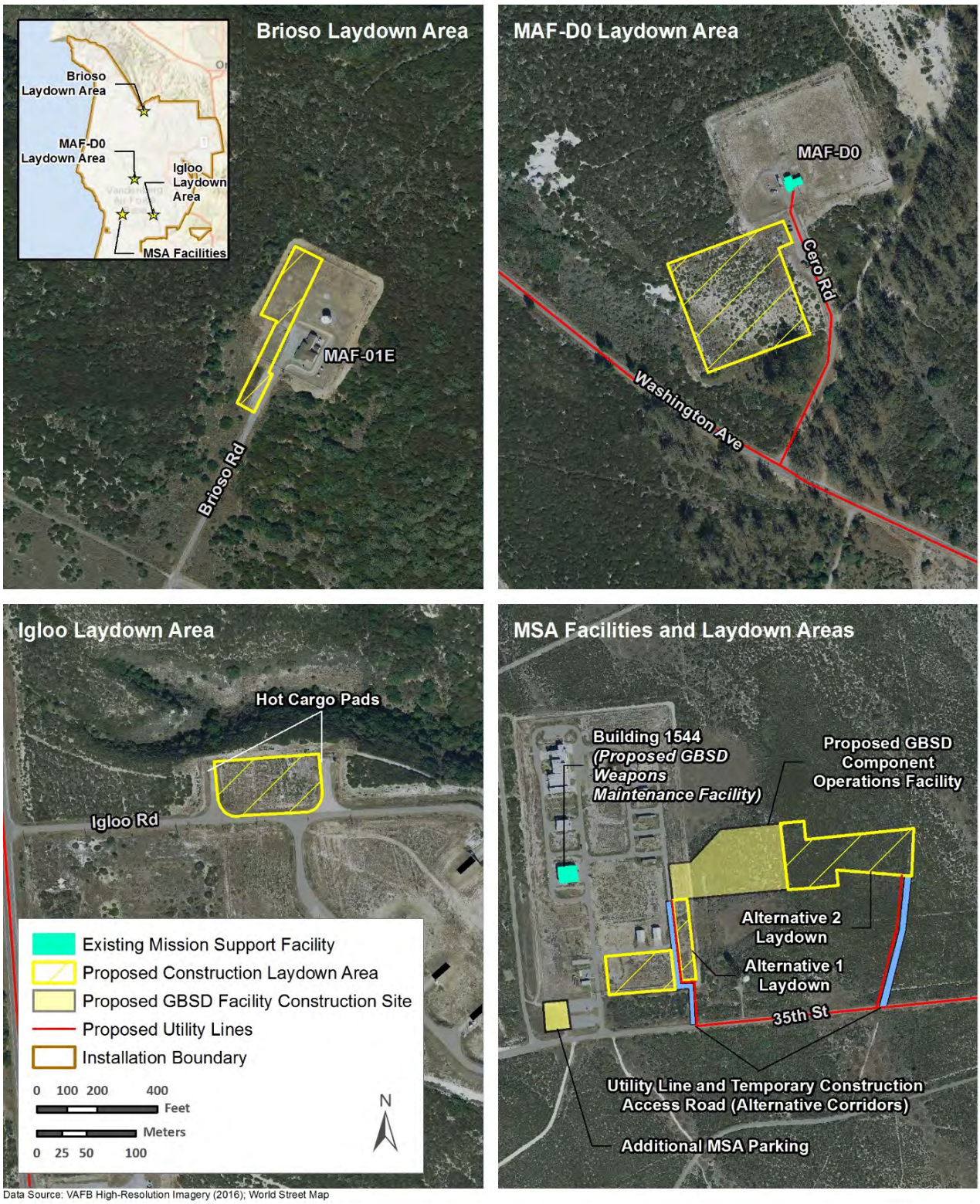


Figure 3. Other GBSD Test Program Temporary Construction Laydown Areas on VAFB North Base



Data Source: VAFB High-Resolution Imagery (2016); World Street Map

Figure 4. Other GBSD Test Program Facilities and Construction Laydown Areas on VAFB North Base and Near the Main Cantonment Area

Table 1. List of New Facilities to be Constructed as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	Facility/Building/ Lot Location	Summary of Site Construction & Modifications
GBSD Launch and Launch Support Facilities and Infrastructure		
Launch Control	Missile Alert Facility D0 (MAF-D0) (Facility 1450); distance to coastal zone is 1.6 miles	Modifications to the MAF will include demolition of the existing top-side building and construction of a new top-side facility. Activities may include demilitarizing or remodeling of the underground launch control center. If demilitarized, a new above-grade launch control center may be constructed on site. Just north of these facilities, a new steel/concrete building and garage (up to 15,000 square feet) may be constructed. Additional activities include trenching for utilities and communication lines; add/replace light/camera towers/poles and antennas; demolish/replace driving surfaces; and modify access road/entry as needed. The MAF is divided into two sections: above ground (LC-A) and below ground (LC-B). For LC-A, there would be one standby 1,500 kilowatt (kW) fixed diesel generator with five underground 10,000-gallon fuel tanks. It is anticipated that the LC-A generator would operate approximately 150 hours/year. For LC-B, there would be one standby 250 kW generator with one underground 1,325-gallon fuel tank. It is anticipated that the LC-B generator would operate approximately 150 hours/year. All construction and renovation work would be within the existing fence line. During demolition and construction, an approximate 3.3-acre temporary laydown area would be established adjacent to the site, which would require minor clearing and grading. A double-wide office trailer would temporarily be placed on site. Electrical power would be drawn from on-site connections. Potable water would be bottled, and portable latrines would be used.
Other GBSD Test Program Support Facilities and Infrastructure		
Consolidated Maintenance Facility	Vacant lot north of Nevada Ave and west of 13th Street (26.8 acres); distance to coastal zone is 2.2 miles	Clear vegetation and construct a new facility with a square footage of approximately 148,400 square feet. Other construction would include approximately 590,000 square feet of paved roadways, parking, and sidewalks; a permanent stormwater retention pond; and extending underground utilities to the site from adjacent areas.
GBSD Component Operations Facility	Vacant lot east of existing MSA (4.7 acres); distance to coastal zone is 0.25 mile	Clear vegetation and construct a new approximate 25,000-square foot facility within an approximate 4.7-acre area. Other construction would include approximately 504,000 square feet of paved roadway, parking, and sidewalks; a perimeter chainlink fence; a permanent stormwater retention pond; and extending underground utilities to the site from 13th Street and the adjacent MSA. During construction, a temporary access road and adjacent laydown areas would be used. New explosive safety quantity distances (ESQDs) would be established around the facility. During construction, alternative temporary laydown areas for equipment and materials have been identified: an approximate 4.3-acre area just east of the building site, and two smaller areas just southwest along the MSA fence line that measure 0.8 and 1.8 acres. For the selected laydown area(s), the site would require minor clearing and grading. A double-wide office trailer may need to temporarily be placed on site. Electrical power would be drawn from on-site connections. Potable water would be bottled, and portable latrines

Table 1. List of New Facilities to be Constructed as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	Facility/Building/ Lot Location	Summary of Site Construction & Modifications
		would be used. Temporary access to the construction site would be via one of two alternative roads off of 35th Street, one east of the site and one just to the west along the MSA fence line. The western-most laydown area and access road are the preferred alternative.
GBSD Vehicle Processing Facility	Vacant lot west of 13th Street (23.1 acres); distance to coastal zone is 2.1 miles	This new facility would be located just off the southern most end of the Main Cantonment Area. Within the 23.1-acre parcel, clear sufficient vegetation and construct a new approximate 16,400-square foot facility. Other construction would include approximately 40,700 square feet of paved access roadway, parking, and sidewalks; a permanent stormwater retention pond; and extending underground utilities (i.e., electric, communications, natural gas, and water) to the site from 13th Street. For wastewater treatment, a septic tank and leach field would be constructed with the parcel. New ESQDs would be established around the new facility. During construction, an approximate 0.5 or 1.5-acre area located just east of 13th Street would be used temporarily for construction laydown. Within either laydown area, up to three construction trailers would be placed on site, which would be enclosed by a perimeter chainlink fence. Following construction, the trailers and fence would be removed.
GBSD Schoolhouse (2 location alternatives)	Vacant lots adjacent to California Boulevard and 6th Street (27.5 acres); distance to coastal zone is 2.6 miles	Alternative 1, as the preferred location for the new GBSD Schoolhouse, would be co-located with the existing Minuteman III Schoolhouse, which would increase program efficiency during weapon system cross over. The approximate 288,500-square foot GBSD Schoolhouse would include classrooms, labs, shops, high bays, unaccompanied housing dormitory and the GBSD Formal Training Unit. Within the 27.5-acre parcel, sufficient area would be cleared to construct the new facility. Other construction would include approximately 240,000 square feet (5.5 acres) of paved roadways, parking, and sidewalks; and extending underground utilities to the site from adjacent areas.
	Vacant lots between Iceland Avenue and Utah Avenue (14.1 acres) ; distance to coastal zone is 2.5 miles	Alternative 2 is a smaller parcel area that is farther from current personnel support facilities (i.e., dining, gym, BX, medical facilities, etc.). Following clearing of sufficient area, the new facility and related infrastructure (as described for Alternative 1) would be constructed.

Table 2. List of Existing Facilities and Temporary Laydown Areas to be Used and Modified as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	**Facility/Building/ Lot Location**	**Summary of Site Modifications**
GBSD Launch and Launch Support Facilities and Infrastructure		
Test Launch Silos (2 sites)	Launch Facility 04 (LF-04) (Facility 1976)	Modifications to the 77-foot deep silo facility may include external repairs to the concrete pad; abutment walls; access hatch; electrical/communication lines and equipment; cable trays; lighting systems; installation of new below-grade structures; repair/replace portions of the above-grade concrete pads and underground LF structure; facility waterproofing and water diversion; refurbish/replace launch tube liner and associated equipment; trenching for utilities and communication lines; add/replace light/camera towers/poles and antennas; and demolish/repave the access road/entry as needed. Any removal of Minuteman III equipment or assets associated with the turnover of the Minuteman III would be managed by the GBSD Program. One standby 105 kW fixed diesel generator with a 192-gallon fuel tank would be installed underground at the facility. An 8-gallon diesel exhaust fuel tank would be used. It is anticipated that the fixed diesel generator would operate approximately 150 hours/year. Additionally, vegetation fire breaks would need to be maintained on a regular basis around the launch facility. During construction, an approximate 3.7-acre temporary laydown area would be established adjacent to the pad, which would require minor clearing and grading. A double-wide office trailer would temporarily be placed on site. Electrical power would be drawn from on-site connections. Potable water would be bottled, and portable latrines would be used. Any removal of Minuteman III equipment or assets associated with the turnover of the Minuteman III would be coordinated with the GBSD Program.
	Launch Facility 26 (LF-26) (Facility 1967)	Modifications to the 87-foot deep silo facility may include external repairs to the concrete pad, abutment walls, access hatch, electrical/communication lines and equipment, cable trays, lighting systems; installation of new below-grade structures; repair/replace portions of the above-grade concrete pads and underground LF structure; facility waterproofing and water diversion; trenching for utilities and communication lines; add/replace light/camera towers/poles and antennas; demolish/repave the access road/entry as needed, and repair/replace the perimeter chainlink fence. Within the launch tube and access, refurbish/replace launch tube liner and associated equipment, and replace/repair electrical/communication cabling. There may be additional utility connections within the existing fence line and internal to the facility. Any removal of Minuteman III equipment or assets associated with the turnover of the Minuteman III would be managed by the GBSD Program. One standby 105 kW fixed diesel generator with a 192-gallon fuel tank would be installed underground at the facility. An 8-gallon diesel exhaust fuel tank would be used. It is anticipated that the fixed diesel generator would operate approximately 150 hours/year. Also, vegetation fire breaks would need to be established and maintained on a regular basis around the launch facility. During construction, an approximate 2.5-acre temporary laydown area would be established adjacent to the pad, which would require minor clearing and grading. A double-wide office trailer would temporarily be placed on site. Electrical power would be drawn from on-site connections. Potable water would be bottled, and portable latrines would be used.

Table 2. List of Existing Facilities and Temporary Laydown Areas to be Used and Modified as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	Facility/Building/ Lot Location	Summary of Site Modifications
Test Launch Pad	Test Pad 01 (TP-01) (Facility 1840)	No facility repairs or modifications are planned, except for installing a new 20 to 25-foot tall launch stool. Existing vegetation fire breaks would need to be maintained on a regular basis around the launch facility or reestablished prior to each launch.
Launch Equipment Storage	Building 2002	No substantial modifications are planned.
Other GBSD Test Program Support Facilities and Infrastructure		
GBSD Component Processing Facility	Building 1900	The existing 75,000 square foot facility would be renovated to support component processing, maintenance, calibration, assembling, and testing; administration; LF refurbishment; and related support (storage, warehouse, industrial use). Facility modifications and upgrades may include exterior corrosion and roof repairs, door repairs, upgrading mechanical and utility systems (e.g., replacing propane boilers with electric boilers; and heating, ventilation, and air conditioning [HVAC] and electrical upgrades), reconfiguring bays to lab and maintenance areas, and installing security systems. There would be one standby 200 kW portable diesel generator with a 60-gallon fuel tank. It is anticipated that the generator would operate approximately 75 hours/year. Paved areas outside the building also would be resurfaced. New ESQDs would be established around the facility.
GBSD Contractor Vehicle/Support Equipment Test and Proof Load Facility	Building 1818 & Peacekeeper Proof Load Test Facility (PK PLTF)	Until the new Consolidated Maintenance Facility is available, testing and proof loading of vehicles and support equipment would need to be conducted at this existing facility. The currently abandoned facility would require refurbishing the existing 300-square foot Building 1818 and repairing/configuring the exterior concrete pad and 30-foot deep test pit to accommodate GBSD and other vehicles.
GBSD Temporary Contractor Test Support Facilities	Buildings 8337 and 8339	Within existing Buildings 8339 (17,770-square feet) and 8337 (60,000 square feet) internal modifications would include repair/modernize of existing mechanical, electrical, and HVAC systems; convert existing administrative/office space to lab and maintenance test/repair operations; install security systems; and install first and second floor workspace (office) module equipment. In Building 8337, there would be one standby 200 kW portable diesel generator with a 60-gallon fuel tank. In Building 8339, there would be one standby 400 kW portable diesel generator with a 60-gallon fuel tank. It is anticipated that each generator would operate approximate 75 hours/year. Surrounding the buildings, the approximate 5.6 acres of paved parking and open areas would be cleared of several trees. All paved and non-paved areas would be paved over. An approximate 2,500-square foot office trailer would be placed temporarily within the parking area outside Building 8339. New underground utility connections (electrical, communications, and water) would tie into the trailer. Temporary exterior lighting also would be installed. These facilities would temporarily be used through FY 2026 or until the GBSD Consolidated Maintenance Facility is ready for occupancy. Buildings 8339 and 8337 would then be turned over for other mission use, and all temporary mobile modules and trailer likely would be removed from the site.

Table 2. List of Existing Facilities and Temporary Laydown Areas to be Used and Modified as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	Facility/Building/ Lot Location	Summary of Site Modifications
GBSD Depot Maintenance Facilities	Buildings 9320, 9325, 9327, and 9330	No substantial modifications are planned at any of these existing buildings. Such actions may include moving or adding walls, and electrical and HVAC modifications.
GBSD Vehicle Maintenance Facilities	Buildings 7501, 10711, and 10713	Existing Building 7501 (8,000 square feet) would be remodeled. No substantial modifications are planned for existing Buildings 10711 and 10713. Such actions may include moving or adding walls, and electrical and HVAC modifications.
GBSD Weapons Maintenance Facility	Building 1544 within the MSA	Existing Building 1544 (8,960 square feet) would be remodeled. Such actions may include moving or adding walls, and electrical and HVAC modifications.
Additional MSA Parking	Vacant area next to existing MSA Parking (0.5 acres)	With the addition of GBSD operations and facilities at the MSA, additional parking for 20 stalls would be needed. Prior to completing the parking lot, the site also could temporarily be used for construction laydown.
Storage Igloos	Igloo Storage Area	Up to four existing igloo facilities would be used. Internal modifications may include electrical upgrades and replacement of storage rails. Changes to existing ESQDs are possible.
Temporary Storage	Existing Hot Cargo Pads next to the Igloo Storage Area (Facilities 6809 and 6810)	No modifications are planned at the two pads.
Utility Corridor	North Base	Up to approximately 25.2 miles of lines would be installed throughout portions of North Base from the Main Cantonment area north to LF-26. Most of the new lines would be installed in trenches within 5 feet of existing road shoulders on either side of the roadway or within the roadway pavement if sensitive resources are to be avoided. Trenches would be up 1 foot wide and 2 feet deep.
Other Mission Relocations due to the GBSD Test Program		
Vehicle Processing	Building 1800	Because GBSD would acquire Building 1900 for program use (described earlier), current operations would require relocation to other facilities. To use existing Building 1800, the building would be modified with installation of a booster processing rail system, and hoist and gantry system. Other modifications likely would include replacing the HVAC, repairing/replacing the roof, repair of external facility corrosion, and other requirements to make the facility functional and safe for vehicle processing. A new guard shack also would be installed at the front entrance. Because new ESQDs would be established around the facility, having boosters in Building 1800 would require Building 1806 (just to the east) to not be occupied, as the new ESQD arc would encompass that facility.
Vehicle Processing and Training	Buildings 1860/1861	As part of the mission relocation from Building 1900, current operations would require the addition of a 20,000-square foot prefabricated metal building on the existing concrete pad at Buildings 1860/1861 for the purpose of vehicle and equipment storage, and training. Electrical power is already accessible at the site. A new waterline connection on the west side of the existing pad would be needed for fire suppression in the new building. Additionally, the existing buildings may require reconfiguration of workspace, repair/replacement of

Table 2. List of Existing Facilities and Temporary Laydown Areas to be Used and Modified as part of the Proposed GBSD Test Program at VAFB, California		
Proposed GBSD Facility/Function	Facility/Building/ Lot Location	Summary of Site Modifications
		mechanical/HVAC systems and roofs, repair of exterior corrosion and/or damaged facility components (e.g., doors, windows, and siding).
Offices	Building 5500	Current office operations in Building 8339 would relocate to Building 5500. Prior to occupying the building, internal modifications to approximately 4,400 square feet would include reconfiguring workspace walls and ceilings, renovation of restrooms and janitorial/storage space, and electrical and communication upgrades.
Equipment Storage and Component Processing	Existing ULA possessed facilities	Current operations would be relocated from Building 8337 to accommodate GBSD test support capability. Vehicles and support equipment would be moved to other ULA possessed facilities on VAFB. No facility repairs or upgrades are anticipated.
Other GBSD Temporary Laydown and Office Areas		
Point Sal Road Laydown Area	Adjacent to Point Sal Road just south of LF-10	During GBSD construction, the existing approximate 0.8-acre gravel area would be used temporarily for storing construction equipment, containers, and bulk material. No utilities or other services would be required.
Globe Laydown Area	MAF-01A (Facility 1974)	The facility currently serves as the MAF for the Minuteman III test program. During GBSD construction, two double-wide trailers would temporarily be placed near the MAF for construction contractor use as offices and to store construction-related equipment. The trailers would occupy less than 0.1 acre and be placed adjacent to existing paved parking. On-site power and communication connections would be aboveground. Potable water would be bottled, and portable latrines would be used.
Brioso Laydown Area	MAF-01E (Facility 1987)	The facility previously served as the MAF for the Peacekeeper test program. During GBSD construction, an approximate 1.0-acre area next to the MAF would be used temporarily for storing construction equipment, containers, and bulk material. No utilities or other services would be required.
Igloo Laydown Area	Vacant lot between existing Hot Cargo Pads next to the Igloo Storage Area	Between the two existing pads is an approximate 1.5-acre lot that temporarily would be used for storing construction equipment, containers, and bulk material. No utilities or other services would be required.

On VAFB North Base where the Proposed Action would occur, multiple construction laydown areas would be established temporarily in support of the GBSD Test Program construction effort. These areas would be used to set up temporary construction management offices, and for the temporary storage of construction equipment, containers, and bulk materials. In preparation for some of the laydown areas, clearing and grading would be required. The locations of key laydown areas are shown on **Figures 2 through 4**.

As part of constructing new facilities, utilities (i.e., potable water, sewer, power, natural gas, and communications) would need to be extended from within the proposed project sites or from adjacent areas. Up to approximately 25.2 miles of new conduit for utility lines would be installed underground throughout portions of North Base from the Main Cantonment area north to LF-26 (see **Figures 1 through 4**). At other locations, existing underground conduits would be used where available. Each new GBSD facility would include HVAC, and water heating systems, most likely natural gas fired.

Potentially, existing facilities to be used may require mechanical and electrical system upgrades or other modifications.

Depending on the types of wastes and excess equipment resulting from demolition and refurbishment activities, such materials would be appropriately disposed of or recycled at a licensed facility; or transferred to the local Defense Logistics Agency Disposition Services for demilitarization, recycling, and disposal. Any resulting hazardous material and waste, and wastewater, would be handled, transported, and disposed of in accordance with established VAFB and USAF procedures, and applicable federal and state laws and regulations.

Preliminary design analyses estimate approximately 70 acres of ground disturbance would occur across VAFB North Base as a result of all project-related construction activities, and a total of approximately 35 acres of new impervious building and pavement areas would be created. All new GBSD facilities at VAFB would be designed and constructed in accordance with Unified Facilities Criteria and other applicable codes and standards, including stormwater management, sustainable design, local wind load, fire protection, lightning protection, and seismic standards. The VAFB Post-Construction Stormwater Standards also would apply to the design.

Additionally, for wildfire protection, fire breaks would be needed around each of the three proposed GBSD launch sites prior to a launch and potentially maintained on a regular basis. This requires clearing or cutting 15- to 20-foot-wide paths around or near the launch sites, then disking these same areas. At LF-04, fire breaks are already established and maintained on a regular basis. For LF-26, fire breaks have not been maintained for at least 10 years, so these would need to be reestablished. For TP-01, fire breaks around the pad would need to be maintained on a regular basis or reestablished prior to each GBSD launch. Along the roadways leading up to each launch site, vegetation would be mowed approximately 10 to 15 feet on either side.

VAFB GBSD Operations and Maintenance. GBSD Test Program operations at VAFB are expected to begin in FY 2021 as facilities become available. Temporary GBSD facilities most likely would be returned to VAFB for other mission use as permanent GBSD facilities become operational. Once all facilities are completed and usable, approximately 260 new personnel would work on site throughout the approximate 10-year test program. All military personnel, government civilians, and contractors working at the installation would be expected to have or find housing and related amenities/services in the local communities.

In preparation for each GBSD flight test missile launch, the individual boosters would be shipped most likely as an integrated stack directly to VAFB from an existing rocket motor manufacturer located in Promontory, Utah. The transport of the booster by truck or by rail would follow established routes, similar to that of other large booster systems. The PBACM-like rocket motor, missile guidance set, and PRS components (including shroud and bulkhead) would be shipped separately from the manufacturer. Just as for Minuteman III, the test RVs for GBSD would be shipped to the installation preassembled from the U.S. Department of Energy. To safeguard these components and other ordnance from fire or other mishap, all transportation, handling, and storage of the components would be accomplished in accordance with DoD, USAF, U.S. Department of Transportation (DOT), and state DOT policies and regulations. Personnel supporting the transportation of components would be trained on missile and ordnance handling procedures.

Once at VAFB, GBSD missile components would be stored in the appropriate GBSD facilities until needed for assembly and integration testing. When ready, the fully integrated booster would be transported to the designated launch site. At the LFs, a transporter erector vehicle would lower the booster into the silo. At TP-01, mobile cranes would be used to transfer the booster to a launch stool. Once

completed, the PRS containing one to three test RVs is loaded onto a payload transporter and taken to the launch site for placement on top of the booster.

All GBSD developmental and operational flight tests are expected to be conducted from the LF-04 and LF-26 silos. At any point during the flight test schedule should there be an issue in using the LFs, TP-01 could be used as an option for conducting launches. In parallel with GBSD flight testing, all Minuteman III flight tests would continue to be conducted from LF-09 and LF-10. The proposed flight test schedule for both missile programs is shown in **Table 3**.

Table 3. Proposed Number of Minuteman III and GBSD Flight Tests from VAFB by Fiscal Year

Test Program	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Minuteman III	4	5	3	4	4	4	3	3	3
GBSD	0	0	0	4	4	5	6	5	4
Total Flight Tests	4	5	3	8	8	9	9	8	7

The types and amounts of hazardous materials used and stored during flight test operations would be minimal and consist of compressed gases, adhesives, lubricants, and solvents. Because the test RVs would arrive at VAFB fully assembled, there would be no direct handling of the hazardous materials contained in them (e.g., high explosives, asbestos, depleted uranium, and other heavy metals). Routine building maintenance and cleaning would require use of paints, pesticides, and cleaning products that are typically used on government installations. Solid and hazardous wastes generated by the program would be collected, temporarily stored (as needed), and disposed or recycled by means of existing installation facilities using established waste management procedures.

GBSD flight tests would be conducted using the same range safety procedures as used for the ongoing Minuteman III flight tests. USAF personnel would conduct a comprehensive safety analysis to determine specific launch and flight hazards for each test. A standard dispersion computer model for both normal and aborted launch scenarios would be run by installation safety personnel. As part of the analysis, risks to off-installation areas and non-participating aircraft, sea vessels, and personnel would be determined. The results of the analysis then are used to identify the launch hazard area, expended booster stage drop zones, and terminal hazard areas.

Prior to each flight test, Notice to Airmen and Notice to Mariners notifications would be released. Within a day prior to launch, radar and other remote sensors would be used to verify that the hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. Depending on which launch site is used and the planned launch trajectory, range safety procedures may require closure of Point Sal State Beach located just north of LF-26—typically for less than a day—and the coordination and monitoring of any train traffic passing through the installation. These actions are considered routine at VAFB and are dictated by standard operating procedures (USAF 2004, 2006, 2010, 2013, 2020a).

If a malfunction were to occur during missile flight, the onboard FTS system (or Autonomous FTS) would be activated. Thrust would be terminated by initiation of an explosive charge that splits or vents the motor casing, which releases pressure and significantly reduces propellant combustion. This action would stop the booster's forward thrust, causing the missile to fall along a ballistic trajectory into the ocean. Just as for ongoing Minuteman III flight tests, actions would be taken immediately to remove unburned propellant and any other hazardous materials that had fallen on land or off the beach in waters up to 6 feet deep. Any recovery from deeper water would be treated on a case-by-case basis.

Once the initial GBSD developmental and operational program testing is completed, the facilities likely would be used to support future GBSD deployment and sustainment program activities or other missions and programs. Also, as part of GBSD system sustainment, LF-09, LF-10, and MAF-01A likely would be converted for GBSD Force Development Evaluation flight testing following a decision to remove the Minuteman III weapon system from active status. The conversion and use of these three facilities for GBSD purposes would be analyzed in future environmental documentation separate from the GBSD Test Program EA/OEA.

2. EFFECTS ANALYSIS

As defined in Section 304 of the federal Coastal Zone Management Act (CZMA), the term "coastal zone" does not include "lands the use of which is by law subject solely to the discretion of or which is held in trust by the federal government." VAFB is owned and operated by the USAF and, therefore, is excluded from the coastal zone. USAF recognizes, however, that actions outside the coastal zone may affect land or water uses or natural resources within the coastal zone and, therefore, are subject to the provisions of CZMA. USAF analyzed the impacts of the Proposed Action on the coastal zone by looking at reasonably foreseeable effects on coastal use or resources, and reviewing relevant California Coastal Management Program (CCMP) enforceable policies and Coastal Resources Planning and Management Policies (CRPMPs) identified in Chapter 3 of the California Coastal Act of 1976. Santa Barbara County has delineated a coastal zone boundary that overlaps VAFB (see **Figure 1**). As noted, however, CZMA provisions are not enforceable on federal property, but this analysis addresses distances to that boundary, where applicable, to support the finding of no to negligible adverse effects on coastal uses or resources. Consistency with each of the policy topics (Public Access, Recreation, Marine Environment, Land Resources, Development, and Industrial Development) are addressed below.

Public Access (CRPMP Section 30210 et seq.) and Recreation (CRPMP Sections 30220 et seq.). Facility modification and new construction activities under the Proposed Action would occur at existing missile launch and launch support facilities, and at the VAFB Main Cantonment Area. These areas are located on federal property. All activities within the coastal zone involve modifications of existing facilities; no new facilities would be constructed within the coastal zone as designated by Santa Barbara County. The closest proposed new facility to the coastal zone shown on **Figure 4** (see lower right image) is outside of and approximately 0.25 mile east of the coastal zone inland boundary.

USAF controls access to the installation, which is restricted to military personnel, DoD employees, authorized contractors, and official visitors. The Proposed Action would not interfere with current access procedures to the coastal zone on VAFB. There is no public access to the construction sites and no public recreation opportunities are located within the construction sites.

VAFB is adjacent to several public coastal recreational areas**,** including beaches and hiking trails, near where GBSD flight test missile launches would occur. With the increase in the total number of ICBM flight tests conducted from North Base, from 3 to 5 annually to a maximum of 9 flights annually in some years (see **Table 3**), Point Sal State Beach (located off the northern end of VAFB) would temporarily be closed more often for public safety purposes. Under agreement with Santa Barbara County and the State of California, the base can close the state beach during launch operations (VAFB 2008). Point Sal State Beach is closed on average 12 times a year, which usually coincides with any launch activity (Ornelaz 2009). There would be no increase in restrictions, other than for these additional launches, to public access at Point Sal State Beach or for any other public beaches at VAFB beyond what is already agreed to in existing county and state agreements. Public notification about launches and beach closures would continue to occur in accordance with the agreement with the County and State. Because the flight test events are temporary and only occur a few times per year, the increase in beach closures would be minimal and would not have a major effect on local recreation.

Overall construction, flight test, and operations and maintenance activities are not anticipated to result in significant noise impacts on recreation. Short-term effects would occur due to noise from the use of light and heavy equipment during construction and facility modifications. Typical noise levels from construction equipment (83 decibels) generally would only occur during daytime hours, would be temporary, and not affect areas outside the installation. Noise exposure levels from missile launches can be characterized from moderately loud to uncomfortable, but they occur infrequently and are very short in duration (about 20 seconds per launch audibility). Point Sal State Beach would not be subjected to noise levels that would affect use, and the recreation area would be closed during the infrequent launch activities

Therefore, there would be no to negligible adverse effects on public access and recreation within the coastal zone.

Marine Environment (CRPMP Section 30230 et seq.). The Proposed Action construction sites are on land within VAFB North Base and the Main Cantonment Area. All construction sites are on land away from the coastline, and no marine species exist within the construction sites. Protective measures for construction of the new facilities and other required infrastructure include implementation of standard construction best management practices would avoid or minimize the potential for accidental releases of fuels/oils during construction. Federal, state, and local regulations regarding maintaining original site hydrology would be followed, and revegetation and identifying areas to leave unpaved (including retention basins) would allow for surface drainage. VAFB and its contractors would follow the established installation stormwater management plan (and site-specific plans as appropriate) and the hazardous waste management plan to ensure there would be no changes in water quality during site preparation and construction. With the implementation of appropriate minimization and mitigation measures, new construction would have no impacts on essential fish habitat or on the Vandenberg State Marine Reserve along the coast. The combination of distance from the ocean, use of protective measures during construction, and following established environmental protection plans would avoid any potential effects to the marine environment.

The types of potential stressors for marine species from flight test activities at VAFB would be the same as those for the ongoing Minuteman III launches from North Base. The USAF has consulted with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) on the effects of base-wide operations, including the ICBM launches, on marine mammals and Endangered Species Act (ESA) listed species. The GBSD missiles are expected to have similar launch characteristics as other missiles (i.e., Minuteman III) that are routinely launched from VAFB. Due to the potential marine mammal disturbance from all types of vehicle launches and aircraft overflights at VAFB, the USAF has consulted with NMFS and has obtained a base-wide incidental take by Level B harassment permit for Pacific harbor seals, California sea lions, elephant seals, and Steller sea lions (NMFS 2019, USAF 2020a). While take by Level B harassment is not expected for the Proposed GBSD action, NMFS has concluded that any permitted takes by Level B harassment due to test activities at VAFB would have no more than a negligible impact on the affected species and stocks (NMFS 2019, USAF 2020a). No significant impacts to hauled out pinnipeds or to other wildlife species are expected to occur as a result of elevated noise levels or vehicle overflight at VAFB (USAF 2020a).

Therefore, the Proposed Action would have no additional effects on marine water quality or marine environment beyond those effects that currently occur at VAFB.

Land Resources (CRPMP Section 30240 et seq.). On VAFB North Base, the California coastal zone extends generally 0.5 mile to up to 3 miles inland (see **Figure 1**). Areas of the Proposed Action would occur within the coastal zone, including each of the current Minuteman III launch and support facilities

(i.e., LF-04, LF-09, and LF-10); proposed GBSD launch and launch support facilities (i.e., LF-04, LF-26, TP-01, PK PLTF; and Buildings 1818 and 2002); and other existing affected facilities (i.e., Buildings 1800 and 1860/1861), new utility lines, and temporary construction laydown areas.

Site preparation and new construction of facilities and utility lines may result in stressors to biological resources including direct physical disturbance, habitat loss and modification, human activity and equipment operation, exposure to hazardous chemicals, and elevated noise levels. The Proposed Action would result in permanent loss or modification of vegetation types within new construction and construction laydown areas. There are no lands in agricultural production or timberlands that would be affected. Most of the vegetation within the new construction areas is highly modified or disturbed including areas where introduced and invasive species predominate, such as habitats dominated by iceplant or non-native trees. The most sensitive or important vegetation types in the new construction areas are vernal pool vegetation, Burton Mesa chaparral, and riparian habitats. Within the new facility construction and laydown areas, up to 29.5 acres of maritime chaparral and less than 0.1 acres of vernal pool habitat may be lost or modified. While these are important and sensitive habitats at VAFB, with implementation of avoidance and mitigation measures, the Proposed Action would not change the relative abundance or distribution of these vegetation types at VAFB or in the region. Overall, there would be moderate impacts to important maritime chaparral vegetation, and impacts on important vegetation in other vegetation types would be minimal.

Wildlife in and near proposed new construction sites and new utility lines may be exposed to habitat loss and modification, elevated noise levels, exposure to hazardous chemicals, and in the case of less mobile species, direct physical disturbance. USAF concluded that the proposed construction activities at VAFB may affect but are not likely to adversely affect Lompoc yerba santa, but are likely to adversely affect Gaviota tarplant, vernal pool fairy shrimp, and California red-legged frog (USAF 2020b). Overall, with implementation of several minimization and mitigation measures, new construction would not change the regional distribution or abundance of or reduce the likelihood of survival and recovery of any ESA-listed species, and would have no impacts on designated critical habitats or riparian habitats. Therefore, the impact of proposed new construction on threatened and endangered species is considered less than significant.

Proposed launch activities are not expected to change the abundance or distribution of any plant species or vegetation type at VAFB. Routine maintenance of firebreaks around the LFs and test pads at VAFB minimizes the potential for impacts on vegetation by reducing vegetation exposure and reducing the risk of wildfire. Overall, launch emissions from proposed tests are not expected to impact wildlife species at VAFB, including the federally endangered El Segundo blue butterfly. With implementation of measures identified in the USFWS Programmatic Biological Opinion, the USFWS concluded that ICBM launch activities within the scope specified would not jeopardize the continued existence of federally listed species (USFWS 2015, USFWS 2018, USAF 2020a).

Three architectural historic properties and three prehistoric archaeological historic properties in the Proposed Action area would be adversely affected under Section 106 of the National Historic Preservation Act by site preparation, new construction, and refurbishing of existing structures. USAF is in the process of consulting with the federally recognized Santa Ynez Band of Chumash Indians, California SHPO, and ACHP, and will develop a Memorandum of Agreement and Written Plan of Action pursuant to the Native American Graves Protection and Repatriation Act that resolves adverse effects to these historic properties to acceptable levels. No adverse effects on archaeological or architectural resources would be expected from flight test activities or operations and maintenance under the Proposed Action. Overall, adverse effects on cultural resources determined under Section 106 would be mitigated to less than significant through activities developed by VAFB in consultation with the California SHPO that is presently underway.

The construction activities that are proposed to occur within the coastal zone would be limited to facility modifications and would not result in significant impacts on sensitive biological or cultural resources. Fire breaks around launch sites would be maintained or reestablished, as necessary for safety purposes. Use of construction laydown areas would be temporary. These actions would occur primarily in already developed areas, are generally spread far apart, and result in limited impacts on the coastal zone.

The construction sites would include the conversion of permeable surface area to impermeable surface area, which may have the potential to lessen natural drainage and increase stormwater runoff. The individual construction sites, however, would be spread far apart in most instances and not have a cumulative effect. Federal, state, and local regulations regarding maintaining original site hydrology would be followed, and revegetation and identifying areas to leave unpaved (including retention basins) would allow for surface drainage. VAFB and its contractors would follow the established installation stormwater management plan (and site-specific plans as appropriate) to ensure there would be no changes in water quality during site preparation and construction.

Flight tests would not be anticipated to affect water resources. If an early launch abort were to occur, actions would immediately be taken to remove unburned propellant and any other hazardous materials that had fallen into waterbodies or off the beach in waters up to 6 feet deep. Any recovery from deeper water would be treated on a case-by-case basis. VAFB would adhere to all established permits, standard operating procedures, and regulations to maintain water quality health.

Therefore, there would be no to negligible adverse effects on land resources in the coastal zone resulting from the Proposed Action.

Development (CRPMP Section 30250 et seq.). There is no new construction associated with Proposed Action development within the coastal zone. The Proposed Action construction sites are located in existing developed areas within the coastal zone, or in or adjacent to the Main Cantonment Area outside the coastal zone. Although facility modification sites might be visible from the coast, no coastal viewing sites are present near the facility modification sites in the coastal zone. The modifications to already developed facilities would not adversely affect the visual or scenic qualities of the coastal zone. Impacts of flight tests on public areas are described under Public Access and Recreation above. Protective measures as described above would be employed to minimize adverse impacts. Therefore, there would be no to negligible adverse effects on coastal resources.

Industrial Development (CRPMP Section 30260 et seq.). Apart from facility modification and construction identified above, the Proposed Action does not include industrial development involving oil and gas extraction and major infrastructure or power plants. The proposed GBSD flight tests would have no new or additional impacts on the local petroleum and natural gas industry occurring outside VAFB, including areas offshore.

3. CONCLUSION

USAF has determined that the GBSD Test Program at VAFB would not adversely affect uses or resources of the California coastal zone. USAF would continue to comply with Federal Coastal Zone Consistency regulations (15 CFR Part 930) and the CCMP. Although facilities at VAFB would be used to support a new launch program, the types of operations and maintenance activities proposed to occur would be similar to that of their current or prior usage. Because the overall proposed activities would not have a significant impact on physical and natural resources, require implementation of new restrictions to beach access or other recreational areas, or adversely affect the visual qualities of the coastline, USAF anticipates that the GBSD Test Program-related actions would be consistent with the enforceable policies of the state's certified program and not adversely affect coastal zone resources.

4. REFERENCES

NMFS. 2019. Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Air Force Launches and Operations at Vandenberg Air Force Base, California. Final rule; issuance of Letters of Authorization (LOA). 84 FR 14314. April 10, 2019.

Ornelaz, L. S. 2009. Electronic communication and information on beach closures provided by 30 SW/JA, Vandenberg AFB. August 24, 2009.

USAF. 2004. Final Environmental Assessment for Minuteman III Modification. December 9, 2004.

USAF. 2006. Final Environmental Assessment—Minuteman III ICBM Extended Range Flight Testing. February 2006.

USAF. 2010. Final Environmental Assessment for Conventional Strike Missile Demonstration. August 2010.

USAF. 2013. Final Supplemental Environmental Assessment for Minuteman III Extended Range Flight Testing. August 2013.

USAF. 2020a. Final Supplemental Environmental Assessment for Minuteman III Modification and Fuze Modernization. February 2020.

USAF. 2020b. Biological Assessment for the Ground Based Strategic Deterrent (GBSD) Test Program at Vandenberg Air Force Base California. October 2020.

VAFB. 2008. Memorandum of Agreement between County of Santa Barbara and Vandenberg Air Force Base, Agreement No. SPCVAN-2-08-0034. April 27, 2008.

USFWS. 2015. *Programmatic Biological Opinion on Routine Mission Operations and Maintenance Activities, Vandenberg Air Force Base, Santa Barbara County, California* (8-8-13-F-49R). December 3, 2015.

USFWS. 2018. Reinitiating of Programmatic Biological Opinion on Routine Mission Operations and Maintenance Activities, Vandenberg Air Force Base, Santa Barbara County, California. November 20, 2018.

COMMENT INCORPORATION SUMMARY

COMMENT INCORPORATOR	DATE 2-26-2021
COMMENTOR Dr. Steve Kolinski	ORGANIZATION OF COMMENTOR
TITLE OF DOCUMENT **Draft Environmental Assessment/Overseas Environmental Assessment Ground Based Strategic Deterrent (GBSD) Test Program**	DATE OF DOCUMENT **19 February 2021**

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES *(Exact wording of suggested change)*	INCORP.? *(Yes/No)*	HOW COMMENT WAS INCORPORATED *(If not incorporated, why?)*
1.	***1-8***	***4***	***30***	***1-1***	***1-1***	***Example***		
1	1-7		38			USFWS is not the designated agency for conducting UES consultations on species in waters of the RMI. It is likely the consultation request and the USFWS LOC were specific to turtle impacts on Kwajalein Atoll islets (Illeginni). Recommend changing the end of the sentence to read, "… not likely to adversely affect sea turtles at Kwajalein Atoll islets".		
2	1-9	1				NMFS consultations for projects that involve USAKA typically cover ESA and UES mandate requirements. Species effects in the missile stage drop area(s) and for landings in international waters tend to be analyzed and considered under ESA, with the analysis and findings for ESA and UES related concerns presented within a single Biological Opinion. If ESA species effects in international waters are being considered as a part of the GBDS consultation, such should be noted within this public NEPA document to indicate full agency compliance.		
3	2-66 2-67				2.5	Biological resources: text suggests up to 6 impacts may affect Illeginni Islet, but continuation on page 2-67 under Illeginni Islet and Nearshore Waters suggest up to 3 total land impact through 2029. Greater clarification on the number of land impacts within a given year appears warranted (up to 3 in a given year through 2029, up to 3 total from year of first flight through 2029, up to 6 in a given year?). Also, on page 2-67, recommend adding the word "effect" to have the sentence read, "The proposed		

COMMENT INCORPORATION SUMMARY

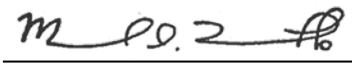
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES *(Exact wording of suggested change)*	INCORP.? *(Yes/No)*	HOW COMMENT WAS INCORPORATED *(If not incorporated, why?)*
						action has the ability to directly or indirectly effect biological resources through ….”		
4	4-88 4-90		13 4			Similar to comment 3, may want to clarify whether the anticipated number of land impacts is within a given year or the overall potential total provided through 2029.		
5	4-93		14 to 16			USFWS is not the designated agency for conducting UES consultations on species in waters of the RMI, so the mention that they concurred with the USAF determination that the proposed action is not likely to adversely affect sea turtles elsewhere in Kwajalein Atoll is irrelevant, if such refers to turtles in marine waters. Please make certain the consultation initiated with the NMFS includes an evaluation of potential effects to sea turtles in all marine waters (including at and outside Kwajalein Atoll) where potential activity impact may occur, as NMFS evaluation of such will be required for UES and ESA compliance. The language in this EA sentence should be cleaned up to ensure a misinterpretation on regulatory roles and UES compliance does not occur.		
6	4-94		21			Please remove “/or” from “and/or”. The records of UES consultation species observations (turtles, marine mammals) in marine environments should be provided specifically to NMFS. It’s ok to have that information provided to USFWS too (i.e. and), but not solely (i.e. or).		
7	4-94		all			Any reporting on UES consultation species to NMFS and or USFWS should be accompanied by similar reporting to the RMIEPA, which is a UES consultation agency for both terrestrial and marine species in the RMI. Recommend RMIEPA be included throughout the document as appropriate.		
8	4-99		33			Apparent typo, add “and” between “conducted test activities”		
9	4-99		35 to 36			Think there may be a typo here: “… direct contact from test components, or hazardous materials, proposed activities would not change species abundance or distribution in the ROI.”		
10	4-100		4			Typo, add “on” before protected habitats.		

COMMENT INCORPORATION SUMMARY

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES *(Exact wording of suggested change)*	INCORP.? *(Yes/No)*	HOW COMMENT WAS INCORPORATED *(If not incorporated, why?)*
11	FONSI					Many of the comments and suggested changes above (1 through 10) apply also to the FONSI.		

Return comments by 22 March 2021: E-mail comments by March 22, 2021 to gbsdtesteaoea-comments@govsupport.us; (2) Mail comments, postmarked no later than March 22, 2021, to: USASMDC, ATTN: SMDC-EN (D. Hasley), P.O. Box 1500, Huntsville, AL 35807.

Endangered Species Act – Section 7 Consultation

Action Agency:	Department of the Air Force, U.S. Air Force (USAF) Nuclear Weapons Center, U.S. Army Space and Missile Defense Command (USASMDC) – Huntsville AL
Activity:	Ground Based Strategic Defense (GBSD) Test Program Activities
Consulting Agency:	National Marine Fisheries Service, Pacific Islands Region, Protected Resources Division
NMFS File No. (PCTS):	PIRO-2020-03355
PIRO Reference No.:	I-PI-20-1884-AG
Approved By:	 Michael D. Tosatto Regional Administrator, Pacific Islands Region
Date Issued:	03/15/2021

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ACRONYMS

BA	Biological Assessment
BMP	Best Management Practice(s)
BO	Biological Opinion
BOA	Broad Ocean Area
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeters
CO_2	Carbon Dioxide
dB	Decibel
DEP	Document of Environmental Protection
DoD	Department of Defense
DPS	Distinct Population Segment
DQA	Data Quality Act
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FE-1	Flight Experiment-1
FE-2	Flight Experiment-2
ft	Feet
FR	Federal Register
FWS	US Fish and Wildlife Service
FY	Fiscal Year
GBSD	Ground Based Strategic Deterrent Weapon System
HAFB	Hill Air Force Base
Hz	Hertz
ICBM	Intercontinental Ballistic Missile
in	Inch(es)
kg	Kilogram(s)
km	Kilometer(s)
km^2	Square Kilometer(s)
LAA	Likely to Adversely Affect
LLNL	Lawrence Livermore National Laboratory
m	Meter(s)
MAC	Mid-Atoll Corridor
mi^2	Square Mile(s)
MMIII	Minuteman III Weapon System
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NLAA	Not Likely to Adversely Affect
nm	Nautical Mile(s)
NMFS	National Marine Fisheries Service (aka NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
PIRO	Pacific Islands Regional Office
PTS	Permanent Threshold Shift
RCCTO	U.S. Army Rapid Capabilities and Critical Technologies Office

RMI	Republic of the Marshall Islands
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
RTS	Ronald Reagan Ballistic Missile Test Site (aka Reagan Test Site)
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSP	Strategic Systems Programs
TTS	Temporary Hearing Effect Threshold
UES	USAKA Environmental Standards
U.S.	United States
USAF	U.S. Air Force
USAG-KA	United States Army Garrison – Kwajalein Atoll
USAKA	U.S. Army Kwajalein Atoll
USASMDC	Space and Missile Defense Command, US Army
VAFB	Vandenberg Air Force Base
yd^2	Square Yard(s)
µPa	Micro-Pascal

1 INTRODUCTION

The proposed action involves the U.S. Air Force's (USAF) development and testing of a new Intercontinental Ballistic Missile (ICBM) weapon system for the proposed Ground Based Strategic Deterrent (GBSD) Test Program. System tests would start in FY 2024 and continue until FY 2029. Each missile test would launch from Vandenberg Air Force Base (VAFB), California, and travel across a broad ocean area (BOA) of the Pacific Ocean. Payload impact would occur at target impacts at United States Army Garrison – Kwajalein Atoll (USAG-KA) sites in the Republic of the Marshall Islands (RMI). Implementation of the test program would also include facility construction or modifications at Hill Air Force Base (HAFB), VAFB, and Dugway Proving Ground.

The GBSD represents the modernization of the land-based nuclear arsenal and would eventually replace the aging Minuteman III (MMIII) weapon system, which has exceeded its designed life expectancy. While the system remains an active, viable deterrent for the United States, many components are becoming obsolete and unsupportable, resulting in continual upgrades to maintain system reliability and performance. It is in the best interest of national security to replace the MMIII weapon system. However, before the USAF can remove the MMIII weapon system from active status and deploy the new weapon system, system development and testing under the proposed GBSD Test Program must first occur. The GBSD tests will be similar to and a crucial step in the developmental process following the MMIII flight tests, which are conducted yearly.

The Endangered Species Act (ESA) would apply for the portions of the action that would take place in and over United States (U.S.) territory and international waters, but not for the portions of the action that would take place within the RMI. The Government of the RMI has agreed to allow the U.S. Government to use certain areas of Kwajalein Atoll (collectively referred to as U.S. Army Kwajalein Atoll or USAKA). "USAKA" is defined as "…the [USAKA]-controlled islands and the Mid-Atoll Corridor, as well as all USAKA-controlled activities within the [RMI], including the territorial waters of the RMI". The USAKA controls 11 islets around the atoll. The relationship between the U.S. Government and the Government of the RMI is governed by the Compact of Free Association (Compact), as Amended in 2003 (48 USC 1681). Section 161 of the Compact obligates the U.S. to apply the National Environmental Policy Act of 1969 (NEPA) to its actions in the RMI as if the RMI were a part of the U.S. However, the ESA does not apply within the RMI. Instead, the Compact specifically requires the U.S. Government to develop and apply environmental standards that are substantially similar to several U.S. environmental laws, including the ESA and the Marine Mammal Protection Act (MMPA). The standards and procedures described in the Environmental Standards and Procedures for USAKA Activities in the RMI (aka USAKA Environmental Standards or UES, 15th Edition) were developed to satisfy that requirement. Therefore, the US Government must apply the UES to its activities within the RMI. Because the ESA and UES both apply to this action, this biological opinion was written in a manner that considers and complies with each of those standards, as applicable.

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (ESA; 16 U.S.C. 1536(a) (2)) requires each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.

When a federal agency's action "may affect" a listed species or its designated critical habitat, that agency is required to consult formally with the National Marine Fisheries Service or the U.S. Fish and Wildlife Service, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species or their designated critical habitat, and NMFS or the FWS concur with that conclusion (50 CFR 402.14 (b)).

If an action is likely to adversely affect a listed species, the appropriate agency (either NMFS or FWS) must provide a Biological Opinion (Opinion) to determine if the proposed action is likely to jeopardize the continued existence of listed species (50 CFR 402.02). "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

The U.S. Air Force Nuclear Weapons Center is the lead agency and action proponent for the Proposed Action, along with the United States Army Space and Missile Defense Command (USASMDC) as a participating Agency. The UES requires all parties of the U.S. Government involved in this project to consult or coordinate with the NMFS and the FWS to conserve species and habitats of special concern at USAKA. We will address the USASMDC exclusively in this document as the participating agency. Section 3.4 of the UES establishes the standards and procedures to be followed "…to ensure that actions taken at USAKA will not jeopardize the continued existence of these species or result in destroying or adversely changing the habitats on which they depend." Section 3.4 is derived primarily from the regulations implementing the ESA, other U.S. regulations, and wildlife protection statutes of the RMI. As such, the list of UES consultation species includes all species present in the RMI that are listed under the ESA (including those that are candidates or are proposed for listing), all marine mammals protected under the MMPA, and all species and critical habitats as designated under RMI law. However, no critical habitat has yet been designated in the RMI.

Under the UES, "the final biological opinion shall contain the consulting agency's opinion on whether or not the action is likely to jeopardize the continued existence of a species or to eliminate a species at USAKA, or to eliminate, destroy, or adversely modify critical habitats in the RMI" (UES at 3-4.5.3(e)). Although the UES does not specifically define jeopardy, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA definition of jeopardy, as described above, and this review relies upon the ESA definition of jeopardy to reach its final conclusions.

This document represents NMFS' final Biological Opinion of the effects on marine species protected under the ESA and the UES that may result from the GBSD tests from VAFB, California, to the impact sites in the Kwajalein Missile Impact Scoring System (KMISS) deeper waters, in the vicinity of, and on Illeginni Islet in Kwajalein Atoll. This Opinion is based on the review of: the USAF and USASMDC November 5, 2020, Biological Assessment (BA) for the proposed action; recovery plans for U.S. Pacific populations of ESA-listed marine mammals, sea turtles, and elasmobranchs; published and unpublished scientific information on the biology and ecology of ESA-listed marine species, UES-

consultation marine species, and other marine species of concern in the action area; monitoring reports and research in the region; biological opinions on similar actions; and relevant scientific and gray literature (see Literature Cited).

1.1 Consultation History

In 2015, the USAF consulted with NMFS on the effects of MMIII Modification activities on UES-listed consultation species in the Action Area. On July 29, 2015 NMFS PIRO issued a Biological Opinion (BO) for MMIII activities that included up to five tests per year with Reentry Vehicle (RV) impacts on land at Illeginni Islet (PIRO-2015-9650). In this BO, NMFS concluded that the proposed MMIII action was not likely to adversely affect 43 consultation species and would have no effect on critical habitats designated in the RMI. NMFS concluded that the debris and ejecta from crater formation were LAA 15 UES-consultation coral species and top shell snails (*Tectus niloticus*), but not likely to result in the jeopardy of any of these UES consultation species (NMFS 2015a).

- After NMFS issued the 2015 BO for the MMIII Modification action, the USAF changed the location of proposed RV impacts and additional species were listed as consultation species under the UES. The USAF removed Illeginni Islet land impact from the MMIII action and proposed RV impacts in the KMISS and nearby deep ocean waters east of Gagan Islet only. Therefore, the USAF revised their effect determinations for the MMIII Modification action, concluding that the action was not likely to adversely affect UES consultation species in the Action Area. On April 17, 2019 NMFS amended the 2015 consultation and concurred with the USAF determination that the MMIII Modification project, with up to five tests per year between fiscal year (FY) 2019 and 2022 and four tests per year through 2030, may affect but would not likely adversely affect ESA or UES listed consultation species (I-PI-18-1732-AG).

On July 23, 2020 NMFS PIRO Biologists met with USASMDC and KFS, LLC personnel to conduct early coordination and discuss general information about the GBSD Test Program project as well as a consultation plan for the Proposed Action. During this meeting, parties discussed the similarity of the Proposed Action activities to those evaluated for the MMIII Fuze Modernization Program.

On November 16, 2020 we received from the USAF and USASMDC this consultation request in a letter dated November 5, 2020 stating that they had determined that the GBSD Test Program (the proposed action) may affect, but is not likely to adversely affect 25 marine ESA and/or UES consultation species (Table 1), and requested consultation for those species.

In the BA, the USAF/USASMDC further determined that the proposed action was likely to adversely affect (LAA) the ten marine UES consultation species listed in Table 2. Formal consultation was initiated on November 5, 2020, resulting in this Opinion.

Table 1. Marine consultation species not likely to be adversely affected by the proposed action

Scientific Name	Species	ESA	MMPA	CITES	RMI
	Sea Turtles				
Chelonia mydas	Central Western Pacific Green Sea Turtle DPS	Endangered		X	X
Eretmochelys imbricata	Hawksbill Sea Turtle	Endangered		X	X
	Marine Mammals				
B. musculus	Blue Whale	Endangered	X	X	X
B. physalus	Fin Whale	Endangered	X	X	
Delphinus delphis	Short-beaked common Dolphin				X
Feresa attenuata	Pygmy Killer Whale		X		
Globicephala macrorhynchus	Short-finned Pilot Whale		X		
Grampus griseus	Risso's Dolphin		X		
Kogia breviceps	Pygmy Sperm Whale			X	
Megaptera novaeangliae	Western North Pacific Humpback Whale DPSs	Endangered	X	X	
Mesoplodon densirostris	Blainville's Beaked Whale		X		
Orcinus orca	Killer Whale		X		
Peponocephala electra	Melon-Headed Whale		X		
Physeter macrocephalus	Sperm Whale	Endangered	X	X	X
	Marine Mammals				
Stenella attenuata	Spotted Dolphin				X
S. coeruleoalba	Striped Dolphin				X
S. longirostris	Spinner Dolphin		X		X
Tursiops truncatus	Bottlenose Dolphin, Pacific		X		
	Fish				
Alopias superciliosus	Bigeye Thresher Shark				X
Manta alfredi	Reef manta ray				X
M. birostris	Giant manta ray				
Sphyrna lewini	Indo-West Pacific Scalloped Hammerhead Shark DPS	Threatened			X
Thunnus orientalis	Pacific bluefin tuna				X
Carcharhinus longimanus	Oceanic white-tip shark	Threatened			

Table 2. Marine consultation species likely to be adversely affected by the proposed action

Scientific Name	Species	ESA	MMPA	CITES	RMI
	Fish				
Cheilinus undulatus	Humphead Wrasse			X	X
	Corals				
Acropora microclados	No Common Name			X	X
A. polystoma	No Common Name			X	X
Cyphastrea agassizi	Agassiz's coral			X	X
Heliopora coerulea	Blue coral			X	X
Pavona venosa	No Common Name			X	X
Turbinaria reniformis	No Common Name			X	X
Pocillopora meandrina	Cauliflower Coral	Candidate			X
	Mollusks				
Tectus niloticus	Top Shell Snail				X
Hippopus hippopus	Giant clam	Candidate			
Tridacna squamosa	Giant clam	Candidate			X

The USAF also has determined that the Proposed Action launch activities would have no effect on ESA-listed species or designated critical habitats at VAFB and that no consultation with NMFS is required for launch activities at VAFB. Guadalupe fur seals (*Arctocephalus townsendi*) are not likely to occur in the Action Area at VAFB, and no part of the Proposed Action would affect designated critical habitat for black abalone (*Haliotis cracherodii*) or leatherback sea turtles (*Dermochelys coriacea*). *In 2015, the USAF determined that MMIII launch activities would have no effect on ESA listed species under NMFS jurisdiction at VAFB (USAF 2020b, NMFS 2015a).*

On January 11, 2020 NMFS emailed USAF and requested the USAF to consider changing their species determination for the humphead wrasse from NLAA to LAA, and also to confirm the NE determination for the following species: green sea turtle (North Pacific DPS), olive ridley sea turtle, sei whale, and 15 coral: *Acanthastrea brevis, Acropora aculeus, A. aspera, A. dendrum, A. listeri, A. speciosa, A. tenella, A. vaughani, Alveopora verrilliana, Leptoseris incrustans, Montipora caliculata, Pavona cactus, P. decussata, Turbinaria mesenterina, and T. stellulata*), two mollusk species (*Pinctada margaritifera* and *Tridacna gigas*). The USAF responded via email on January 12, 2020 confirming their agreement to change the humphead wrasse species determination from NLAA to LAA, and also confirmed the NE determination for the above species.

2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is described in detail in the USAF/USASMDC BA. The proposed flight tests would implement flight testing and booster development of the proposed GBSD weapon system that is intended to replace the aging MMIII weapon system. Testing will verify and validate system performance capabilities (baseline requirements), assess attainment of technical design parameters, and determine whether the system is operationally effective, survivable, and safe for its intended use. The proposed missile tests would launch from Vandenberg Air Force Base (VAFB), and would travel across a broad ocean area (BOA) of the Pacific Ocean with payload impact occurring on Illeginni Islet, in the vicinity of Illeginni Islet, and in the KMISS area in the RMI (Figure 1). In addition, the test program would also include facility construction/modifications at Hill Air Force Base (HAFB), VAFB, and Dugway Proving Ground. No ESA listed threatened, endangered, or candidate species or designated critical habitats are known to occur at or near any of the proposed GBSD Test Program sites on Dugway Proving Ground or on HAFB (USAF 2016; U.S. Army 2016; U.S. Army 2020). Infrastructure development would occur on land and would have no effect on any ESA or UES listed species; therefore, this part of the proposed action will not be discussed further in this Opinion.

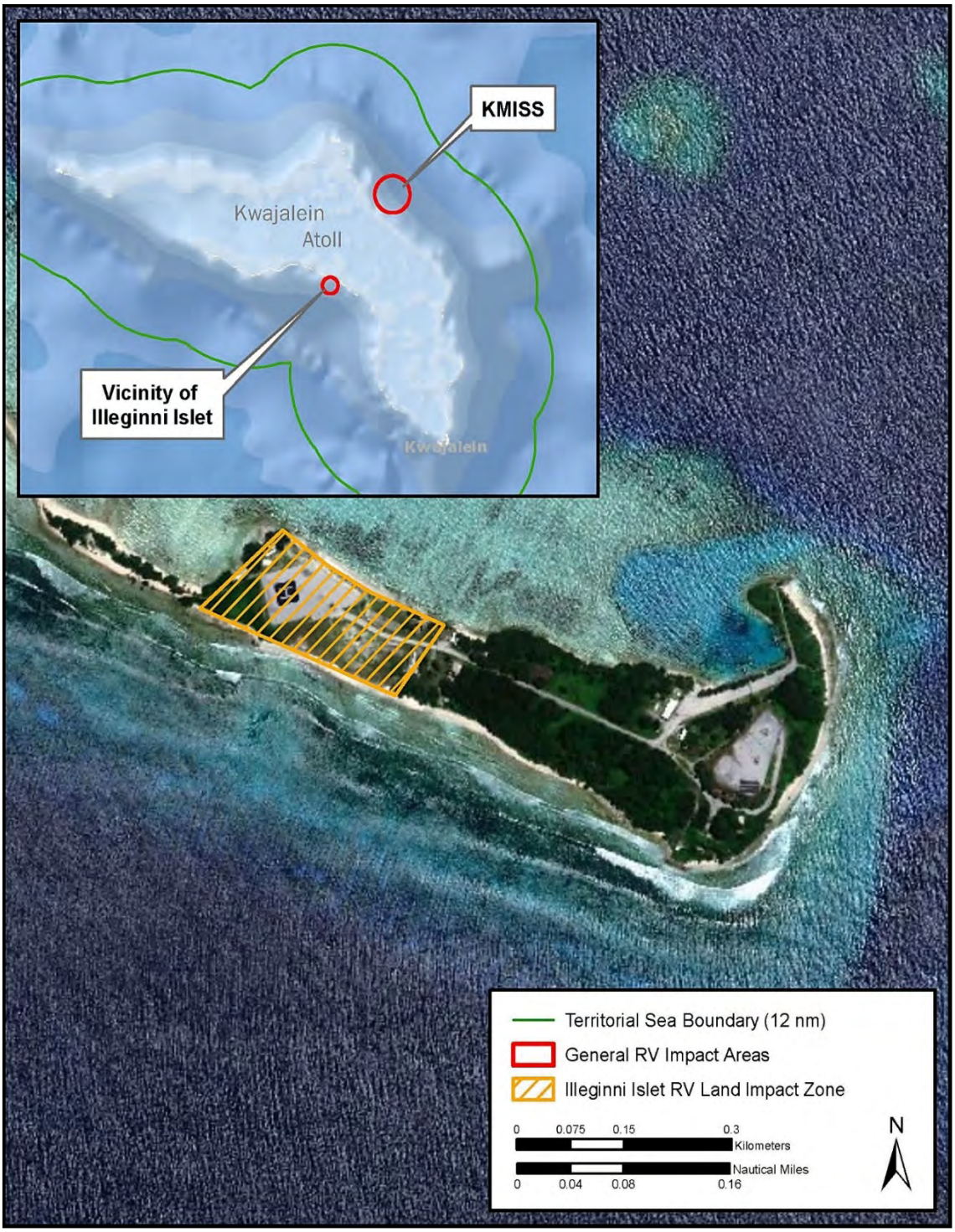

Figure 1. GBSD Reentry Vehicle (RV) Impact Areas at Kwajalein Atoll, RMI.

The proposed GBSD flight test activities include pre-flight preparation activities at Kwajalein Atoll, multiple flight tests in and above Kwajalein Atoll (including RV impact), payload impact, post-flight impact data collection, and post-flight operations at Kwajalein Atoll, debris recovery, and clean-up operations at USAKA. There are currently up to six GBSD flight tests planned per year (for a total of 28 GBSD flight tests) between FY 2024 and FY

2029, but the USAF anticipates up to nine tests per year (launching from VAFB) to account for shifts in scheduling and planning (Table 3). A portion of these tests would involve flight termination at USAG-KA; however, since the number of tests with terminal impact at Kwajalein remains unspecified, these analyses assume that all tests could use USAG-KA. The USAF currently anticipates only one land impact flight test at Illeginni Islet for the GBSD Test Program, but up to three total land RV impacts may be possible through FY 2029.

Deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently developed for operational use; therefore, both GBSD and MMIII flight test activities and related operations would overlap at HAFB, VAFB, and USAG-KA. This testing would overlap for up to 10 years, or until decisions are made to remove the MMIII weapon system from active status.

Table 3. Proposed Number of GBSD and MMIII Flight Tests by Fiscal Year.

Test Program	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
GBSD	0	0	0	4	4	5	6	5	4
MMIII	4	5	3	4	4	4	3	3	3
Total	4	5	3	8	8	9	9	8	7

The following subsections include descriptions of the launch vehicle, pre-flight operations, flight, terminal phase operations, and post-flight operations.

Launch Vehicle Description

The specific design of the launch vehicle/proposed GBSD weapon system has not yet been confirmed; however, the plan is for the design of the launch vehicles to be sized to fit within existing MMIII launch facilities (LFs) at VAFB. The booster would use a solid propellant composition with similar properties to that of the MMIII booster. Comparable to the MMIII flight test missile, the GBSD flight test missile would carry a post boost vehicle on top of the booster that includes a propulsion system rocket engine with liquid hypergolic propellants, missile guidance set, and reentry system (Figure 2).

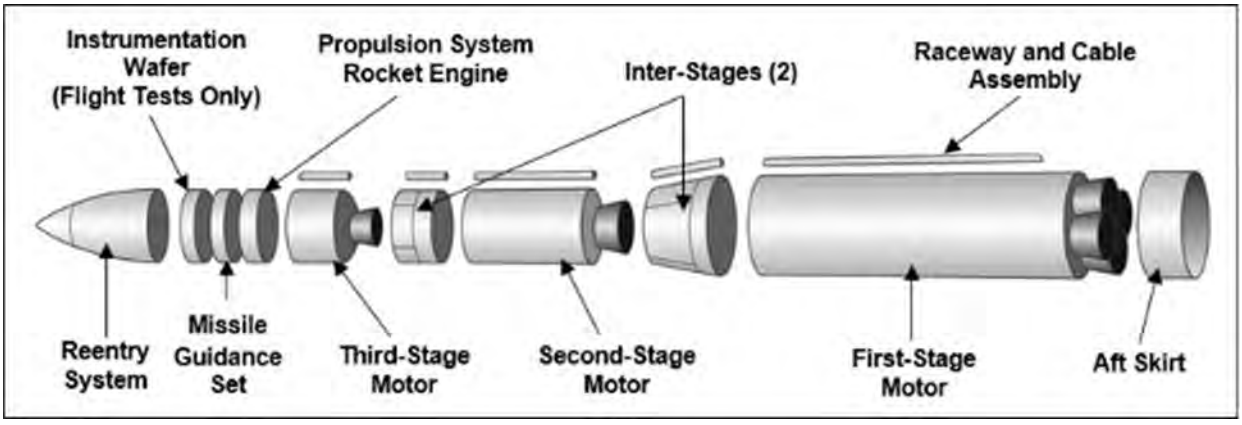

Figure 2. Minuteman III Missile Components.
Source: USAF 2004, 2013, 2020b

Similar to the MMIII system, the GBSD weapon system design is expected to use ordnance including a shroud ejection motor initiator, motor igniter assemblies, gas generators, and a flight termination system destruct package.

Although the GBSD payload may be of a new design, it would contain one to three test RVs which would be the same or similar to those used for MMIII flight testing. The MMIII reentry system was designed to contain one to three Mark 21 or Mark 12A RVs with a two-piece protective shroud (Figure 3). Test RVs are used for the annual MMIII flight tests, and the same is also expected for GBSD testing.

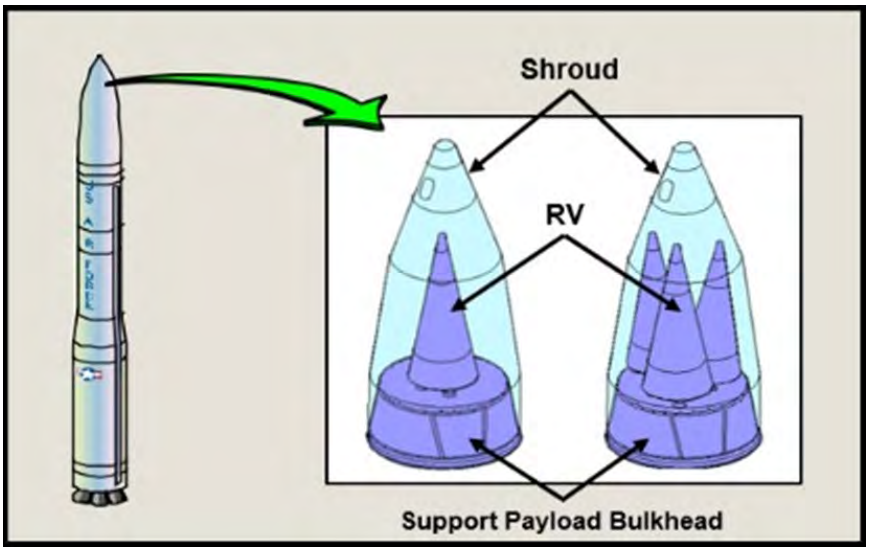

Figure 3. Minuteman III Payload/Reentry System.
Source: Modified from USAF 2013, 2020b

Typical test RVs, similar to the MMIII vehicles, do not contain any fissile materials but do contain some hazardous materials that would include silver zinc and thermal batteries, asbestos, depleted uranium, and other heavy metals (Table 4).

Table 4. MMIII Reentry Vehicle Characteristics.

Component	Description
Batteries	Mark 12A RVs contain one silver zinc battery, approximately 0.7 kilogram (1.6 pounds) Mark 21 RVs contain one silver zinc and one thermal battery, totaling approximately 1.1 kilograms (2.4 pounds)
Hazardous Materials	All test RVs typically include: 8 to 623 grams (1 to 22 ounces) of asbestos approximately 1 to 10 grams (<1 ounce) each of beryllium (Be), cadmium (Cd), and chromium (Cr) approximately 136 grams (45 ounces) of lead (Pb) less than 84 kilograms (185 pounds) of depleted uranium (DU)

Sources: USAF 2004, USAF 2020a, USAF 2020b

Pre-flight Preparations:

Pre-flight preparations would be the same as, or similar to, those conducted for the MMIII flight tests. Pre-flight activities would occur at the KMISS site, on land at Illeginni Islet, and in Kwajalein Atoll waters. In the vicinity of Illeginni Islet, pre-flight activities would include several vessel round-trips and helicopter trips to the RV impact location for personnel and equipment transport. For tests conducted at Illeginni Islet, portable camera stands would be set up on the western end of Illeginni Islet to record the flight test prior to the test. A barge or landing raft would be used to transport test equipment to Illeginni Islet. It is anticipated that, similar to other flight tests (such as the MMIII and FE-2 programs) with payload impact at Illeginni Islet, there would be increased human activity on Illeginni Islet over a three-month period (USAF 2020).

Launch: The GBSD weapon system RVs will be launched from land at VAFB, California and enter an over-ocean flight phase within seconds after the launch. *As described in the Consultation History, the USAF and USASMDC have concluded that all Proposed Action launch activities at VAFB are covered under existing programmatic consultations for ongoing launch activities at VAFB, and therefore will not be covered under or discussed further in this consultation.*

Over-Ocean Flight: After launching, a series of ground, sea, and/or air based sensors would monitor the GBSD vehicle during flight and collect data on vehicle flight and system performance (details below). Each flight test may have up to three RVs which would impact at USAG-KA. It is expected that most test RVs would be targeted at the KMISS ocean area just east of Gagan Islet, or within deep ocean waters in the vicinity of Illeginni Islet on the western side of Kwajalein Atoll (Figure 1). For flight tests terminating at Kwajalein Atoll, only test RVs would impact within RMI territorial waters or on land at Illeginni Islet. For security purposes, all other activities relating to over-ocean flight would occur over international waters and are described and evaluated in a separate classified annex to the GBSD Test Program Environmental Assessment, and will therefore not be discussed in this Opinion (USAF 2020a).

Testing at the KMISS ocean area would be conducted in the same manner as for the current/ongoing MMIII flight tests, while testing in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2020b; USAF 2004, USAF 2015). The KMISS RV impact area would be in deep ocean waters east of Kwajalein Atoll. At Illeginni Islet, RVs would typically impact in ocean waters southwest of the islet. The RV impact zone on Illeginni Islet would only be used for up to three total tests through FY 2029, and only three total RV impacts would be expected. There is a small risk that a potential land impact test might result in an RV strike near the shallow waters or reef flats adjacent to the western end of Illeginni. For MMIII tests, the USAF estimated the probability of a shallow water or reef RV impact to be between 0.10 and 0.20 (USAF 2015).

A crater would form with soil, rubble, and RV fragments being ejected outward from the impact site as a result of an RV strike at Illeginni Islet. Prior MMIII RV tests have resulted in craters 6.1 to 9.1 m in diameter and 2.1 m to 3.0 m deep (USAF 2015). Any RV components or substances would be ejected outward from the RV impact point. Based on observations from MMIII and other payload testing at Illeginni Islet, most of the RV materials and substrate ejecta would remain close to edge of the crater. The density of ejecta would be

expected to decrease with distance from the impact point. For MMIII and other program flight tests (such as the FE-2 tests), ejecta resulting from crater formations was estimated to extend no more than 60 to 91 m from the impact location (USAF 2015, U.S. Navy 2019) and would be primarily within an area 120 degrees downrange along the flight path (USAF 2015) (Figure 4).

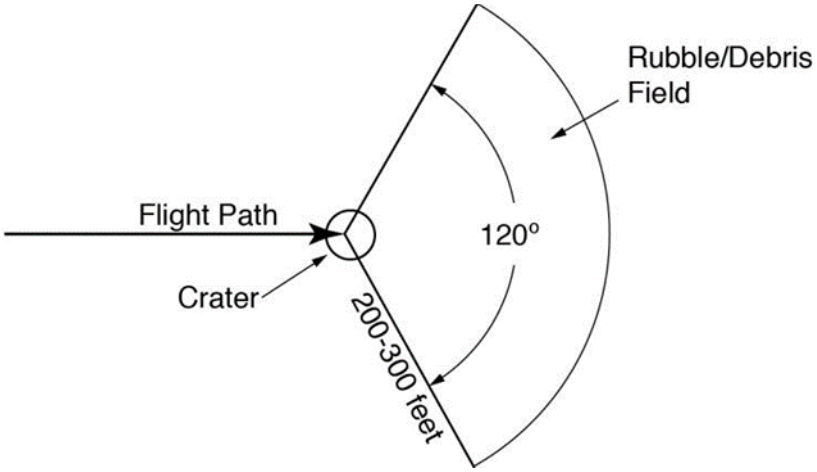

Figure 4. Approximate Debris Field for Reentry Vehicle Land Impacts.
Source: USAF 2015

A land impact test that strikes the shoreline could result in the dispersal of soil and rubble onto the shallow near shore reef flat. Although not planned, an RV shallow water impact (water depths of 3.0 m less) on the reef at Illeginni Islet could create a crater 3.0 to 4.6 m wide and 0.6 to 1.2 m deep (as estimated for MMIII testing). Prior tests have shown that no craters are formed in waters deeper than 3.0 m (USAF 2015). During most GBSD tests, RVs would remain intact until ocean water or land impact. However, up to two test RVs per year may contain an explosive charge for purposes of conducting a high fidelity test. During such tests, the RV may detonate upon contact with the land or ocean waters or may detonate at some altitude in air (airburst). Because of the RV's hypersonic velocity at time of detonation, the resulting debris (mostly aerosolized) impacts in a focused area at the impact site (USAF 2015). For MMIII, the USAF estimated that the energy associated with high fidelity test debris is less than the energy associated with a conventional RV impact (USAF 2015).

If the launch vehicle were to deviate from its course or should other problems occur during flight that might jeopardize public safety, the destruct devices (in the form of linear explosive assemblies) would separate the stages, split the motor casings, and stop forward thrust. This action would initiate a predetermined safe mode for the vehicle, causing it to terminate flight and fall into the ocean. No termination debris would be expected to fall on land. The need for flight termination is unplanned and would be an unexpected and unlikely event.

Sensor Coverage:

The flight paths would initiate from VAFB, travel across the BOA, and continue to USAKA in the RMI. A series of ground, sea, and/or air based sensors would monitor the GBSD vehicle during flight and collect data on vehicle flight and system performance. Up to 17 Lawrence Livermore National Laboratory (LLNL) sensor rafts stored at USAG-KA would be temporarily deployed in ocean waters near the RV impact location. The rafts measure

approximately 2.7 m wide and 4.6 m long, and contain various sensors including neutron detectors, hydrophones, video equipment, and cameras (Figure 5). The rafts generally use battery-powered tolling motors for station-keeping to ensure proper positioning for the flight tests (USAF 2020b). No anchors would be used to maintain the raft positions. Rafts would be deployed from a landing craft utility or similar vessel and would be placed in water depths at least 3 m.

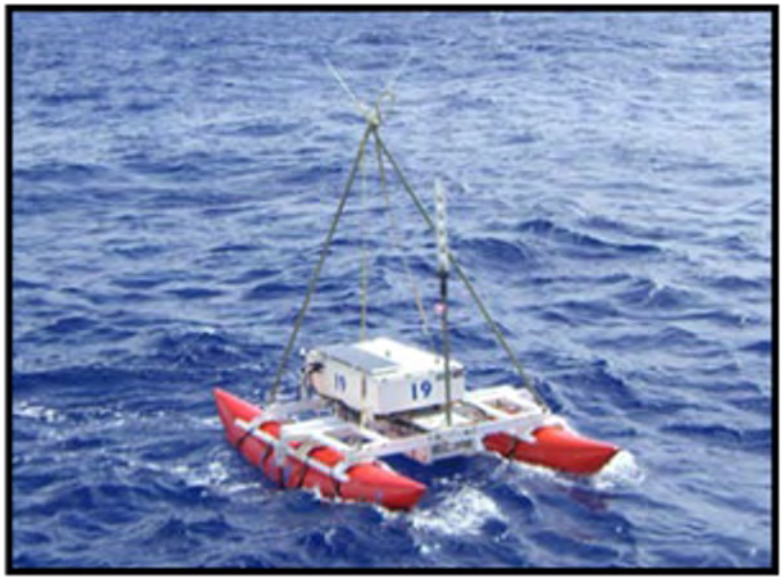

Figure 5. Representative Sensor Raft System.
Source: USAF 2010

Post-flight Operations:

Post-flight operations would involve post-test recovery and clean-up, which would include vessel traffic and personnel recovering GBSD post-flight debris at Illeginni islet either manually or with heavy equipment (similar to that used during site preparation). LLNL sensor rafts described above would be recovered with a landing craft. Landing craft utilities or other vessels would be used to transport cleanup and recovery equipment (such as a backhoe or grader) from Kwajalein Islet to Illeginni Islet. Visible RV debris on land, including hazardous materials, would be cleaned up by hand. Most RV debris would normally be found in the crater and a backhoe may be used to excavate the craters. The material excavated from these craters would be screened for RV debris and would then be backfilled with soil and rubble that was ejected around the wall of the crater. All recovered RV and other man-made debris would be shipped back to Kwajalein Islet or the United States.

Although lagoon and ocean reef flats will not be intentionally targeted during GBSD testing, recovery and cleanup of RV debris in these areas would be necessary if RV debris entered these areas due to a shoreline land impact or an unintentional reef impact. RV debris recovery would be attempted in areas within 152 to 305 m of the shoreline on the lagoon side of Illeginni Islet (USAF 2004). In shallow, nearshore areas recovery would be conducted similarly to land operations when tide conditions and water depth permit (USAF 2004, USAF 2015). If recovery operations were necessary in lagoon or ocean reef flats, USAF and USAG-KA personnel would coordinate with NMFS and USFWS to identify and use access corridors

to the crater site to avoid unnecessary and accidental impacts to protected species and sensitive habitats. If RV debris were in deeper waters, a USAG-KA dive team would be brought in to conduct underwater searches (USAF 2004). A ship would also be used for recovery operations. A remotely operated vehicle would first be used to locate the debris field and then divers in scuba gear would recover debris manually (USAF 2004). In the event of an unplanned lagoon or reef flat impact, it is predicted that rubble ejected from an impact crater larger than one inch would be found within a 1.5–3 m radius around the crater rim (USAF 2015).

No post-test recovery and clean-up activities are anticipated for GBSD flight tests conducted at the KMISS site. For a nominal/planned mission, RVs that impact in the deep ocean waters/ocean side of Illeginni Islet are not recovered. Searches for RV debris would only be attempted out to depths of 15 to 30 m in an operation similar to lagoon recovery operations (USAF 2004).

Further, the USAF would prepare a post-test recovery/cleanup plan detailing specific actions which would be taken, including the Mitigation Measures/Best Management Practices (BMPs) listed below, to avoid impacts to listed species. The Mitigation Measures listed below would be implemented as part of GBSD test program and are very similar to those implemented for MMIII (USAF 2015, USAF 2020b) and other recent test programs with payload impacts at Illeginni Islet (U.S. Navy 2019, U.S. Navy 2017). The following measures would be implemented as part of the Proposed Action and would be included in the DEP for GBSD Test Program activities at Kwajalein Atoll.

Mitigation Measures/Best Management Practices (BMPs):

Marine Mammal and Sea Turtle Monitoring

- During travel to and from impact zones, including Illeginni Islet, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would adjust speed or raft deployment based on expected animal locations, densities, and/or lighting and turbidity conditions.
- USAG-KA personnel would conduct a helicopter or fixed-wing aircraft overflight of the impact area three times over the week preceding a flight test and as close to launch as safely practical to survey for marine mammals and sea turtles. The final overflight would be within one day of the proposed launch. If personnel observe marine mammals or sea turtles in the vicinity, they would report such findings to the USAG-KA Environmental Office.
- Any observations of marine mammals or sea turtles during ship travel or overflights would be reported (including location, date, time, species or taxa, and number of individuals) to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to NMFS and/or USFWS.
- Pre-flight monitoring by qualified personnel will be conducted on Illeginni Islet for sea turtles or sea turtle nests. For at least eight weeks preceding the launch, Illeginni Islet would be surveyed by pre-test personnel for sea turtles, sea turtle nesting activity, and sea turtle nests. If possible, personnel will inspect the area within days of the launch. If sea turtles or sea turtle nests are observed near the impact area, observations would be reported to appropriate test and USAG-KA personnel for consideration in approval of the launch, and to USFWS and NMFS.

- Personnel will report any observations (including location, date, time, species, and number of individuals) of sea turtles or sea turtle nests on Illeginni Islet to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to USFWS.
- Although unexpected, any dead or injured marine mammals or sea turtles sighted by post-flight personnel would be reported to the USAG-KA Environmental Office and USASMDC, who would then inform NMFS and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas would also similarly report any opportunistic sightings of dead or injured marine mammals or sea turtles.

Hazardous Materials Measures

- Vessel and equipment operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm terrestrial or marine life.
- Any accidental spills from support equipment operations would be contained and cleaned up and all waste materials would be transported to Kwajalein Islet for proper disposal.
- Hazardous materials would be handled in adherence to the hazardous materials and waste management systems of USAG-KA. Hazardous waste incidents would comply with the emergency procedures set out in the Kwajalein Environmental Emergency Management Plan and the UES.
- Vessel and heavy equipment operators would inspect and clean equipment for fuel or fluid leaks prior to use or transport and would not intentionally discharge fuels or waste materials into terrestrial or marine environments.
- All equipment and packages shipped to Kwajalein Atoll will undergo inspection prior to shipment to prevent the introduction of alien species into Kwajalein Atoll.
- Following a land-impact test, the USAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium (Be), DU, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation.

Reef Protection Measures

- To avoid impacts on coral heads in waters near Illeginni Islet, sensor rafts would not be located in waters less than 3 m deep.
- When feasible, within one day after the land impact test at Illeginni Islet, USAG-KA environmental staff would survey the islet and the near-shore waters for any injured wildlife, damaged coral, or damage to sensitive habitats (i.e., reef habitat). Any impacts to biological resources would be reported to the Appropriate Agencies, with USFWS and NMFS offered the opportunity to inspect the impact area to provide guidance on mitigations.
- If an inadvertent impact occurs on the reef, reef flat, or in shallow waters less than 3 m deep, an inspection by project personnel would occur within 24 hours. Representatives from NMFS and USFWS would also be invited to inspect the site as soon as practical after the test. The inspectors would assess any damage to coral and

other natural and biological resources and, in coordination with USAF, USAG-KA, and RTS representatives, decide on any response measures that may be required.
- If any man-made debris were to enter the marine environment and divers were required to search for payload debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of payload debris that they would be looking for.

General Measures at Illeginni Islet

- At Illeginni Islet, should any missile components or debris impact areas of sensitive biological resources (i.e., sea turtle nesting habitat or coral reef), a USFWS or NMFS biologist would be allowed to provide guidance and/or assistance in recovery operations to minimize impacts on such resources. To the greatest extent practicable, protected marine species including invertebrates will be avoided or effects to them will be minimized. This may include movement of these organisms out of the area likely to be affected.
- Debris recovery and site cleanup would be performed for the land impact. To minimize long-term risks to marine life, all visible project-related man-made debris would be recovered during post-flight operations. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.
- For recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni Islet, USFWS and NMFS would be notified to advise on best care practices and qualified biologists would be allowed to assist in recovering and rehabilitating any injured sea turtles found.
- During post-test recovery and cleanup, should personnel observe endangered, threatened, or other species requiring consultation moving into the area, work would be delayed until such species were out of harm's way or leave the area.

2.1 Interrelated/Interdependent Actions

Military training and testing at Kwajalein Atoll has been ongoing since World War II. Testing of missile programs at Kwajalein began in 1959 for the Nike Zeus missile program. The Minuteman (MM) I program began in 1962, MMII began in 1965, and MMIII began in 1970. In addition to the MM program, anti-ballistic missile (e.g. Terminal High Altitude Area Defense (THAAD)), and other missile development and testing take place at the RTS, along with other military training and testing activities, and commercial missile launches. If it were not for these numerous activities, it is doubtful that the facilities at USAKA and RTS would be required. Therefore actions to develop and maintain USAKA and RTS facilities and infrastructure, and to support the various missions, are interrelated and/or interdependent with the training and testing activities that occur at the USAKA and RTS. However, much of the infrastructure and facilities are designed to support numerous programs and missions, with few being project-specific. Therefore, support activities that are solely attributable to the GBSD weapon system constitute a small portion of the total that occur at USAKA and RTS in support of the site's numerous missions. Further, per the Document of Environmental Protection (DEP) procedures outlined in the UES, any USAKA and RTS actions that may affect the USAKA environment require structured environmental review, with coordination and/or consultation as appropriate. Based on this, we expect that interrelated or interdependent actions that may be solely attributable to the GBSD flights would be virtually

inseparable from the routine activities at USAKA and RTS, and any impacts those actions may have would be considered through the DEP procedures outlined in the UES.

2.2 Action Area

The action area for this consultation begins at the launch site on VAFB, California to the terminal end of the GBSD test flights within the RMI territory, which includes the RV impact sites at: 1) in ocean waters of the KMISS area; 2) in ocean waters in the vicinity of Illeginni Islet; or 3) on land at Illeginni Islet. The GBSD launch vehicle would launch from VAFB, California and likely consist of a three stage booster system with an experimental payload. As described above, to comply with GBSD Test Program security classification requirements regarding missile flight paths and downrange testing, only GBSD downrange target locations at USAG-KA are described and analyzed in this Opinion. Other downrange actions and locations are described and analyzed in a separate, classified annex to the GBSD Test Program Environmental Assessment / Overseas Environmental Assessment (USAF 2020a). GBSD spent booster motors, post boost vehicle components, and test RVs would be expected to impact primarily in ocean waters away from land areas. Furthermore, although the launch activities will have no effect on listed species and are not discussed in this consultation, it is still included as part of the action area.

As mentioned above, testing in the RMI would be conducted in the same manner as for the ongoing MMIII flight tests in the KMISS area (USAF 2020b), and testing on and in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2004, USAF 2015). The KMISS impact area currently used for MMIII is in deep ocean waters east of Kwajalein Atoll, at least 5.6 km (3 nm) offshore of Gagan Islet. The RV impact zone in the vicinity of Illeginni Islet would be in ocean waters southwest of the islet. For MMIII testing, the test RVs were expected to typically impact up to approximately 792 meters (2,600 ft) from the islet. The RV impact zone on Illeginni Islet is an area on the non-forested, northwest end of the islet that has been used for DoD testing for several decades.

The action area covered under this Opinion (RV impact areas) are not located in any ESA critical habitats.

3 SPECIES AND CRITICAL HABITATS NOT LIKELY TO BE ADVERSELY AFFECTED

As explained above in Section 1, the USAF/USASMDC determined that the proposed action was not likely to adversely affect (NLAA) the 35 consultation species listed in Tables 1 and 2. This section serves as our concurrence under section 7 of the ESA of 1973, as amended (16 U.S.C. §1531 et seq.), and under section 3-4.5.3(d) of the UES, 15th Edition, with the USAF/USASMDC's determination.

The UES does not specifically define the procedure to make a NLAA determination. However, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA NLAA determination process. In order to determine that a proposed action is not likely to adversely affect listed species, under the ESA, we must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint

FWS-NMFS Endangered Species Consultation Handbook. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs; discountable effects are those that are extremely unlikely to occur; and beneficial effects are positive effects without any adverse effects (FWS and NMFS 1998). Many of the stressors for the Proposed Action are expected to be similar to the MMIII action and other test programs; therefore, portions of the MMIII Modification BA (USAF 2015), the NMFS BO on that action (NMFS 2015a), and Flight Experiment 2 (FE-2) BA (U.S. Navy 2019) are referenced and used in this analysis. Each phase has potential stressors; however, only stressors associated with terminal flight and impact in the RMI will be discussed and listed below, which are based on what the missile is doing and on activities done to support the test. As mentioned earlier in this Opinion, the launch activities portion of the action will not be discussed in this consultation, as the USAF has determined that the launch will have no effect on any listed species and critical habitat. Over-ocean flight activities will also not be discussed due to security measures; however, based on effects determinations made in previous consultations (such as with the MMIII program, Flight Experiment 1 (FE-1), and FE-2 tests) with similar test flights impacting the RMI, we expect similar effects to listed species.

No critical habitat has been designated in the RMI, and the action area covered under this consultation does not occur within any ESA-listed species critical habitats; therefore, no designated critical habitat occurs in the Action Area and there would be no effects to critical habitat.

Reentry Vehicle Impact in the RMI: The potential stressors during payload impact and preparation and restoration work in the KMISS, vicinity of Illeginni Islet, and Kwajalein Atoll are:

a) Exposure to elevated noise levels;
b) Direct contact from payload impacts;
c) Exposure to hazardous materials;
d) Disturbance from human activity and equipment operation; and
e) Collision with vessels.

NMFS has determined an additional stressor from this proposed action:

a) Long-term addition of man-made objects to the ocean.

Each of these stressors are addressed below to determine whether or not individuals of any of the ESA-listed and UES-protected marine species considered in this consultation are likely to be adversely affected by that stressor. The species that may be exposed to stressors during each phase, and their likely response to exposure are based on the biological and/or ecological characteristics of each species. Any incidence where a stressor has more than a discountable risk of causing an adverse effect on any individual of the ESA- and/or UES-protected species will result in that stressor and those species being considered in the following biological opinion.

a. Exposure to elevated noise levels: While in flight between VAFB and the RMI, the missile and the payload would travel at velocities that cause sonic booms. High-intensity in-water noise would be created when large missile components, such as the missiles payload, impact the ocean's surface. The impact from the payload hitting the ground will also create a sound to land and water that could transfer to water causing impulsive sound sources. High intensity

impulsive noises can adversely affect marine life. The USAF/USASMDC will also create sounds from vessels and human activity in and near water during placement and retrieval of sensors and other data collecting instruments, and retrieval of debris from the impact. Effects vary with the frequency, intensity, and duration of the sound source, and the body structure and hearing characteristics of the affected animal. Effects may include: non-auditory physical injury; temporary or permanent hearing damage expressed as temporary threshold shift (TTS) and permanent threshold shift (PTS) respectively; and behavioral impacts such as temporarily masked communications or acoustic environmental cues and modified behaviors.

Sound is a mechanical disturbance consisting of minute vibrations that travel through a medium, such as air, ground, or water, and is generally characterized by several variables. Frequency describes the sound's pitch and is measured in hertz (Hz) or cycles per second. Sound level describes the sound's loudness. Loudness can be measured and quantified in several ways, but the logarithmic decibel (dB) is the most commonly used unit of measure, and sound pressure level (SPL) is a common and convenient term used to describe intensity. Sound exposure level (SEL) is a term that is used to describe the amount of sound energy a receiver is exposed to over time. The dB scale is exponential. For example, 10 dB yields a sound level 10 times more intense than 1 dB, while a 20 dB level equates to 100 times more intense, and a 30 dB level is 1,000 times more intense. Sound levels are compared to a reference sound pressure, based on the medium, and the unit of measure is the micro-Pascal (μPa). In water, sound pressure is typically referenced to a baseline of 1 μPa (re 1 μPa), vice the 20 μPa baseline used for in-air measurements. As a rule of thumb, 26 dB must be added to an in-air measurement to convert to an appropriate in-water value for an identical acoustic source (Bradley and Stern 2008).

Transmission loss (attenuation of sound intensity over distance) varies according to several factors in water, such as water depth, bottom type, sea surface condition, salinity, and the amount of suspended solids in the water. Sound energy dissipates through mechanisms such as spreading, scattering, and absorption (Bradley and Stern 2008). Spreading refers to the apparent decrease in sound energy at any given point on the wave front because the sound energy is spread across an increasing area as the wave front radiates outward from the source. In unbounded homogenous water, sound spreads out spherically, losing as much as 7 dB with each doubling of range. Toward the other end of the spectrum, sound may expand cylindrically when vertically bounded such as by the surface and substrate, losing only about 3 dB with each doubling of range. Scattering refers to the sound energy that leaves the wave front when it "bounces" off of an irregular surface or particles in the water. Absorption refers to the energy that is lost through conversion to heat due to friction. Irregular substrates, rough surface waters, and particulates and bubbles in the water column increase scattering and absorption loss. Shallow nearshore water around Illeginni where the payload may impact, is vertically bounded by the seafloor and the surface, but is considered a poor environment for acoustic propagation because sound dissipates rapidly due to intense scattering and absorption. The unbounded deep open ocean waters where the motors would impact is considered a good acoustic environment where spherical spreading would predominate in the near field.

In the absence of location-specific transmission loss data, equations such as RL = SL – #Log(R) (RL = received level (dB); SL = source level (dB); # = spreading coefficient; and R = range in meters (m)) are used to estimate RL at a given range (isopleth). Spherical

spreading loss is estimated with spreading coefficient of 20, while cylindrical spreading loss is estimated with spreading coefficient of 10. Spreading loss in near shore waters is typically somewhere between the two, with absorption and scattering increasing the loss. RL = SL – 20_{Log}(R) was used here to estimate ranges in deep open ocean water, and RL = SL – 15_{Log}(R) was used to estimate ranges in the lagoon and reef flat areas around Illeginni.

The sound pressures associated with non-auditory injury are very high and are generally associated with a shock wave that is generally not found in sounds that are created by a splashdown. The Navy identified a threshold for non-auditory injury based on gastrointestinal bursting at 237 dB re: 1 µPa (Finneran and Jenkins 2012). The sounds estimated from the splashdowns and sonic booms are clearly below those thresholds and are not likely to cause non-auditory injury to marine mammals, sea turtles, elasmobranchs, and large fishes.

Table 5. Estimated thresholds for TTS and behavioral changes for hearing groups. Source: Finneran and Jenkins 2012; Popper et al. 2014; NMFS 2016.

Hearing Group	**TTS peak pressure threshold (SPL_{peak})**	**Weighted TTS onset threshold (SEL_{CUM})**	**Estimated threshold for behavioral changes**
Low-frequency cetaceans (humpback whale and other baleen whales)	213 dB	179 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Mid-frequency cetaceans (dolphins, pilot whales and other toothed whales)	224 dB	178 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
High-frequency cetaceans (Kogia, true porpoises)	196 dB	153 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Phocid pinnipeds (Hawaiian monk seals and other true seals)	212 dB	181 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Sea turtles	224 dB	200 dB	160 dB
Sharks, rays, and fish	229 dB*	186 dB*	150 dB

* - SPL for lethal and sublethal damage to fish with swim bladders exposed to not specific to hearing.

The threshold for the onset of behavioral disturbance for all marine mammals from a single exposure to impulsive in-water sounds is ≥ 160 dB. Ongoing research suggests that these

thresholds are both conservative and simplistic (detailed in Southall et al. 2007 and NOAA 2013). The draft revised thresholds for marine mammals uses two metrics: 1) exposure to peak sound pressure levels (SPL_{peak}); and 2) exposure to accumulated sound exposure levels (SEL_{cum}). The thresholds for single exposures to impulsive in-water sounds are listed in Table 5 for the onset of injury and temporary hearing impacts (NMFS 2016). Corals and mollusks can react to exposure to intense sound and could be affected by concussive forces if exposed to very intense sound sources such as an underwater detonation.

The major sources of noise during this project are: 1) airborne sonic boom, and 2) objects impact onto the water and onto land.

Sonic booms

A sonic boom is a thunder-like noise caused by the shock wave generated by an object moving at supersonic speed. As objects travel through the air, the air molecules are pushed aside with great force and this forms a shock wave much like a boat creates a bow wave (Kahle et al. 2019).

These types of man-made sounds can physically adversely affect animals exposed to them in several ways: 1) non-auditory injury (e.g., barotrauma), hearing loss (expressed as permanent or temporary threshold shift), and behavioral responses. They may also experience reduced hearing by masking (i.e. the presence of one sound affecting the perception of another sound). Of these physical effects, the one measurable effect that is most likely to occur at the lowest noise intensity, would be temporary threshold shift (TTS) or temporary hearing loss. The level of noise generated during the action was not loud enough to cause non-auditory injuries, and animals were not close enough or exposed long enough to lose their hearing permanently.

The missile travels faster than the speed of sound, generating a sonic boom, which follows the object. Each vehicle would fly at speeds sufficient to generate sonic booms from close to launch and extending to impact in Kwajalein Atoll. Sonic booms create elevated pressure levels both in the air and underwater. Models were used to estimate sound pressure levels for sonic booms for the MMIII flight tests (Moody 2004, USAF 2015), and those estimates are used for the Proposed Action. As each descending test RV approaches KMISS at hypersonic velocity, sonic booms are generated over a very broad area of the open ocean northeast of the atoll and continue southwesterly toward the point of impact (Figure 6) (USAF 2015). The sonic boom footprint narrows to just a few miles on either side of the flight path (USAF 2015). At the ocean surface, the sound pressure levels for the sonic booms would vary from 91 decibels (dB) in-air (reference value at 20 μPa) (117 re 1 μPa in-water) at the eastern-most range and increase to 150 dB in-air (176 re 1 μPa in-water) at the western-most range, close to the point of impact (USAF 2015). For those RVs that impact in the KMISS area, the sonic boom footprint would occur almost entirely over the open ocean (USAF 2015). The duration for sonic boom overpressures produced by the RVs ranges from 40 milliseconds where the boom is strongest to 124 milliseconds where it is weakest (Moody 2004, USAF 2015).

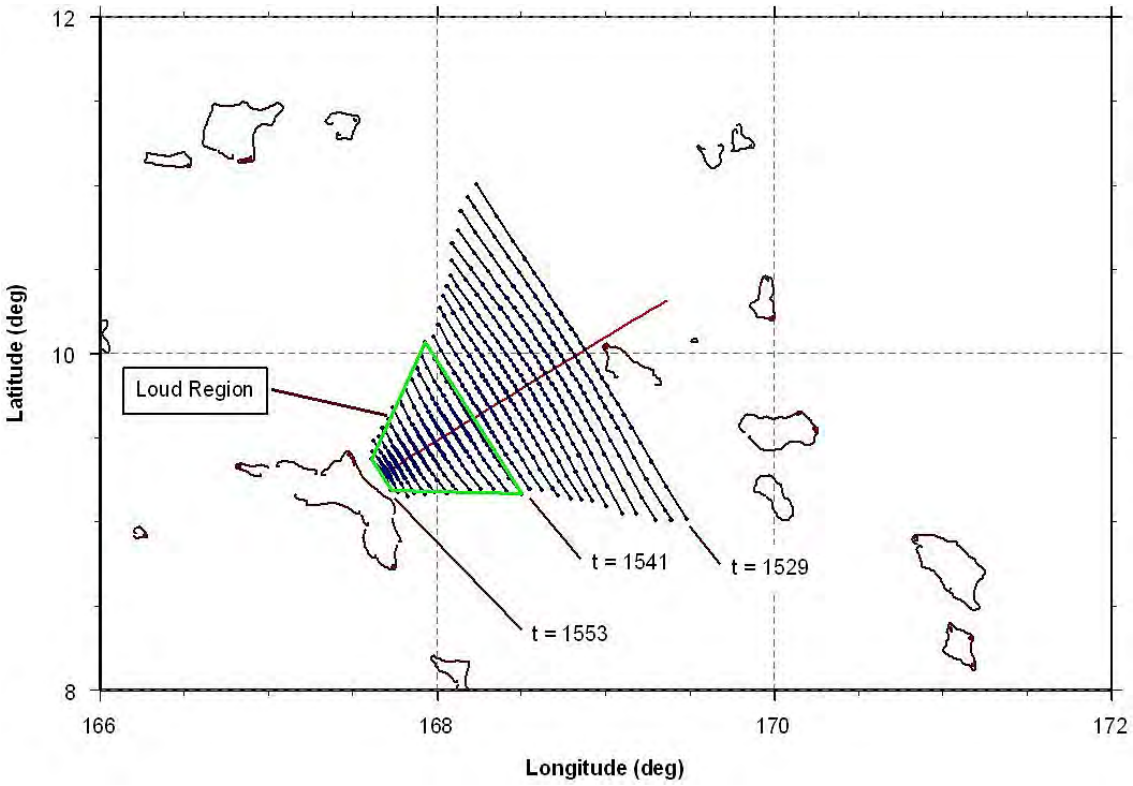

Figure 6. Representative Sonic Boom Footprint for an RV Impact at Kwajalein Atoll. Source: USAF 2015

At its loudest (176 dB in-water), the sonic boom at Kwajalein Atoll would not exceed permanent injury thresholds for consultation organisms and is below the TTS thresholds as well. Sonic booms are classified as impulsive and non-continuous sounds; therefore, for the purposes of this consultation we will be using the peak pressures to evaluate effects. Sounds in air are generally not loud enough to cause vibration and more specifically water molecules to move into each other and carry the sound further. Most of the airborne sound will be deflected, while the rest of the sound energy will be absorbed or refracted even further. The source sound level when it enters the surface is likely to be well below thresholds for injury of hearing loss. The sonic boom footprint for sounds above 160 dB re 1 µPa would likely cover a large area around the flight path; however, the sound would only last a fraction of a second (0.3 seconds). We believe that, at most, an exposed individual may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. We expect exposure to sonic booms would have insignificant effects on any of the species considered in this consultation.

RV Impact Noise

Impact of the RV at the terminal end of the flight would result in elevated sound levels in-air and underwater. Sound pressure estimates for the MMIII RV impact in ocean waters were up to 240 dB re 1 µPa at 3.1 m (USAF 2015). The sound pressures would decrease with water

depth and distance from the point of RV impact. Using a point source attenuation model with spherical spreading coefficient, sound pressures attenuate to 230 dB re 1 µPa at 10 m from RV splashdown, 224 dB re 1 µPa at 20 m, and 202 dB re 1 µPa at 251 m. Sound pressure estimates are not available for high fidelity RV tests; however, the energy released during high fidelity tests is expected to be an order of magnitude less than that of a non-high fidelity test RV and the airburst would occur at some altitude above the surface (USAF 2015). Because the energy release would be less than for a non-high fidelity test RV and because much of sound intensity loss at the air-water interface, in-water sound pressures of high fidelity tests are expected to be less than for non-high fidelity test RV impacts.

For RV impacts in KMISS or the Vicinity of Illeginni Islet waters, sound pressure levels may peak up to 250 dB (1 µPa) at impact (which would last no more than a couple of seconds). Using a spherical spreading model for deep ocean waters (described in USAF 2015, NMFS 2015a, U.S. Navy 2019, NMFS 2019), the range to pressure effect thresholds from RV impact was calculated for UES consultation species groups (Table 6). This is a conservative approach given that it does not account for differential sound attenuation due to ocean conditions such as water depth, temperature, salinity, or stratification. The sound pressures from RV impact would exceed the PTS or non-auditory injury thresholds for consultation species but only very close to the impact point. Sound pressures would also exceed the TTS thresholds out 20 to 501 m from impact for cetaceans and sea turtles and up to 1,585 m for fish. RV impacts in the Vicinity of Illeginni Islet would in deep waters approximately 790 m southwest of Illeginni Islet and approximately 470 m from the outer edge of the fringing reef (NMFS 2015a). Therefore, maximum sound levels in reef habitats would be less than 196 dB re 1 µPa.

No data on UES listed cetaceans, sea turtle, and fish species densities are available in deep ocean waters of Kwajalein Atoll. However, if maximum density data for these species in other areas of the central Pacific Ocean (detailed in U.S. Navy 2019 and Hanser et al. 2017) are used, the number of expected injury, PTS, and TTS exposures for all species is substantially less than one. For example, around the Hawaiian Islands, the island stocks of pantropical spotted dolphins have maximum density estimates of 0.061 per square kilometer (km^2) (Hanser et al 2017), which would likely be on the very upper end of density for any cetacean species at Kwajalein Atoll. Using this density, the estimated number of exposures to PTS would be only 0.00002 individuals for each impact and only 0.00006 potential TTS exposures per impact. Using green sea turtle density estimates for offshore waters of Guam of 1 per 3.4 km^2 (U.S. Navy 2015b), there may be 0.00008 individual turtle exposures per impact to sounds above the PTS threshold, and 0.00029 exposures to sounds above the TTS threshold. These examples provide an estimate of the maximum number of exposures for UES-consultation species in deep ocean waters of Kwajalein Atoll. Even if summed across the maximum of nine tests per year with up to three RVs per test, the number of individuals that might be exposed to pressures high enough to cause PTS or TTS is still estimated to be substantially less than one per year for these species and less than one over the proposed six years of the GBSD Test Program.

Table 6. Maximum Underwater Radial Distance to Elevated Sound Pressure Level Effect Thresholds for UES Consultation Species from GBSD RV Ocean Impact.

Species Group	Effect Category	Threshold Criterion (re 1 µPa)	Radial Distance from RV Impact Point	Area around Impact Point, km^2 (mi^2)
Low Frequency Cetaceans	PTS (non-lethal injury)	219 dBpeak	35 m (116 ft)	0.004 (0.002)
	TTS	213 dBpeak	71 m (232 ft)	0.016 (0.006)
Mid Frequency Cetaceans	PTS (non-lethal injury)	230 dBpeak	10 m (32 ft)	<0.001 (<0.001)
	TTS	224 dBpeak	20 m (65 ft)	0.001 (<0.001)
High Frequency Cetaceans	PTS (non-lethal injury)	202 dBpeak	251 m (824 ft)	0.198 (0.076)
	TTS	196 dBpeak	501 m (1,644 ft)	0.789 (0.305)
All Cetaceans	Behavioral Disturbance	160 dBpeak	32 km (20 mi)	3,142 (1,213)
Sea Turtles	Mortality/ Mortal Injury	237 dBpeak	4 m (15 ft)	<0.001 (<0.001)
	PTS (non-lethal injury)	230 dBpeak	10 m (32 ft)-	<0.001 (<0.001)
	TTS	224 dBpeak	20 m (65 ft)	0.001 (<0.001)
	Behavioral Disturbance	160 dBpeak	32 km (20 mi)	3,142 (1,213)
Fish	Mortality/ Mortal Injury	229 dBpeak	11 m (37 ft)-	<0.001 (<0.001)
	TTS	186 dB SELcum re 1 μPa^2-s	1,585 m (5,200 ft)	7.891 (3.046)
	Behavioral Disturbance	150 dBRMS	100 km (62 mi)	31,416 (12,129)

It is more likely that at some UES consultation species would be exposed to sound pressures above the behavioral disturbance thresholds and that some individuals may respond to the RV impact noise. However, NMFS concluded for the similar MMIII action that any effects of this single impulsive noise are expected to "be limited to a temporary behavioral modification in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure" (NMFS 2015a). Therefore, the probability of those individuals being within injury or TTS thresholds from RV impact sound pressures are discountable, and their effects of non-injurious sound generated from the GBSD testing on all listed sea turtles, marine mammals, and fish species are expected to be insignificant.

Acute and temporary acoustic exposures such as those associated with RV impact would be expected to cause, at most, temporary consequences for some of the more specialized marine invertebrates (U.S. Navy 2019). Temporary disruption of feeding or predator avoidance behaviors (Mooney et al. 2010) in some invertebrates (such as mollusks) are possible; however, being much less acoustically sensitive, any exposed corals or mollusks that may be on the outer reef edge are expected to be unaffected by payload impact noise. Giant clam larvae are not likely to be present in BOA and most likely will not be present in the KMISS, or will be in low numbers. Based on the above information, the payload impact noise

associated with the GBSD testing would be insignificant on the ESA or UES-listed corals and mollusks listed in Table 2.

For payload impacts in the vicinity of Illeginni, the sea turtle and fish species listed in Table 1 that could occur along the outer edge of the fringing reef may be exposed to a brief pulse of sound from air or underground. Because the BOA and the KMISS are large open areas and the habitat for primarily pelagic and migratory sea turtle and fish species are as large, the probability of any individual of the pelagic species being in the action area during payload impacts is extremely low. The sound generated by vehicle impact will carry long distances and could be heard by the individuals of the species identified in table 1. Considering the large distribution of pelagic animals, the probability of those individuals being within injury or TTS thresholds are discountable, and their effects of non-injurious sound generated from the action are expected to be insignificant. At most, we expect that an exposed individual may experience a temporary behavioral disturbance, in the form of slight change in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects. Based on the best available information, exposure to payload impact noises is expected to have insignificant effects for all species considered in this consultation.

Shock Waves

RV impact would result in the RV impacting the ocean at high velocity either in the deep ocean waters of the KMISS or in the vicinity of Illeginni Islet and would generate underwater shock/sound waves. These in-water pressures were discussed above and are expected to have a larger area of potential effect than the contact area of the RV itself. RV impact in these deep ocean waters would not result in ground borne shock waves strong enough to injure corals or other any other species considered in this consultation.

However, for MMIII tests, shock waves resulting from payload impact on land were estimated to be strong enough to damage corals out as far as 37.5 m from the point of impact, and if impact occurred on the shoreline, shock waves would propagate into the submerged seafloor (USAF 2015). Even though shoreline impact is not planned or expected for GBSD testing, it is assumed that shock waves strong enough to damage corals might propagate up to 37.5 m into the marine environment, and larger pieces of debris could also crack or break parts of coral colonies or injure individual mollusks or fish. The adverse effects of shock waves associated with payload impact on Illeginni islet on coral species listed in Table 2 are further discussed in Section 6.

Exposure to intense ground borne shock waves could also injure soft tissues in mollusks, but the range of onset of significant injuries is likely much less than that estimated for corals (NMFS 2019). Since top shell snails are anchored to the substrate by their muscular foot, the muscular foot would somewhat isolate the snail's shell and soft tissues from vibration and damage (NMFS 2019). Giant clams are anchored to the substrate; therefore, ground borne vibrations would travel through the clam's shell and soft tissues (NMFS 2019). Since the range to potential shock wave effects for mollusks is less than for corals, shock waves are not likely to be strong enough to injure these species. Therefore, shock waves are expected to have insignificant effects to top shell snails and giant clams.

Humphead wrasses have the potential to be injured by the concussive shock waves; however, several factors make this highly unlikely. The shock waves would propagate primarily through the substrate and it can be assumed that little of the pressure intensity would be transferred to the water. Therefore, the range of onset of significant injuries to fish from shock waves is likely substantially less than for corals (NMFS 2019). In addition, humphead wrasses observed near Illeginni Islet have been observed beyond the reef crest around 91 m from the shoreline (NMFS 2019). As with elevated noise levels discussed previously, any realized effects of shock waves on nearshore fish, including the humphead wrasse, would likely be limited to temporary behavioral responses. Fish would be expected to return to normal behaviors within moments of exposure to shock wave pressures; therefore, shock waves produced from payload impact at Illeginni islet are expected to have insignificant effects on listed fish in the Action Area.

Sea turtles have the potential to be injured by shock waves produced during crater formation. Empirical evidence from previous tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Although green and hawksbill sea turtles may occur around Illeginni Islet, they do so infrequently and in low numbers, and typically in waters closer to the reef edge, which is over 150 m (~500 ft) from shore, where they spend the majority of their time under water. Therefore, we consider it unlikely that either turtle species would be close enough to shore to be within the range of shock wave effects. In the unlikely event of a turtle being within the ejecta zone during the impact, at most, an exposed animal may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, shock waves are expected to have insignificant effects to sea turtles.

Given that the target area on Illeginni Islet only includes terrestrial areas, sea turtles hauled out or nesting on land and their nests also have the potential to be injured from shock waves during crater formation. However, no sea turtle nesting activity has been recorded on Illeginni Islet in over 20 years. Therefore, it is considered extremely unlikely that sea turtles would be in terrestrial habitats on Illeginni Islet and it is discountable that sea turtles would be affected by shock waves. As an additional avoidance measure, Illeginni Islet would be surveyed for sea turtle nesting and haul-out activity prior to the flight tests as described in BMPs listed in Section 2.

No UES or ESA-listed marine mammals are expected to be close enough to be the area affected from potential direct contact. Therefore, there would be no effect of shock waves on cetaceans from land impacts.

Non-larval Fish, Corals, and Mollusks near Illeginni Islet. Non-larval forms of humphead wrasse, seven coral species, and three mollusk species (Table 2) have the potential to occur on the reefs and waters in the vicinity of Illeginni Islet. These forms include the relevant coral and mollusk species and adults and juveniles of the relevant fish species. Although coral reefs are not planned or expected to be targeted, a land payload impact on the shoreline of Illeginni could result in shock waves, which may affect and will likely adversely affect at least some of the consultation fish, coral and mollusk species on the adjacent reef. The analysis of these potential effects are analyzed below in Section 6.

Vessel Noise

The USAF/ USASMDC will use vessels of varying size to install and retrieve equipment in water to gather data and remove debris. Large vessels can create sounds ranging from 170-190 dB (re: 1 µPa). Smaller vessels like skiffs with outboards range from 150-170 dB. Vessels are generally moving and the sound sources are considered non-impulsive and mobile. Human activity in water during retrieval of instruments, debris, and ejecta are not louder than those sources. Air bubbles from SCUBA are among the higher noise sources considered, and were reported by Radford et al. (2005) with mean levels of 161 dB and mean peak levels of 177 dB at 1 m. We consider this source a non-impulsive, mobile, intermittent noise source. Because of the mobile nature of vessels and the intermittent nature of SCUBA bubbles, animals of all hearing groups are not likely to be exposed to the source long enough or continuously enough to experience TTS from vessels and SCUBA air bubbles. Furthermore, behavioral disturbances are likely brief because the mobile and temporary nature of the sources, and the noises will likely have an immeasurable effect on an individual's behavior during and after exposure.

b. Direct contact from payload impacts: The Proposed Action will result in impact of the payload on land at Illeginni Islet, within the vicinity of Illeginni Islet, and in the KMISS. The RVs payloads and components will directly contact aquatic and/or terrestrial habitats and have the potential to directly contact consultation species. Payload component contact with the land may result in cratering and ejecta radiating out from the point of impact. For the reasons discussed below, it is discountable that any of the species considered in this consultation would be hit by a RVs payload, or to be close enough to an impact site to be significantly affected by concussive forces. It is also discountable that any of the species identified in Table 1 would be hit by payload or ejecta, or be significantly affected by concussive forces during the planned payload strikes on/within the vicinity of Illeginni Islet or in the KMISS. However, the payload strikes on Illeginni Islet may adversely affect the species identified in Table 2. Therefore, the potential effects of this stressor on those species are considered below in the effects of the action section (Section 6).

Direct Contact - Deep Ocean Water Impact

The GBSD RVs could potentially expose pelagic species in the vicinity of Illeginni Islet and KMISS by directly hitting them when the payload impacts into the ocean. Considering the size and speed of the components, a direct impact would likely kill or severely injure any animal it terminates on. Because the vicinity of Illeginni Islet and the KMISS are large open areas and the habitat for primarily pelagic and migratory shark, ray, and tuna species is as large, the probability of any individual of the pelagic species being in the action area during payload impact is extremely low. The likelihood of directly falling onto giant clam larvae is also extremely small, if present; however, the corals and mollusks listed in Table 2 are not expected to occur in deep ocean waters, and therefore would not be affected. If maximum density data for UES-consultation species in other areas of the central Pacific Ocean are used, the number individuals expected to be exposed to direct contact would be substantially less than one. Even if summed across the maximum of nine tests per year with up to three RVs per test and summed across the proposed six years of testing, the probability that any individual would be exposed to direct contact is still extremely low.

Therefore, the probability of falling missile payloads directly contacting listed marine mammals, sea turtles, fish, corals, and mollusks in deep ocean waters of the KMISS or in the vicinity of Illeginni Islet are discountable.

Direct Contact - Land Impact

For up to three total GBSD missile tests, an RV may impact on land at Illeginni Islet. Test RV components terminating at this test site would only directly impact terrestrial habitats but would have the potential to directly contact ESA and UES consultation species. No listed species would be at risk from crater formation; however, the potential exists for shoreline and nearshore reef-associated species to be at risk from debris being ejected from the crater and by shock waves radiating out from the point of impact as a result of the force from RV impact. Data from previous MMIII RV impact cratering and shock waves are used as estimates for the proposed GBSD testing. Craters from MMIII RV land impacts have been documented to be 6–9 m in diameter and 2–3 m deep (USAF 2015).

Crater formation would result in natural substrate (i.e., soil and coral rubble) being ejected around the rim of the crater upon impact. For MMIII testing, ejecta resulting from crater formations was estimated to extend no more than 60 to 91 m from the impact location (USAF 2015, U.S. Navy 2019). Based on observations from MMIII and other payload testing at Illeginni Islet, most of the RV materials and substrate ejecta would remain close to edge of the crater and the density of ejecta would be expected to decrease with distance from the impact point (USAF 2015).

A shoreline payload impact not expected or planned for the GBSD testing program, and most of the ejected debris would fall on land; however, a land RV impact near the shoreline could result in the dispersal of soil and rubble onto the shallow nearshore reef flat. For MMIII testing, the USAF estimated that the probability of a shallow water impact was between 0.1 and 0.2 (USAF 2015). Since the exact impact location and distribution of ejecta is unknown, these analyses assume a worst-case scenario of a shoreline RV impact where the ejected debris could enter the nearshore marine environment. Although the exact shape of the potential debris field is unknown, the seaward portion of such an area is conceptually illustrated below as a rough semi-circle on the lagoon and ocean sides of Illeginni Islet with a radius of 91 m (Figure 7). Based on the worst-case scenario, ejected debris has the potential to occur in a 13,008 square meter (m^2; 15,557 square yard [yd^2]) area.

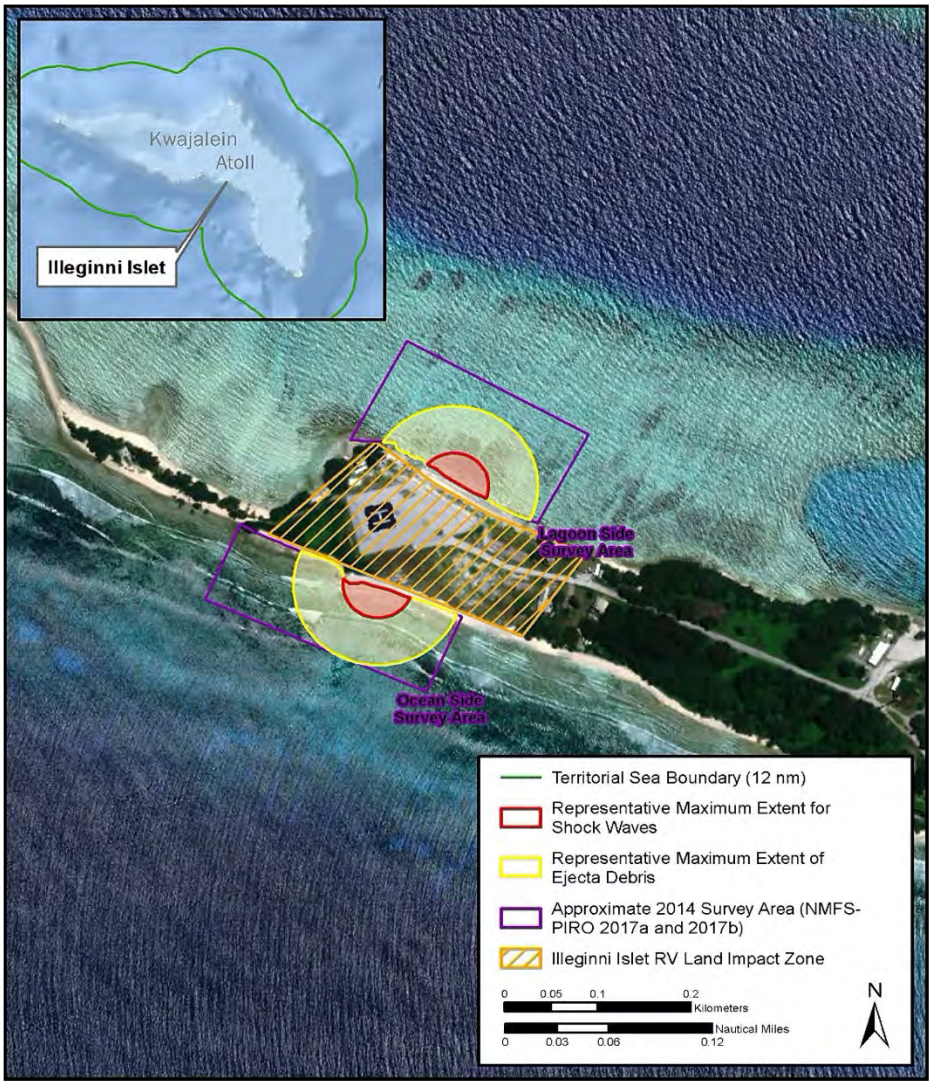

Figure 7. Representative Maximum Ejecta Debris Extent and Maximum Shock Wave Extent for a Shoreline RV Impact at Illeginni Islet (provided by USAF).

Furthermore, debris and ejecta from a land impact would be expected to fall within 91 m of the impact point. Of the species identified in Table 1, only green and hawksbill sea turtles may occur close enough to the potential impact site at Illeginni Islet to be affected by these stressors. Therefore we believe that, with the exception of green and hawksbill sea turtles, it is discountable that any of those species would be exposed to debris from the payload impact on Illeginni Islet.

Sea turtles have the potential to be injured if struck by debris ejected during crater formation. Empirical evidence from previous tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Although green and hawksbill sea turtles may occur around Illeginni Islet, they do so infrequently and in low numbers, and typically in waters closer to the reef edge, which is over 150 m from shore, where they spend the majority of their time under water. Therefore, we consider it unlikely that either turtle species would be close enough to shore to be within this range and

that any exposure to ejecta would be in the form of relatively slow moving material sinking to the bottom near the animal. In the unlikely event of a turtle being within the ejecta zone during the impact, at most, an exposed animal may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, direct contact from ejecta is expected to have insignificant effects to sea turtles.

Given that the target area on Illeginni Islet only includes terrestrial areas, sea turtles hauled out or nesting on land and their nests also have the potential to be injured if struck by debris ejected during crater formation. However, no sea turtle nesting activity has been recorded on Illeginni Islet in over 20 years. Therefore, it is considered extremely unlikely that sea turtles would be in terrestrial habitats on Illeginni Islet and it is discountable that sea turtles would be affected by direct contact. As an additional avoidance measure, Illeginni Islet would be surveyed for sea turtle nesting and haul-out activity prior to the flight tests as described in BMPs listed in Section 2.

No UES or ESA-listed marine mammals are expected to be close enough to be the area affected from potential direct contact. Therefore, there would be no effect of direct contact on cetaceans from land impacts.

Non-larval Fish, Corals, and Mollusks near Illeginni Islet. Non-larval forms of humphead wrasse, seven coral species, and three mollusk species (Table 2) have the potential to occur on the reefs and waters in the vicinity of Illeginni Islet. These forms include the relevant coral and mollusk species and adults and juveniles of the relevant fish species. Although coral reefs are not planned or expected to be targeted, a land payload impact on the shoreline of Illeginni could result in ejecta/debris fall and post-test cleanup operations, which may affect and will likely adversely affect at least some of the consultation fish, coral and mollusk species on the adjacent reef. The analysis of these potential effects are analyzed below in Section 6.

c. Exposure to hazardous materials: Impact of the GBSD RVs would have the potential to introduce propellants, battery acids, and heavy metals into the terrestrial or marine environment at the impact sites. The test RVs do not contain any fissile materials. However, based on the composition of MMIII RVs (detailed in Section 2), the test RVs would likely contain varying quantities of hazardous materials, potentially including batteries, explosives, asbestos, DU, and other heavy metals.

Immediately after payload impact in the KMISS or vicinity of Illeginni Islet, fragmentation of the RV would disperse any onboard hazardous materials such as Be and DU around the impact point. Be and DU fragments are highly insoluble (i.e., they dissolve extremely slowly), and dilution/mixing in the ocean water occurs much faster than dissolution of Be and DU; therefore, their concentrations in seawater would likely be indistinguishable from natural background levels (USAF 2015). RV components would also sink relatively quickly to the ocean floor and would not be recovered in waters greater than 30 m deep. Although we would not expect materials such as Be and DU to dilute quickly, we would not expect these chemicals that leak at the oceans' surface and water column accumulating to levels expected to elicit a detectable response should a protected species be exposed to the material in the upper reaches of the water column. Furthermore, on the seafloor, the materials would leak or

leach into the water and into bottom sediments. However, due to the amount of ocean water affected, this is highly immeasurable and is expected to be rapidly diluted by ocean currents.

Following an RV impact on land, fragmentation of the RV would also disperse any of the residual onboard hazardous materials around the impact point, however the majority of the RV fragments and materials would be expected to remain close to the impact point in terrestrial habitats. During post-test clean-up activities, attempts would be made to recover all visible man-made test debris. The impact crater and ejecta immediately surrounding the crater would be excavated and screened to remove RV debris. Pre-test preparatory and post-test cleanup activities may involve heavy equipment and ocean-going vessels, which have the potential to introduce fuels, hydraulic fluids, and battery acids to terrestrial habitats as well as marine habitats. Any accidental spills from support equipment operations would be contained and cleaned up. All waste materials would be transported to Kwajalein Islet for proper disposal in the United States. Only trace amounts of hazardous materials would be expected to remain in terrestrial areas after the test. Few, if any, hazardous materials would be expected to enter the nearshore marine environment and would be quickly diluted and dispersed by the large volume of ocean water and wave action.

Several avoidance, minimization, and mitigation measures would be in place as part of the Proposed Action to reduce the potential for adverse effects to listed species, including post-test soil and groundwater sampling for hazardous materials. Considering the planned cleanup of man-made materials, the very small quantities of hazardous materials expected to be introduce to terrestrial and marine habitats, and the dilution and mixing capabilities of the ocean and lagoon waters, materials released during RV impact would not be present in sufficient quantities or concentrations to adversely affect any of the UES or ESA-listed species listed in Tables 1 and 2 in the Action Area. Therefore, we believe that any effects from hazardous materials will be insignificant to all UES and ESA-consultation species in the area.

d. Disturbance from human activities and equipment operation: Both pre-flight preparations and post-flight cleanup activities may result in elevated levels of human activity in terrestrial and marine environments for several weeks.

At Illeginni Islet

During the several weeks of increased activity, several vessel round-trips are likely to occur. Helicopters would also be used to transport equipment and personnel to Illeginni Islet. Personnel and equipment would be used for preparation of the impact site including placement of cameras and other sensors in both terrestrial areas. Sensor rafts with onboard optical or acoustic sensors would be deployed by landing craft utility in the lagoon or ocean waters within approximately 792 m of the islet in waters no less than 3 m deep. Post-flight cleanup would involve recovery of all man-made test debris possible and would include personnel and equipment use in terrestrial habitats. Man-made debris would also be removed from the impact crater and filled with the surrounding substrate that was ejected. These post-test activities may involve the use of heavy equipment such as a backhoe or grader.

Post-test human activity in the marine areas near Illeginni Islet would likely only involve vessel traffic to and from Illeginni Islet as well as the collection of sensor rafts. Use of heavy equipment in the nearshore marine environment is not expected since shallow water and reef habitats would not be targeted. However, if test debris enters the nearshore marine

environment, including the reef flat, test personnel may manually recover debris. Human activity in the nearshore marine environment would be limited to the area near the RV land impact where debris entered the water. In the event of an unexpected shoreline or reef-flat payload impact, several measures and procedures would be in place to guide post-test activities in order to avoid impacts to listed species. If divers are required to search for RV debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of RV debris that they would be looking for.

During planned testing activities, nearshore reef species including corals and mollusks would not be affected by human activity and equipment operation. Sessile organisms such as mollusks may temporarily close their shells or adhere more tightly to the substrate, also returning to normal behaviors within minutes of cessation of the activity. Corals are not expected to have any measurable reaction to short-term non-contact activities. While it has properly been assumed for listed vertebrate species that physical contact of equipment or humans with an individual constitutes an adverse effect due to high potential for harm or harassment, the same assumption does not hold for listed corals due to two key biological characteristics: 1) all corals are simple, sessile invertebrate animals that rely on their stinging nematocysts for defense, rather than predator avoidance via flight response, so whereas it is logical to assume that physical contact with a vertebrate individual results in stress that constitutes harm and/or harassment, the same does not apply to corals because they have no flight response; and 2) Most reef-building corals, including all the listed species, are colonial organisms, such that a single larva settles and develops into the primary polyp, which then multiplies into a colony of hundreds to thousands of genetically-identical polyps that are seamlessly connected through tissue and skeleton. Colony growth is achieved mainly through the addition of more polyps, and colony growth is indeterminate. The colony can continue to exist even if numerous polyps die, or if the colony is broken apart or otherwise damaged. The individual of these listed species is defined as the colony, not the polyp, in the final coral listing rule (79 FR 53852). Thus, affecting some polyps of a colony does not necessarily constitute harm to the individual.

Motile listed species are either not expected to be within this area (marine mammals and oceanic whitetip sharks), or they are expected to temporarily leave the area with no measurable effect on their fitness (green and hawksbill turtles, manta rays, oceanic white tip sharks, bigeye thresher sharks, and scalloped hammerhead sharks), and animals would be expected to return to normal behaviors within minutes of cessation of activity. Therefore, increased human activity and equipment operation is expected to have insignificant effects.

Since most human activities and equipment operation would take place on land, the only listed species with the potential to be affected by human activity and equipment operation on Illeginni Islet are hauled out or nesting sea turtles. Several mitigation measures would be in place to minimize the chance of affecting sea turtles, including sea turtle nest and activity searches of suitable habitat at Illeginni Islet leading up to the test. As discussed previously, no sea turtle nests or nesting activity have been observed on Illeginni in over 20 years. Sea turtle nest pits (unidentified species) were last found on the northern tip of Illeginni Islet in 1996. Therefore, it is considered discountable that any sea turtles or sea turtle nests would be affected by human activity and equipment operation in terrestrial habitats.

Vicinity of Illeginni Islet

In the Vicinity of Illeginni Islet, human activity would involve pre-test deployment and post-test recovery of sensory rafts as well a possible post-test RV recovery and cleanup. RVs typically strike waters in the Vicinity of Illeginni at a distance of approximately 792 m from shore. If necessary, searches for debris would be attempted to depths of 15–30 m (USAF 2015). A ship would be used for recovery and a remotely operated vehicle would be used to locate the debris field on the bottom before scuba divers would attempt to recover the debris manually (USAF 2015). Divers would be briefed prior to operations about coral fragility and provided guidance on how to avoid or minimize unavoidable contact with fragile marine resources as they carefully retrieve the very small pieces of RV debris that they would be looking for (USAF 2015).

KMISS

There are no pre-test or post-test cleanup or recovery activities required for GBSD flight tests in the KMISS portion of the Action Area. KMISS optical and electronic sensors and system support equipment are already in place on Gagan Islet and in the offshore ocean waters. For nominal missions, RVs that impact in deep ocean waters are not recovered.

e. Collision with vessels: The Proposed Action has the potential to increase ocean vessel traffic in the action area during both pre-flight preparations and post-flight activities for several weeks. Pre-test activities would include several vessel round-trips to and from Illeginni Islet or the vicinity of Illeginni Islet for personnel and equipment transport. Sensor rafts would also be deployed from a vessel near either of these impact sites. Post-test recovery efforts would also result in increased vessel traffic to Illeginni Islet or the Vicinity of Illeginni Islet. Vessels would be used to transport heavy equipment (such as backhoe or grader) and personnel for manual cleanup of debris, backfilling or any craters, instrument, and sensor raft recovery.

Sea turtles and cetaceans must surface to breathe air. They also rest or bask at the surface. Therefore, when at or near the surface, turtles and cetaceans are at risk of being struck by vessels or their propellers as the vessels transit. Corals could also be impacted if a vessel runs aground or drops anchors on the reef. Conversely, scalloped hammerhead sharks, bigeye thresher sharks, oceanic white tip sharks, manta rays, Pacific Bluefin tuna, and humphead wrasse respire with gills and as such do not need to surface to breathe and are only infrequently near the surface. They are also agile and capable of avoiding oncoming vessels.

The conservation measures that are part of this action include requirements for vessel operators to watch for and avoid marine protected species, including adjusting their speed based on animal density and visibility conditions. Additionally, no action-related anchoring is planned and vessel operators are well trained to avoid running aground, and no increased vessel traffic would occur for RV impacts in the KMISS area. Therefore, based on the best available information we consider the risk of collisions between project-related vessels and any of the consultation species identified in Tables 1 and 2 to be discountable.

f. Long-term addition of man-made objects to the ocean

This operation will scatter missile components in the KMISS, vicinity of Illeginni Islet, and likely throughout the Pacific Ocean. Man-made objects in the form of vessels, piles,

pipelines, vehicles, and purposeful and unintended marine debris has entered all oceans for millennia and most of it is unquantified, especially things that do not float. Whales and sea turtles are most commonly observed entangled in fishing gear that floats on the surface, and recent surveys of sea turtles noted that they ingest plastics that float (high-density polyethylene, low-density polyethylene, and polypropylene) more commonly than plastic that does not float (Jung et al. 2018; White et al. 2018). This may suggest that man-made objects that float may pose more risk than objects that lay at the bottom of the ocean.

Almost all of the products in the missiles sink as soon as they impact the water and will likely remain on the bottom after the project is implemented. Although we do not know the specifics of the GBSD vehicle components and measurements, we expect complete combustion of propellant and liquid fuel.

All components of each missile are expected to sink immediately after entry into the water. If the payload does not detach and the missile is lost to the BOA, it would be expected to sink as well. We also understand that there is a paucity of data or observations of animals' interactions with debris at the bottom of the ocean, and that carcasses that do not float on the surface are almost never observed or captured for study. Nonetheless, based on empirical observation, the majority of entanglements are observed in gear that floats. Similarly, material that floats are observed more often in ingested non-organic material. The pelagic species are generally observed in the water column and are not considered bottom-dwelling, and they are less likely to be exposed to objects that are at the bottom than if they were mid-column or at the surface. We therefore expect the addition to debris from this proposed action to the bottom of the ocean to be insignificant.

4 STATUS OF THE SPECIES

This section presents biological or ecological information for the UES consultation species that the proposed action is likely to adversely affect. As stated above in Section 1, the USAF/USASMDC determined that the proposed action was likely to adversely affect the 11 marine UES consultation species listed in Table 2.

As described above in the introduction, the jeopardy analyses in this Opinion considers the risk of reducing appreciably the likelihood of survival and recovery of UES-protected marine species within USAKA. As such, subsections 4.1 through 4.11 provide species-specific descriptions of distribution and abundance, life history characteristics (especially those affecting vulnerability to the proposed action), threats to the species, and other relevant information as they pertain to these animals within USAKA. Factors affecting these species within the action area are described in more detail in the Environmental Baseline (Section 5).

4.1 *Pocillopora meandrina* (Cauliflower coral)

Pocillopora meandrina is listed as a species of "least concern" by the IUCN (IUCN 2015). The Center for Biological Diversity petitioned the NMFS to list the cauliflower coral in Hawaii as endangered or threatened under the ESA in March 2018 (CBD 2018). In September 2018, NMFS found that *P. meandrina* may warrant listing under the ESA (83 FR 47592 [September 20, 2018]). This species had been a candidate for listing under the ESA and was therefore protected under the UES; however, in 2020 NMFS found that the listing was not warranted and was removed as a candidate species. At this time, *P. meandrina* is still a UES consultation species.

Pocillopora meandrina is in the family Pocilloporidae. This hard coral species forms small upright bushes up to 30 cm in diameter that are cream, green, or pink in color (CBD 2018). Colonies form flattened branches that uniformly radiate out from the original growth point (CBD 2018). This species has a relatively fast growth rate with high recruitment; however, colonies may also be short lived due to recolonization by other coral species and high sensitivity to disturbance (CBD 2018).

4.1.1 Distribution and Abundance

Pocillopora meandrina is found throughout tropical and subtropical Indian and Pacific oceans in shallow reefs (CBD 2018). This range includes Hawaii, Johnston Atoll, American Samoa, the Marshall Islands, Micronesia, the Northern Mariana Islands, and Palau among other island groups (CBD 2018). *Pocillopora meandrina* occurs in shallow reef environments with high wave energy at depths of 1 to 27 m (CBD 2018). The abundance of this coral is still being determined through the status review process.

4.1.2 Life History Characteristics Affecting Vulnerability to Proposed Action

Pocillopora meandrina has been observed at all 11 of the surveyed Kwajalein Atoll islets since 2010 as well as in the Mid-Atoll Corridor. Overall, *P. meandrina* has been observed at 96% (120 of 125) survey sites in Kwajalein Atoll. This species was observed at 100% (5 of 5) of sites at Illeginni Islet since 2010 including in Illeginni harbor.

4.1.3 Threats to the Species

Major threats to *Pocillopora meandrina* include destruction and/or modification of habitat, harvest for the aquarium trade, disease, predation, and high susceptibility to bleaching due to thermal stress (CBD 2018). During a bleaching event in the coastal waters of West Hawaii in 2015, *P. meandrina* exhibited high post-bleaching mortality with approximately 96% of colonies exhibiting partial post-bleaching tissue loss (greater than 5%) and 78% of colonies exhibiting total post-bleaching mortality (CBD 2018). Other bleaching events in the Hawaiian Islands resulted in 1 to 10% mortality for this species (CBD 2018). NMFS is currently evaluating the threats to the species through its status review process.

4.1.4 Conservation of the Species

Pocillopora meandrina has been retained as a consultation species under the UES.

4.2 *Acropora microclados* (Coral)

A. microclados is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. microclados* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.2.1 Distribution and Abundance

The reported range of *A. microclados* is from the Red Sea and northern Madagascar, the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Pitcairn Island. It ranges as far north as the Ryukyu Islands of Japan,

and to the south down along the eastern and western coasts of Australia. *A. microclados* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. microclados* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *A. microclados* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.2.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. microclados is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard et al. 2011).

A. microclados colonies are typically corymbose plates that are attached to hard substrate, with short, uniform, evenly spaced tapered branchlets. It occurs on upper reef slopes and subtidal reef edges at depths of 5 to 20 m. Like other corals, *A. microclados* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *A. microclados* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard et al. 2011).

4.2.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. microclados* to these threats. However, the genus *Acropora* is ranked as one of the more susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard et al. 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Brainard et al. 2011). The susceptibility and impacts of disease on *A. microclados* are not well understood, but subacute dark spots disease has been reported in this species, and its genus is considered moderate to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance,

concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. microclados* is likely included in this trade (Brainard et al. 2011). As described above, *A. microclados* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects on a global level.

4.2.4 Conservation of the Species

A. microclados is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.3 *Acropora polystoma* (Coral)

A. polystoma is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. polystoma* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.3.1 Distribution and Abundance

The reported range of *A. polystoma* is from the Red Sea to central Africa and Madagascar, and the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the south of Taiwan, through the South China Sea and the Philippines, and to the south down along the northern coast of Australia and the Coral Sea. *A. polystoma* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. polystoma* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *A. polystoma* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.3.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. polystoma is a stony coral. *A. polystoma* colonies are typically clumps or corymbose plates that are attached to hard substrate, with tapered branches of similar length. It occurs in highly active intertidal to shallow subtidal reef tops and edges with strong wave action and/or high currents, at depths down to about 10 m. *A. polystoma* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard et al. 2011).

4.3.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. polystoma* to these threats. However, the genus *Acropora* is ranked as one of the most severely susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching

can also result in mortality of the affected colony (Brainard et al. 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony et al. 2008). The genus *Acropora* is considered moderate to highly susceptible to disease, and *A. polystoma* has been reported to experience severe white-band/white plague disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. polystoma* is likely included in this trade (Brainard et al. 2011). As described above, *A. polystoma* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.3.4 Conservation of the Species

A. polystoma is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.4 *Cyphastrea agassizi* (Coral)

C. agassizi is found primarily in the Indo-Pacific. As a candidate species for listing under the ESA, *C. agassizi* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.4.1 Distribution and Abundance

The reported range of *C. agassizi* is from Indonesia to the Hawaiian Islands in the central Pacific Ocean, and from southern Japan and the Northern Mariana Islands, south to Northeastern Australia. *C. agassizi* is reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *C. agassizi* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, at six more of the 11 USAKA islands, and at 14 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *C. agassizi* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.4.2 Life History Characteristics Affecting Vulnerability to Proposed Action

C. agassizi is stony coral. *C. agassizi* typically forms deeply grooved massive colonies attached to hard substrate. It occurs in shallow reef environments of back- and fore-slopes, lagoons and outer reef channels at depths of about 2 to 20 m. Like other corals, *C. agassizi* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. The reproductive characteristics of *C. agassizi* are undetermined, but its congeners include a mix of hermaphroditic spawners and brooders (Brainard et al. 2011).

4.4.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. *Cyphastrea* are considered generally resistant to bleaching, but elevated temperatures may still cause mortality within this genus (Brainard et al. 2011). The effects of increased ocean acidity are unknown for this genus, but in general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals. It also can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates. The specific susceptibility and impacts of disease on *C. agassizi* are not known, but some of its congeners have been infected with various "band" diseases. As such, it appears that *C. agassizi* is susceptible (Brainard et al. 2011). The susceptibility of *C. agassizi* to predation is unknown. The effects of land-based pollution on *C. agassizi* are largely unknown, but it may pose significant threats at local scales. This coral light to moderately exploited in trade at the genus level (Brainard et al. 2011). As described above, the genus *Cyphastrea* is considered generally resistant to bleaching, but mortality due to elevated temperatures, which may be attributable to anthropogenic climate change, may still occur. As such, this species may be currently adversely affected by those effects on a global level.

4.4.4 Conservation of the Species

C. agassizi is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.5 *Heliopora coerulea* (Coral)

H. coerulea is a very broadly distributed Indo-Pacific coral. It is considered the oldest living coral species. *H. coerulea* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.5.1 Distribution and Abundance

The reported range of *H. coerulea* is from southern east Africa to the Red Sea, across the Indian Ocean to American Samoa in central Pacific Ocean, and from Japan, south to Australia (Brainard et al. 2011). Colonies of *H. coerulea* are often patchy in their distribution, but can dominate large areas. Within the area potentially impacted at Illeginni, *H. coerulea* is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.53 colonies/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 32 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *H. coerulea* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.5.2 Life History Characteristics Affecting Vulnerability to Proposed Action

H. coerulea is a non-scleractinian stony coral. Stony corals are sessile, colonial, marine invertebrates. Unlike the calcium carbonate skeleton of scleractinian corals, the skeleton of *H. coerulea* consists of aragonite, and it is blue instead of white. As with scleractinian corals, the individual unit of a coral colony is called a polyp, which is typically cylindrical in shape, with a

central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense, but instead of living in "cups on the surface of the coral, *H. coerulea* polyps live in tubes within the skeleton. Each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue called the coenenchyme. As with other corals, *H. coerulea* acts as a plant during the day and as an animal at night, or in some combination of the two. The soft tissue harbors mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard et al. 2011).

H. coerulea is a massive coral that typically forms castellate blades. It occurs in water depths from the intertidal zone down to about 60 m. It is most abundant from the shallow reef crest down to forereef slopes at 10 m, but is still common down to 20 m. Like other corals, *H. coerulea* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *H. coerulea* colonies have separate sexes. Fertilization and early development of eggs begins internally, but the planula larvae are brooded externally under the polyp tentacles. Larvae are considered benthic, as they normally distribute themselves by crawling away vice drifting in the plankton (Brainard et al. 2011).

4.5.3 Threats to the Species

Brainard et al. (2011) suggest that *H. coerulea* is a hardy species. They report that it is one of the most resistant corals to the effects of thermal stress and bleaching, and although there is no specific research to address the effects of acidification on this species, it seems to have survived the rapid acidification of the oceans during the Paleocene-Eocene Thermal Maximum acidification. They also report that disease does not appear to pose a substantial threat, and that adult colonies are avoided by most predators of coral. However, the externally brooded larvae are heavily preyed upon by several species of butterflyfish. Although *H. coerulea* tends to prefer clear water with low rates of sedimentation, Brainard et al. (2011) report that sediment appears to pose no significant threat to the species. Land-based sources of pollution may pose significant threats at local scales. Collection and trade appear to be the biggest threat to this species. *H. coerulea* has been reported as one of the top 10 species involved in international trade. Its morphology and natural color make it highly desirable (Brainard et al. 2011). As described above, *H. coerulea* does not appear to be particularly susceptible to effects attributed to anthropogenic climate change, but it is likely being adversely affected by international trade.

4.5.4 Conservation of the Species

H. coerulea is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.6 *Pavona venosa* (Coral)

P. venosa is a broadly distributed Indo-Pacific. It became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.6.1 Distribution and Abundance

The reported range of *P. venosa* extends down the eastern shore of the Saudi Arabian, into the Red Sea, down to central Africa and Madagascar, across the Indian Ocean to include the Chagos Archipelago and Sri Lanka, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the Ryukyu Islands, through the South China Sea and the Philippines, and to the south down along the east and west coasts of Australia and the Coral Sea. *P. venosa* has been reported as common. Within the area potentially impacted at Illeginni, *P. venosa* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 16 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *P. venosa* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.6.2 Life History Characteristics Affecting Vulnerability to Proposed Action

P. venosa is a stony coral. *P. venosa* typically forms massive to encrusting colonies attached to hard substrate. It occurs in shallow reef environments at depths of about 2 to 20 m. The reproductive characteristics of *P. venosa* are unknown, but six of its congeners are gonochoric (separate sexes) spawners; releasing gametes of both sexes that become fertilized in the water (Brainard et al. 2011).

4.6.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. *P. venosa* has moderate to high susceptibility to thermal stress induced "bleaching" where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard et al. 2011). In general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals. It can increase the susceptibility to thermal stress, and tends to decrease growth and calcification rates (Anthony et al. 2008). No studies have examined the direct impacts of ocean acidification on *P. venosa*, but some evidence suggests that the genus *Pavona* has some degree of tolerance to acidification (Brainard et al. 2011). The specific susceptibility and impacts of disease on *P. venosa* are not known, but susceptibility is considered to be low (Brainard et al. 2011). There are a medium number of reports of acuter white disease for the genus *Pavona*. The susceptibility of *P. venosa* to predation is considered to be low, but there is no specific information. Members of the genus *Pavona* have varied susceptibility to predation by the crown of thorns seastar (*Acanthaster planci*). There is no specific information about the effects of land-based pollution on *P. venosa*, but it may pose significant threats at local scales. International trade includes the genus *Pavona*, but at relatively low levels (Brainard et al. 2011). As described above, *P. venosa* is susceptible to effects of thermal stress, which may be attributable to anthropogenic climate change. As such, this species is likely being adversely affected by those effects across its range.

4.6.4 Conservation of the Species

P. venosa is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.7 *Turbinaria reniformis* (Coral)

T. reniformis is very broadly distributed across the Indo-Pacific region. *T. reniformis* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.7.1 Distribution and Abundance

The reported range of *T. reniformis* includes the Persian Gulf, the Red Sea, and most of the Indian Ocean basin, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Samoa and the Cook Islands. It ranges as far north as central Japan, down through the Philippines, around New Guinea, and down along the east and west coasts of Australia, and also down the Marianas, the Marshalls, and east to the Line Islands. It has been reported as common (Veron 2014). Within the area potentially impacted at Illeginni, *T. reniformis* is estimated to occur in small aggregations on submerged hard pavement reef areas, at a density of up to 0.16 colonies/m^2. It has been observed at Illeginni, at five more of the 11 USAKA islands, and at nine of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *T. reniformis* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.7.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. reniformis is a stony coral. *T. reniformis* colonies are attached to hard substrate and typically form large lettuce-like assemblages of plates. The plates tend to be very convoluted in shallow active water, whereas they are broad and flat in deeper calmer waters. It has been reported from the surface down to over 0 to 40 m, commonly on forereef slopes at 10 m and deeper, but it prefers turbid shallow protected waters where it forms massive and extensive stands. Like other corals, *T. reniformis* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *T. reniformis* is a gonochoric (separate sexes) spawner; releasing gametes of one sex or the other that become fertilized in the water (Brainard et al. 2011).

4.7.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Susceptibility of *Turbinaria spp*. to thermal stress induced bleaching (where the coral expels its zooxanthellae) varies regionally, and among species, but ranges between low to moderate. The physiological stress and reduced nutrition from bleaching may have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony. However, *T. reniformis* has shown the potential to reduce bleaching impacts through increased heterotrophic feeding rates (Brainard et al. 2011). The susceptibility of *T. reniformis* to acidification appears to be lower than that of other genera of scleractinian corals tested. However, in most corals studied, acidification impaired growth, as

well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species (Brainard et al. 2011). Susceptibility and impacts of disease on *T. reniformis* are not known, but both white syndrome disease and black lesions have affected members of this genus. Adult colonies of *Turbinaria spp.* are rarely eaten by the crown of thorns seastar (*Acanthaster planci*), but the gastropod nudibranch (*Phestilla sibogae*) both feeds upon, and infects *Turbinaria spp.* with disease. *T. reniformis* appears to tolerate high turbidity and sedimentation, as well as low-salinity events, but land-based toxins and nutrients may have deleterious effects on a regional scale, depending on the substance, concentration, and duration of exposure. The genus *Turbinaria* has been heavily exploited in international trade, and *T. reniformis* is likely included in this trade (Brainard et al. 2011). As described above, *T. reniformis* may be susceptible to some effects attributed to anthropogenic climate change, and as such could be currently adversely affected by those effects on a global level.

4.7.4 Conservation of the Species

T. reniformis is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.8 *Tectus niloticus* (Top Shell Snail)

The top shell snail is also sometime referred to as *Trochus niloticus*. It is a broadly distributed marine gastropod, and is a consultation species under UES section 3-4.5.1 (a).

4.8.1 Distribution and Abundance

The top shell snail is distributed in sub-tropical to tropical waters of the Indo-Pacific region. They are indigenous to Yap, Palau, and Helen Reef in Micronesia, but have been introduced to nearly every island group across the Indo-Pacific region (Smith 1987). Larvae recruit to shallow intertidal zones, typically along exposed (seaward) shores. Individuals migrate into deeper water as they grow (Heslinga et al. 1984) with maximum reported depth being 24 m (Smith 1987). Data are insufficient to determine current population levels and trends across its range, including in the RMI. Within the area potentially impacted at Illeginni, the top shell snail is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.09 individuals/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 12 of 35 sites within the mid-atoll corridor (NMFS 2014a).

4.8.2 Life History Characteristics Affecting Vulnerability to Proposed Action

The top shell is a nocturnal, herbivorous, marine gastropod mollusk. It is normally found on the reef surface in the intertidal and subtidal zones. The life span is between 15 and 20 years, with sexual maturity occurring at about 2 years. It is a hardy species that is commonly relocated between island groups with high success. Dobson (2001), reports that top shell snails can survive out of the water for up to 36 hours when kept cool and damp. After being relocated on a new reef area and left undisturbed for a brief period, top shell snails typically resume normal behaviors with no measurable effects assuming the relocation site supports adequate forage and shelter.

4.8.3 Threats to the Species

The top shell is highly susceptible to over-exploitation. It is an edible species whose shells are also commercially important in the mother of pearl button industry (Heslinga et al. 1984). They

are slow moving and are easily spotted by reef-walkers and snorkelers. Unregulated or poorly regulated harvesting has led to their depletion across their range. Although top shell snails are probably beginning to be affected by impacts associated with anthropogenic climate change (described in more detail in the Environmental Baseline section below), no significant climate change-related impacts to its populations have been observed to date.

4.8.4 Conservation of the Species

The top shell is afforded protection at USAKA as a consultation species under the UES (USAKA 2014).

4.9 *Hippopus hippopus* (giant clam)

H. hippopus is broadly distributed across the Indo-Pacific region. It is a candidate species for listing under the ESA, *H. hippopus* became a consultation species under UES section 3-4.5.1 (a).

4.9.1 Distribution and Abundance

H. hippopus are reported to be found in the eastern Indian Ocean at Myanmar and east to the Fiji and Tonga Islands, in the north as far as southern Japan and then south to the Great Barrier Reef, New Caledonia and Western Australia. Within the area potentially impacted at Illeginni, *H. hippopus* was found throughout the lagoon area but was rare on the ocean side in a recent survey conducted at the impact area. It has been observed at Illeginni, and at eight more of the 11 USAKA islands, and at nine of 35 sites within the mid-atoll corridor (NMFS 2017b).

4.9.2 Life History Characteristics Affecting Vulnerability to Proposed Action

H. hippopus is a giant clam which is markedly stenothermal (i.e., they are able to tolerate only a small range of temperature) and thus restricted to warm waters. Giant clams are typically found living on sand or attached to coral rock and rubble by byssal threads (Soo and Todd 2014), but they can be found in a wide variety of habitats, including live coral, dead coral rubble, boulders, sandy substrates, seagrass beds, macroalgae zones, etc. (Gilbert et al. 2006; Hernawan 2010).

The exact lifespan of tridacnines has not been determined; although it is estimated to vary widely between 8 to several hundred years (Soo and Todd 2014). Little information exists on the size at maturity for giant clams, but size and age at maturity vary by species and geographical location (Ellis 1997). In general, giant clams appear to have relatively late sexual maturity, a sessile, exposed adult phase and broadcast spawning reproductive strategy, all of which can make giant clams vulnerable to depletion and exploitation (Neo *et al.* 2015). All giant clam species are classified as protandrous functional hermaphrodites, meaning they mature first as males and develop later to function as both male and female (Chambers 2007); but otherwise, giant clams follow the typical bivalve mollusk life cycle. At around 5 to 7 years of age (Kinch and Teitelbaum 2010), giant clams reproduce via broadcast spawning, in which several million sperm and eggs are released into the water column where fertilization takes place. Giant clam spawning can be seasonal; for example, in the Central Pacific, giant clams can spawn year round but are likely to have better gonad maturation around the new or full moon (Kinch and Teitelbaum 2010). In the Southern Pacific, giant clam spawning patterns are seasonal and clams are likely to spawn in spring and throughout the austral summer months (Kinch and Teitelbaum 2010). Once fertilized, the eggs hatch into free-swimming trochophore larvae for around 8 to 15 days

(according to the species and location) before settling on the substrate (Soo and Todd 2014; Kinch and Teitelbaum 2010). During the pediveliger larvae stage (the stage when the larvae is able to crawl using its foot), the larvae crawl on the substrate in search of suitable sites for settlement and metamorphose into early juveniles (or spats) within 2 weeks of spawning (Soo and Todd 2014).

According to Munro (1993), giant clams are facultative planktotrophs, in that they are essentially planktotrophic (i.e., they feed on plankton) but they can acquire all of the nutrition required for maintenance from their symbiotic algae, *Symbiodinium*.

4.9.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, pollution, and exploitation. The harvest of giant clams is for both subsistence purposes (e.g., giant clam adductor, gonad, muscle, and mantle tissues are all used for food products and local consumption), as well as commercial purposes for global international trade (e.g., giant clam shells are used for a number of items, including jewelry, ornaments, soap dishes). The extent of each of these threats is largely unknown. Blidberg et al. (2000) studied the effect of increasing water temperature on *T. gigas, T. derasa*, and *H. hippopus* at a laboratory in the Philippines. *H. hippopus* experienced increased respiration and production of oxygen in elevated temperatures and was therefore more sensitive to higher temperature than the two other species tested. After 24 hours at ambient temperature plus 3°C, however, no bleaching was observed for any of the species. The susceptibility and impacts of disease on *H hippopus* are not known, but incidences of mortality from rickettsiales-like organisms in cultured clams in the western Pacific, one in the Philippines and one in Kosrae have been documented (Norton et al. 1993).

4.9.4 Conservation of the Species

H hippopus is listed in CITES Appendix II, is an ESA candidate species and is therefore a consultation species under the UES.

4.10 *Tridacna squamosa* (giant clam)

T. squamosa is broadly distributed across the Indo-Pacific region. It is a candidate species for listing under the ESA, therefore *T. squamosa* is a consultation species under UES section 3-4.5.1 (a).

4.10.1 Distribution and Abundance

T. squamosa has a widespread distribution across the Indo-Pacific. Its range extends from the Red Sea and East African coast across the Indo-Pacific to the Pitcairn Islands. It has also been introduced in Hawaii (CITES 2004). The species' range also extends north to southern Japan, and south to Australia and the Great Barrier Reef (bin Othman *et al*. 2010). This range description reflects the recent range extension of *T. squamosa* to French Polynesia as a result of observations by Gilbert et al. (2007). Within the area potentially impacted at Illeginni, *T. squamosa* was observed in the lagoon area but not on the ocean side in a recent survey conducted at the impact area. It has been observed at Illeginni, at five more of the 11 USAKA islands, and at 24 of 35 sites within the mid-atoll corridor (NMFS 2017b).

4.10.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. squamosa is a giant clam which are markedly stenothermal (i.e., they are able to tolerate only a small range of temperature) and thus restricted to warm waters. *T. squamosa* is usually recorded on reefs or sand; it is found attached by its byssus to the surface of coral reefs, usually in moderately protected localities such as reef moats in littoral and shallow water to a depth of 20 m (Kinch and Teitelbaum 2010). This species tends to prefer fairly sheltered lagoon environments next to high islands; however, *T. squamosa* appears to be excluded by *T. maxima* in the closed atoll lagoons of Polynesia (Munro 1992). Neo et al. (2009) found that *T. squamosa* larvae, like many reef invertebrates, prefer substrate with crustose coralline algae. *Tridacna squamosa* is also commonly found amongst branching corals (staghorn, *Acropora* spp.; CITES 2004).

The exact lifespan of tridacnines has not been determined; although it is estimated to vary widely between 8 to several hundred years (Soo and Todd 2014). Little information exists on the size at maturity for giant clams, but size and age at maturity vary by species and geographical location (Ellis 1997). In general, giant clams appear to have relatively late sexual maturity, a sessile, exposed adult phase and broadcast spawning reproductive strategy, all of which can make giant clams vulnerable to depletion and exploitation (Neo *et al.* 2015). All giant clam species are classified as protandrous functional hermaphrodites, meaning they mature first as males and develop later to function as both male and female (Chambers 2007); but otherwise, giant clams follow the typical bivalve mollusk life cycle. *T. squamosa* reaches sexual maturity at sizes of 6 to 16 cm, which equates to a first year of maturity at approximately four years old (CITES 2004). Giant clam spawning can be seasonal; for example, in the Central Pacific, giant clams can spawn year round but are likely to have better gonad maturation around the new or full moon (Kinch and Teitelbaum 2010). In the Southern Pacific, giant clam spawning patterns are seasonal and clams are likely to spawn in spring and throughout the austral summer months (Kinch and Teitelbaum 2010). Once fertilized, the eggs hatch into free-swimming trochophore larvae for around 8 to 15 days (according to the species and location) before settling on the substrate (Soo and Todd 2014; Kinch and Teitelbaum 2010). During the pediveliger larvae stage (the stage when the larvae is able to crawl using its foot), the larvae crawl on the substrate in search of suitable sites for settlement and metamorphose into early juveniles (or spats) within two weeks of spawning (Soo and Todd 2014).

According to Munro (1993), giant clams are facultative planktotrophs, in that they are essentially planktotrophic (i.e., they feed on plankton) but they can acquire all of the nutrition required for maintenance from their symbiotic algae, *Symbiodinium*.

4.10.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, pollution, and exploitation. The harvest of giant clams is for both subsistence purposes (e.g., giant clam adductor, gonad, muscle, and mantle tissues are all used for food products and local consumption), as well as commercial purposes for global international trade (e.g., giant clam shells are used for a number of items, including jewelry, ornaments, soap dishes). The extent of each of these threats is largely unknown. Blidberg et al. (2000) studied the effect of increasing water temperature on *T. gigas, T. derasa,* and *H. hippopus* at a laboratory in the Philippines. *H. hippopus* experienced increased respiration and production of oxygen in elevated temperatures and was therefore more sensitive to higher temperature than the two other species tested. After 24 hours at ambient temperature

plus 3°C, however, no bleaching was observed for any of the species. In a lab experiment, short-term temperature increases of 3 °C resulted in *T. squamosa* maintaining a high photosynthetic rate but displaying increased respiratory demands (Elfwing et al. 2001). Watson et al. (2012) showed that a combination of increased ocean CO_2 and temperature are likely to reduce the survival of *T. squamosa*. Specifically, in a lab experiment, *T. squamosa* juvenile survival rates decreased by up to 80 percent with increasing pCO_2 and decreased with increasing seawater temperature for a range of temperatures and pCO_2 combinations that mimic those expected in the next 50 to 100 years. The susceptibility and impacts of disease on *T. squamosa* are not known, but incidences of mortality from rickettsiales-like organisms in cultured clams in the western Pacific, one in the Philippines and one in Kosrae have been documented (Norton et al. 1993).

4.10.4 Conservation of the Species

T. squamosa is listed in CITES Appendix II, is an ESA candidate species and is therefore a consultation species under the UES.

4.11 Humphead wrasse

In October 2012, NMFS was petitioned to list the humphead wrasse as threatened or endangered under the ESA and to designate critical habitat for the species. In February 2013, in its 90-day finding, NMFS determined that this action may be warranted and initiated a status review to determine whether the species would be officially listed (78 FR 13614 [February 28, 2013]). In September 2014, NMFS determined that ESA listing of the humphead wrasse was not warranted (79 FR 57875 [September 26, 2014]). However, this species remains protected under the UES and is therefore a consultation species.

4.11.1 Distribution and Abundance

The humphead wrasse is widely distributed on coral reefs and nearshore habitats throughout much of the tropical Indo-Pacific Ocean. The biogeographic range of the humphead wrasse spans from 30° N to 23° S latitude and includes the Red Sea south to Mozambique in the Indian Ocean, from southern Japan in the northwest Pacific south to New Caledonia in the south Pacific and into the central Pacific Ocean including French Polynesia. The humphead wrasse has been recorded from many islands of Oceania including Kwajalein Atoll, but appears to be absent from the Hawaiian Islands, Johnston Island, Easter Island, Pitcairn, Rapa, and Lord Howe Island with the exception of occasional waifs (Randall et al. 1978).

Although humphead wrasses are widely distributed, natural densities are typically low, even in locations where habitats are presumably intact. Unfished or lightly fished areas have densities ranging from 2–27 individuals per 10,000 square meters of reef. At sites near human population centers or at fished areas, densities are typically lower by tenfold or more and in some locations humphead wrasse are rarely observed (Sadovy et al. 2003). Total abundance throughout its range is difficult to estimate because survey methods may not cover all habitable areas. Existing information suggests that humphead wrasse populations are most abundant and stable in the Indian Ocean.

The humphead wrasse is known to occur in the vicinity of Illeginni Islet. As was found in other studies (Donaldson and Sadovy 2001), the humphead wrasse appears to occur in low densities throughout the Kwajalein Atoll area in NMFS and USFWS biennial surveys. Occurrence records

of humphead wrasse suggest a broad, but scattered distribution at USAKA with observations of the species at 26% (32 of 125) of sites at 10 of the 11 surveyed islets since 2010. Adult humphead wrasses have been recorded in seaward reef habitats at Illeginni Islet (shallowest depths approximately 5 m deep (USFWS and NMFS 2012; NMFS and USFWS 2018). Although encountered on numerous occasions at USAKA, direct density measures of humphead wrasse have not been obtained. The adults of this species may range very widely, with typically four or fewer individuals observed within a broad spatial reef area (Dr. R. Schroeder pers, comm.). Two neighboring seaward reef flat sites in 2008 were noted to have adult humphead wrasse present (USFWS 2011); thus, a total of 24 adult individuals might be exposed to potential GBSD impacts in this region. Absent a direct physical or sound related impact, the adults might be expected to show temporary curiosity, altered feeding patterns, and/or displacement.

Shallow inshore branching coral areas with bushy macro-algae, such as those which may exist along the shallow lagoon reef flat at Illeginni Islet, have been noted as potential essential nursery habitat for juvenile humphead wrasse (Tupper 2007). Recent settler and juvenile numbers are presumed to greatly exceed 20 in such habitat (Tupper 2007) and might be grossly approximated to range from 0 to 100 within the lagoon-side waters of Illeginni (NMFS 2014a). A direct physical strike from a payload fragment, toppling or scattering of coral habitat and/or reef substrate, increased exposure to predation through displacement, and/or sound impacts may result in mortalities of juvenile humphead wrasse, assuming they are present within the impact area. Otherwise, loss of habitat may lead to simple displacement, but with a longer-term functional loss of nursery potential contingent both spatially and temporarily on habitat recovery potential (NMFS 2014b).

Humphead wrasse have been observed to aggregate at discrete seaward edges of deep slope drop-offs to broadcast spawn in the water column; they do not deposit their eggs on the substrate (Colin 2010). This type of behavior is not known at Illeginni Islet, but it may exist; however, similar habitat would occur in nearby waters. The flow dynamics of developing fish eggs and larvae around Illeginni Islet are not understood. Initial flow may be away from the islet, with future return or larval/adult source dynamics from another area. No information exists to support any reasonable estimation of potential ARRW impacts to humphead wrasse eggs and developing larvae (NMFS 2014a).

4.11.2 Life History Characteristics Affecting Vulnerability to Proposed Action

The humphead wrasse is the largest member of the family Labridae. The humphead wrasse is distinguished from other coral reef fishes, including other wrasses, due primarily to its large size along with its fleshy lips in adults (Myers 1999), prominent bulbous hump that appears on the forehead in larger adults of both sexes, and intricate markings around the eyes (Marshall 1964; Bagnis et al. 1972; Sadovy et al. 2003).

Similar to other wrasses, humphead wrasses forage by turning over or crushing rocks and rubble to reach cryptic organisms (Pogonoski et al. 2002; Sadovy et al. 2003 citing P.S. Lobel, pers. comm.). The thick fleshy lips of the species appear to absorb sea urchin spines, and the pharyngeal teeth easily crush heavy-shelled sea snails in the genera *Trochus* spp. and *Turbo* spp. The humphead wrasse is also one of the few predators of toxic animals such as boxfishes (*Ostraciidae*), sea hares (*Aplysiidae*), and crown-of-thorns starfish (*Acanthaster planci*) (Randall 1978; Myers 1989; Thaman 1998; Sadovy et al. 2003).

Both juveniles and adults utilize reef habitats. Juveniles inhabit denser coral reefs closer to shore and adults live in deeper, more open water at the edges of reefs in channels, channel slopes, and lagoon reef slopes (Donaldson and Sadovy 2001). While there is limited knowledge of their movements, it is believed that adults are largely sedentary over a patch of reef and during certain times of the year they move short distances to congregate at spawning sites (NMFS 2009). Humphead wrasse density increases with hard coral cover, where smaller fish are found in areas with greater hard coral cover (Sadovy et al. 2003).

Field reports reveal variable humphead wrasse spawning behavior, depending on location (Sadovy et al. 2003; Colin 2010). Spawning can occur between several and all months of the year, coinciding with certain phases of the tidal cycle (usually after high tide) and possibly lunar cycle (Sadovy et al. 2003; Colin 2010). Spawning can reportedly occur in small (< 10 individuals) or large (≤ 100 individuals) groupings, which can take place daily in a variety of reef types (Sadovy et al. 2003; Sadovy de Mitcheson et al. 2008; Colin 2010). Based on available information, it is suggested that the typical size of female sexual maturation for the humphead wrasse occurs at 40–50 cm TL (Sadovy de Mitcheson et al. 2010). Choat et al. (2006) estimated length at first maturity as 45–50 cm FL for females (6–7 years) and 70 cm FL (9 years) for males.

4.11.3 Threats to the Species

The ERA team identified four major threats to humphead wrasse: 1) habitat destruction, modification, or curtailment; 2) overutilization for commercial, recreational, scientific or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; and 5) natural and other man-made factors. Habitat destruction, overfishing, and inadequacy of existing regulatory mechanisms, and some man-made factors such as pollution are threats locally throughout portions of its range. However, the ERA team concluded that four of the five threats evaluated are not significant risks to extinction. Natural and man-made factors, namely climate change, were noted as a small to moderate effect on species risk of extinction.

4.11.4 Conservation of the Species

Humphead wrasse is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

5 ENVIRONMENTAL BASELINE

The UES does not specifically describe the environmental baseline for a Biological Opinion. However, under the ESA, environmental baselines include the past and present impacts of all state, federal or private actions and other human activities in the Action Area, anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The Consultation Handbook further clarifies that the environmental baseline is “an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the Action Area” (FWS and NMFS 1998). The purpose of describing the environmental baseline in this manner in a biological opinion is to provide context for effects of the proposed action on listed species. We apply the ESA standards consistent with the intent of the UES agreement in our effects analysis. As described in Sections

2 and 3 above, the action area where the proposed action may adversely affect consultation species consists of the marine waters adjacent to Illeginni Islet at Kwajalein Atoll, RMI and in the KMISS area.

The Marshall Islands consist of 29 atolls and five islands aligned in two roughly parallel northwest-southeast chains: the northeastern Ratak Chain and the southwestern Ralik Chain. The total land area is about 70 square miles (mi^2), and the total lagoon area is about 4,500 (mi^2). Kwajalein Atoll is located near the center of the island group, about eight degrees above the equator, and is one of the largest coral reef atolls in the world. The past and present impacts of human and natural factors leading to the status of UES-protected species within the action area include coastal development, armed conflict, direct take, fishing interactions, vessel strikes and groundings, marine debris, and climate change.

Kwajalein Atoll was the site of heavy fighting during World War II (1940s), when the U.S. took it from the Japanese. Many of the islets have been heavily modified by dredge and fill construction operations by both the Japanese and U.S. forces. More recently, the RMI has provided eleven islets around the rim of Kwajalein Atoll for the use by the U.S. Government as part of the RTS. Hundreds of U.S. personnel live on some of the islets, and Marshallese workers commute daily between the U.S. occupied islets and the ones on which they reside. Vessel traffic occurs regularly between the islets, and to and from the atoll. This includes fishing boats, personnel ferries, military service craft, visiting military ships, and cargo vessels that supply the peoples of Kwajalein Atoll. For more than 18 years, the USAKA has participated in testing hypersonic vehicles from ICBM and other flight tests launched from Vandenberg AFB and other locations. Vehicle impacts from such tests have occurred and continue to occur on and in the vicinity of Illeginni Islet and in adjacent ocean waters. In the Opinion on the Minuteman III operations through the year 2030 it was estimated that 49,645 colonies of the 15 species of UES corals and 117 top shell snails may be killed (NMFS 2015).

On May 16, 2005, we issued a letter of concurrence with the USAF's "not likely to adversely affect" determination for sea turtles and marine mammals under our jurisdiction. It is important to note that sea turtles are under the jurisdiction of the FWS while in terrestrial habitats, whereas they are under our jurisdiction when in marine habitats. Therefore, any impacts on hauled-out or nesting adult turtles, eggs in nests, or hatchlings before they reach the water, were considered in the 2005 FWS Opinion, not in our letter of concurrence.

On March 2, 2017, the U.S. Navy SSP consulted with NMFS on the effects of a near identical action, the FE-1. NMFS concluded in a biological opinion dated May 12, 2017 that the FE-1 would not jeopardize 59 marine ESA/UES consultation species." (PIR-2017-10125; I-PI-17-1504-AG). In that opinion, NMFS estimated that the action would result in up to up to 10,417 colonies of UES consultation corals (as quantified in table 7) could experience complete mortality, up to four top shell snails may be killed by the proposed action, and up to 90 clams, and 108 humphead wrasses could be injured or killed by the proposed action. The target site was the exact same as this proposed action and made an impact on land and not in water. No take was quantified for this action.

On February 12, 2019, USASMDC/ARSTRAT, consulted on the Air-launched Rapid Response Weapon (ARRW) Flight Tests NMFS' Biological Opinion was dated July 30, 2019 (PIRO-2019-00639; I-PI-19-1751-AG). This missile test is expected to impact the same islet targeted in this proposed action. As with the FE-1 and FE-2, impact is expected to occur on land, but could

occur in water. In that opinion, NMFS estimated that the action would result in up to 10,417 colonies of UES consultation corals could experience complete mortality, up to four top shell snails may be killed by the proposed action, and up to 90 clams, and 108 humphead wrasses could be injured or killed by the proposed action.

On July 4, 2019, we completed informal consultation on the effects of launching a THAAD missile and subsequent intercept of a medium-range ballistic missile over the Pacific Ocean concluding the operation was not likely to adversely affect 44 species protected under the standards and procedures described in the Environmental Standards and Procedures for U.S. Army Kwajalein Atoll (PIRO-2019-01962; I-PI-19-1769-AG). This test is expected to launch from a neighboring islet within USAKA.

On June 14, 2018, USASMDC/ARSTRAT, on behalf of the U.S. Navy SSP, requested consultation on the effects of launching a single Flight Experiment-2 (FE-2) missile from the PMRF on Hawaii, across the Pacific, and impact at Kwajalein Atoll. NMFS concluded in a Biological Opinion dated September 27, 2019 that the FE-2 would not jeopardize any of the marine ESA/UES consultation species covered under that consultation (PIR-2019-02607; I-PI-19-1782-AG). In that opinion, NMFS estimated that the action would result in up to 10,404 colonies of UES consultation corals (as quantified in Table 10) could experience complete mortality, up to 4 top shell snails, 108 humphead wrasse, and up to 75 clams could be killed by the proposed action. The target site was the exact same as this proposed action and made an impact on land and not in water.

These estimates are likely higher than what the total impacts will be due to the unlikely event of a shoreline impact and the data the estimates were based on. The estimates were based on surveys that have been conducted throughout the area but not in the impact zone. A survey was completed after these estimates were made and some of the corals that were predicted to be in the area were not observed and others were observed at densities lower than what had been estimated (NMFS 2017a). Additional surveys could show that they are indeed in the area but not at higher levels than estimated. Direct take through harvest continues in the RMI for several of the UES consultation species. For example, sea turtles, black lip pearl oysters, and top shell snails (all of which are UES consultation species) are considered a food source or of economic value by many RMI nationals. The harvest of these and other UES-protected marine species is believed to continue on most of the inhabited islands and islets of the RMI, with the possible exception of the USAKA-controlled islets, where access is limited and the UES prohibits those activities. However, the level of exploitation is unknown, and no concerted research or management effort has been made to conserve these species in the RMI. No information is currently available to quantify the level of impact direct take is having on consultation species in the Marshall Islands.

Despite the development, wartime impacts, and human utilization of marine resources mentioned above, the atoll's position at the center of the Pacific Ocean is far from highly industrialized areas, and its human population remains relatively low. Consequently, the water quality level of the lagoon and the surrounding ocean is very high, and the health of the reef communities, along with the overall marine environment of Kwajalein Atoll, borders on pristine.

Climate change may be affecting marine ecosystems at Kwajalein Atoll. Climate refers to average weather conditions within a certain range of variability. The term climate change refers to distinct long-term changes in measures of climate, such as temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from: natural factors, such as

changes in the Sun's energy or slow changes in the Earth's orbit around the sun; natural processes within the climate system (e.g., changes in ocean circulation); and human activities that change the atmosphere's makeup (e.g., burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.), also known as anthropogenic climate change (U.S. Environmental Protection Agency). The global mean temperature has risen 0.76°C over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (Solomon et al. 2007). Sea level rose approximately 17 cm during the 20th century (Solomon et al. 2007) and further increases are expected. Climate change is a global phenomenon so resultant impacts have likely been occurring in the action area. However, scientific data describing impacts in the action area are lacking, and no climate change-related impacts on UES-protected species within the action area have been reported to date.

Climate change-induced elevated water temperatures, altered oceanic chemistry, and rising sea level may be contributing to changes to coral reef ecosystems, and is likely beginning to affect corals and mollusks found in the action area. Globally, climate change is adversely affecting many species of corals. Increasing thermal stress due to rising water temperatures has already had significant effects on most coral reefs around the world. It has been linked to widespread and accelerated bleaching and mass mortalities of corals around the world over the past 25 years (Brainard et al. 2011). As the atmospheric concentration of CO_2 has increased, there has been a corresponding reduction in the pH of ocean waters (acidification). As ocean acidity increases, the calcium carbonate saturation state of the water decreases. Increased ocean acidity has the potential to lower the calcium carbonate saturation state enough to slow calcification in most corals and may increase bioerosion of coral reefs. It is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for corals, and can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates (Brainard et al. 2011). By the middle of this century, ocean acidity could lower calcium carbonate saturation to the point where the reefs may begin to dissolve (Brainard et al. 2011).

Attempting to determine whether recent biological trends are causally related to anthropogenic climate change is complicated because non-climatic influences dominate local, short-term biological changes. However, the meta-analyses of 334 species and the global analyses of 1,570 species show highly significant, nonrandom patterns of change in accord with observed climate warming in the twentieth century. In other words, it appears that these trends are being influenced by climate change-related phenomena, rather than being explained by natural variability or other factors (Parmesan and Yohe 2003). However, the implications of these changes are not clear in terms of population level impacts, and data specific to the action area are lacking. Over the long-term, climate change-related impacts could influence the biological trajectories of UES-protected species on a century scale (Parmesan and Yohe 2003). However, due to a lack of scientific data, the specific effects climate change could have on these species in the future are not predictable or quantifiable to any degree that would allow for more detailed analysis in this consultation (Hawkes et al. 2009).

6 EFFECTS OF THE ACTION

In this section of a biological opinion, we assess the probable effects of the proposed action on UES-protected species. In Effects of the Action sections of biological opinions, NMFS presents the results of its assessment of the probable effects of federal actions on threatened and

endangered species and designated critical habitat that are the subject of a consultation. According to 50 CFR 402.02, Effects of the Action "are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. Furthermore, 50 CFR 402.17 defines reasonably certain to occur as "A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to: (1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;(2) existing plans for the activity; and (3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward (50 CFR 402.02). The effects of the action are considered within the context of the Status of the Species, together with the Environmental Baseline and Cumulative Effects sections of this Opinion to determine if the proposed action can be expected to have direct or indirect effects on UES-protected species that appreciably reduce their likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (50 CFR 402.02), otherwise known as the jeopardy determination. The actions are not expected to adversely affect any essential features of critical habitat has been designated in the action area.

Approach. We determine the effects of the action using a sequence of steps. The first step identifies potential stressors associated with the proposed action with regard to listed species. We may determine that some potential stressors result in insignificant, discountable, or beneficial effects to listed species, in which case these potential stressors are considered not likely to adversely affect protected species, and subsequently are considered no further in this Opinion. Those stressors that are expected to result in significant negative (i.e., adverse) effects to listed species are analyzed via the second, third, and fourth steps described below.

The second step identifies the magnitude of the stressors (e.g., how many individuals of a particular species would be exposed to the stressors; *exposure analysis*). In this step of our analysis, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to a proposed action's effects, and the populations or subpopulations those individuals represent.

The third step describes how the exposed individuals are likely to respond to the stressors (*response analysis*). In this step, we determine if the stressors are likely to result in any adverse effects on exposed individuals.

The final step in determining the effects of the action is to establish the risks those responses pose to listed resources (*risk analysis*). The risk analysis is different for listed species and designated critical habitat. However, as mentioned above, the action area includes no designated critical habitat, thus it is not considered in this Opinion. Our jeopardy determinations must be based on an action's effects on the continued existence of UES-protected species within USAKA. Because the continued existence of listed species depends on the fate of the populations that comprise them, the viability (probability of extinction or probability of persistence) of listed species depends on the viability of their populations.

6.1 Stressors

As described above in Section 3, we believe that the proposed action would cause six stressors that may affect the consultation species considered in this consultation: exposure to elevated noise levels; direct contact from payload impact/shockwaves; exposure to hazardous materials; disturbance from human activity and equipment operation; collision with vessels; and long-term additions of man-made objects in the ocean. Of those stressors, direct contact from payload impact/shockwaves, is the only stressor that is likely to adversely affect consultation species. The remaining stressors are expected to have insignificant effects (i.e. effects would not result in take) and/or exposure is discountable (extremely unlikely to occur), and those stressors are discussed no further in this Opinion. Similarly, Section 3 described why all of the species identified in Table 1 are unlikely to be adversely affected, and therefore considered no further in this Opinion. In summary, the seven coral species, top shell snail, and two giant clams, and the humphead wrasse identified in Table 2 may be hit by the falling payload or by ejecta, or be significantly affected by concussive forces during the planned payload impacts (up to three) on Illeginni Islet.

Note: Within the seven coral species that may be adversely affected by the proposed action, the effects are expected to be practically identical. Addressing the species individually would significantly increase the length of this Opinion with no discernible improvement in the evaluation. Therefore, all seven coral species are referred to together as "corals", unless an individual species needs to be identified due to some unique sensitivity or response. The same is true for the two clam species.

6.2 Exposure to Impact by GBSD Reentry Vehicles

This section analyzes the proposed action's potential for exposing UES-consultation corals, giant clams, and top shell snails to being hit by up to three GBSD payload or ejecta thereof planned to strike on Illeginni Islet. This analysis is based on the distribution and density report completed for the MM III proposed action, the follow-up survey post action, and on personal communication with the survey team (NMFS 2014b, NMFS 2017a, Kolinski pers. comm. 2015), and the FE-2 flight test (SSP 2019). We believe that the distribution and density report likely over-estimates the number of coral and mollusk species that may be within the action area at Illeginni, but that it represents the best available information to make those estimates.

The quantitative estimates of species distribution and abundance within the potentially affected areas at Illeginni are based on surveys of 136 sites around the 11 USAKA islets, including four sites around Illeginni (NMFS 2014b). Species observed to occur on reef flat, crest, and gently sloping substrates around USAKA islets at depths less than or equal to 35 feet water depth were considered as potentially being present within the MMIII, FE-1, THAAD, and FE-2 impact area and hence the GBSD payload impact area. Because the available survey information also includes the observed distribution and abundance of the affected consultation species in numerous habitat types around the 11 USAKA islets and at 35 survey sites throughout the mid-atoll corridor (MAC), we believe that the existing information also serves as a reasonable foundation to estimate the distribution and abundance of these organisms throughout USAKA. Analyses of effect of MMIII reentry vehicle (USAFGSC and USASMDC/ARSTRAT 2015), FE-1 (U.S. Navy 2017), and FE-2 (U.S. Navy 2019) payload impacts at Illeginni Islet were conducted based on coral, mollusk, and fish densities extrapolated from coral presence and abundance from similar reef habitats throughout USAKA. In 2017, NMFS completed a report

with revised density estimates for many consultation species based on 2014 assessments of the reefs adjacent to the impact area at Illeginni Islet (NMFS-PIRO 2017a and 2017b). The areas surveyed for this assessment encompassed all of the Affect Area reef habitat on the lagoon side and 99% of the reef area on the ocean side (NMFS 2017a and 2017b). Additionally, NMFS conducted a survey within USAKA at two launch sites in 2018 to provide data for the THAAD operation (NMFS 2018). Based on coverage area of this assessment, these data are considered the best available information for coral and mollusk species presence and density in the affect area.

The humphead wrasse (*Cheilinus undulatus*) was not observed during the 2014 surveys for the most recent assessment of consultation organisms at Illeginni Islet (NMFS 2017a); however, this species has been recorded in both ocean-side and lagoon-side habitats adjacent to the impact area in other surveys. Since the humphead wrasse is a highly mobile species, the extrapolation methods for estimating density which were previously used for impact analysis are still considered the best available data for a conservative approach. Therefore, humphead wrasse densities were estimated by NMFS PIRO based on quantitative data collected during the 2008 species inventory, recent impact assessments on natural substrates at USAKA and, for egg and fish recruit derivations, from the literature (NMFS 2014b). *Cheilinus undulatus* typically occurs in broadly distributed low numbers and has been seen near Illeginni islet. It was estimated for the similar FE-2 single payload impact that eight adults may occur within the entire potential ocean-side affected area, and 0-100 juveniles could occur within the entire potential lagoon-side affected area. The same assumptions would be made for this consultation for each possible test, where it was discussed in Section 2 that up to three payload impacts could occur at Illeginni Islet. Therefore, we would estimate that up to 24 adults and 300 juveniles could be adversely affected (for up to the three anticipated payload impacts at Illeginni, with the assumption that each test could impact a different area each time).

There is a chance that the GBSD payloads could strike the water's edge along the lagoon or ocean shore at Illeginni. Empirical observations of historical reentry vehicle impacts from MMIII tests in very shallow waters found that most debris was contained within the crater and ejecta were concentrated within 1.5 to 3 m of the crater rim (USAFGSC and USASMDC/ARSTRAT 2015). As with MMIII reentry vehicles, FE-1, FE-2, or THAAD tests, we estimate that the payload land impacts may produce ejecta and debris concentrated near the impact site and extending outward to 91 m. Empirical evidence from MMIII tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Coral, and mollusk mortality or injury could occur from impacts by shock/vibration. These reef impacts were based on observations of damaged corals, which can be affected by ground borne vibration.

Habitat suitability for consultation species is lowest along the water's edge and with the exception of sandy patches, typically increases with distance from shore. Only a portion of the area of potential direct contact effect offshore of the Illeginni Islet impact area is suitable habitat for consultation species. Based on the 2014 NMFS surveys of the area offshore of the RV land impact zone and the best professional judgment of NMFS survey divers, approximately 80 percent of the lagoon-side survey area and 75 percent of the ocean-side survey area are considered potentially viable habitat for consultation coral, mollusk, and reef-associated fish species (Figure 8) (NMFS 2019). Using these estimates of suitable habitat and assuming the

ejecta would be on only one side of the islet for a given test (i.e., either on the lagoon or ocean sides of the islet); the area of lagoon- side and ocean-side suitable habitat which may be impacted by debris was calculated. Using these percentages of suitable habitat likely results in an overestimate of the area of potential effect because habitat suitability for consultation species is lowest along the water's edge (where debris is more likely to occur) and with the exception of sandy patches, typically increases with distance from shore (NMFS 2019).

Figure 8. NMFS 2014 Marine Resource Survey Areas at Illeginni Islet, Kwajalein Atoll (provided by U.S. Army).

It is reasonable to assume that the effects of debris fall and shock waves would not occur evenly across an entire area of potentially viable habitat. Thus, the actual habitat area that would be

affected is considered to be a proportion of the total estimated viable habitat. Since there are no data available to identify this unknown proportion or the actual amount of viable habitat that would be affected by debris fall or shock waves, these analyses should be regarded as an overestimate and those of maximum effect.

Also, the area within the shockwave range of effect would be completely contained within the area at risk for ejecta impacts. The anticipated worst-case scenario of a payload land impact at Illeginni islet is a shoreline strike, which would result effects that would extend outward from the point of strike. On both sides of Illeginni Islet, the area may potentially be affected debris fall. Since these areas overlap and since harmed individuals should be counted only once in the effects of the Action, the affected habitat area with the largest estimated take was selected as the worst-case scenario. Although the exact shape of the affect area is impossible to estimate, the seaward portion of such an area is conceptually illustrated as a rough semi-circle on the lagoon and ocean sides of Illeginni Islet with a radius of 91 m (Figure 9).

Figure 9. Representative Maximum Direct Contact Affect Areas for a Shoreline Payload Impact at Illeginni Islet, Kwajalein Atoll.

If the worst- case scenario of a shoreline RV impact is considered, coral colonies might be exposed to shock waves. As discussed above, habitat suitability for consultation species is lowest along the water's edge (where shock waves would be most intense) and typically increases with distance from shore (NMFS 2019). If shock waves strong enough to damage corals might extend out 37.5 m from impact, shock waves might occur in approximately 2,209 m^2 (2,642 yd^2) of nearshore marine areas. In the event of a shoreline RV impact, it is likely that some coral

colonies would be affected, but the most likely realized effects would be cracks in the colony or broken branches or plates. As discussed for direct contact above, fracturing or broken branches would injure the soft tissue near the break but affecting some polyps of a colony does not necessarily constitute harm to the individual as the colony can continue to exist even if the colony is damaged.

Since the maximum debris exposure and potential shock wave exposure areas overlap and since harmed individuals should be counted only once in determining the effects of the Proposed Action, the effects on nearshore coral species were calculated based on the potential debris exposure area.

The estimated total number of colonies or individuals exposed for all three tests with land RV impact was calculated based on the 99% upper confidence level of the bootstrap mean densities for the potentially affected colonies or individuals exposed during a single test multiplied by three (Table 7). The number of colonies or individuals were based on a 2014 assessment of the reef areas offshore of the Illeginni Islet Impact Zone (NMFS-PIRO 2017a and 2017b). Coral colony, individual mollusk mean densities and 99% upper confidence level (UCL) were provided by NMFS-PIRO (2017a and 2017b). If it is assumed that each potential test involving land impacts would have a shoreline impact (a worst-case scenario) and assuming each test would expose different marine areas to debris, an estimated 31,224 UES-consultation coral colonies and 228 individual mollusks might be exposed to direct contact from debris from a total of three anticipated payload impacts based on mean densities in the area.

Table 7. Estimated numbers of consultation coral colonies, and individual mollusks and fish in affected habitat from three anticipated payload impacts.

Scientific Name	**Species**	**Colonies or Individuals Affected**
	Corals	
Acropora microclados	No Common Name	51
A. polystoma	No Common Name	51
Cyphastrea agassizi	No Common Name	42
Heliopora coerulea	No Common Name	14,049
Pavona venosa	No Common Name	42
Turbinaria reniformis	No Common Name	42
Pocillopora meandrina	Cauliflower coral	16,947
	Mollusks	
Tectus niloticus	Top Shell Snail	9
Hippopus hippopus	Giant clam	186
Tridacna squamosa	Giant clam	33

Scientific Name	Species	Colonies or Individuals Affected
	Fish	
Cheilinus undulates	Humphead wrasse	324 (24 adults/300 juveniles)

6.3 Response to Falling Missile Components

This section analyzes the responses of UES-consultation corals, top shell snails, giant clams, and humphead wrasse that may be exposed to being hit by the GBSD payloads and/or ejecta.

The GBSD payloads would be traveling at hypersonic velocity when it impacts the islet. The kinetic energy released into the substrate would be similar to the detonation of high explosives. The payload will effectively "explode", with some of its mass reduced to very fine particles ("aerosolized") and the remainder reduced to an undescribed range of fragment sizes. The substrate at the impact site would be blasted into a range of fragment sizes ranging from powder to larger rocks toward the outer edges of the crater. Some debris and substrate rubble would remain in the crater. The remainder would be thrown from the crater (ejecta). Initially, some of the ejecta would be moving at high velocity (bullet speeds). Some ejecta would move laterally, some would travel upward then fall back down up to 91 m from the impact site. The substrate immediately around the crater would be covered by larger chunks of ejecta from the outer edges of the crater as well as finer material that was thrown more vertically before falling back down. The movement of ejecta away from the crater would act to spread it out (scatter) over an increasing area, with decreasing available material being scattered over an increasing area. The velocity of the ejecta would also diminish with distance.

The intensity of the payload impact, and the uniformity of exposure to ejecta and the shockwave would decrease with distance from the point of impact. Any corals and top shell snails directly beneath the payload, or within the crater radius are expected to be instantly killed, with very little left of the organisms that would be recognizable. Beyond the crater, corals and top shell snails would be exposed to ejecta and the ground borne shockwave. Corals and top shell snails immediately beyond the crater would likely experience mortality from impact by high-velocity ejecta, from burial under mobilized crater material, or from exposure to the ground borne shockwave.

The response of corals to ejecta and the ground borne shockwave would depend largely on the scale and intensity of the exposure as well as the morphology of the coral. Impact by high-velocity dense ejecta (rock or metal), could fracture the hard structure of corals and would likely injure or destroy soft tissues. Fracturing would depend largely on the size and intensity of the impact and on morphology of the impacted coral. Plate-forming and branching corals are more easily broken than large massive or encrusting forms. Fractures due to payload impact are expected to range from pulverization of colonies in and close to the crater, to cracks and/or loss of branches in colonies toward the outer edge of effect. Additionally, exposure to the ground based shockwave could also fracture or dislodge coral colonies out to about 37.5 m from the payload impact. Because the coral skeletons are hard rock-like structures that are rigidly fixed to the hard substrate through which the shock wave would travel, much of the available energy in the substrate can be transferred directly into the coral's skeletal structure. If the shockwave is

intense enough, the coral's structure may crack or fracture and/or it may become unattached from the substrate. At close ranges, impact by lower velocity and/or lower density ejecta could affect the soft tissues of corals, ranging from burial to scouring away all or most of the living polyps and interconnecting soft tissues from a colony. At greater ranges, localized damage of a small part of a colony is possible.

Pulverization of a colony's structure, deep burial, or loss of a large proportion of a colony's soft tissue would likely result in the mortality of the colony. Partial fracturing of a coral skeleton and/or dislodgement of a coral from the substrate due to ejecta impact or from exposure to the ground based shock wave would injure the soft tissues at and around the break. Re-growth of soft tissues has energetic costs that could slow other growth and reproduction. Exposed areas of coral skeleton are prone to bioerosion and overgrowth by algae and certain sponges. Large areas of damaged or dead tissue could result in the introduction of algae that may prevent the regeneration of healthy coral tissue, or that may overcome the whole colony. Damaged and stressed tissues may also be more susceptible to infection by coral diseases that may hinder or prevent healing to the point that the colony dies.

Fragmentation is a form of asexual reproduction in some branching corals, resulting in the development of new, but genetically identical colonies. Bothwell (1981) reports that several *Acropora* species successfully colonize through fragmentation and translocation of fragments by storm-driven waves. However, not all coral fragments, or dislodged colonies would be expected to survive. Survival would depend largely on where a fragment falls and how it is oriented after it settles to substrate. A fragment or colony is likely to die if the living tissue is on the underside of the fragment or if the fragment settles into fine sediments. Additionally, in areas that experience regular high surf, such as the ocean side reef at Illeginni, loose coral fragments and colonies could repeatedly become mobilized by the waves. This reduces the likelihood of their survival, and potentially injures additional coral colonies should the fragments be cast against them.

Based on the available information, we believe that the numbers of coral colonies, identified above in Table 7, represent a conservative yet reasonable estimate of the corals that may be adversely affected by the proposed action. Further, this Opinion conservatively assumes that mortality would result for all exposed coral colonies. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the top shell snail, the effects of exposure to ejecta and shockwave is expected to quickly diminish to insignificance with distance from the payload impact site. Impact by high-velocity dense ejecta (rock or metal) immediately around the crater could penetrate or fracture an exposed snail's shell, either killing the animal directly, or leaving it vulnerable to predation. Conversely, with movement away from the payload impact site, ejecta would become slower, and the ejecta would have to penetrate increasing water depth to impact the snails. Considering the conical shape and thickness of a top shell snail's shell, most ejecta that may strike one that is under water and at any distance from the payload impact site is likely to be deflected without imparting a significant proportion of its kinetic energy to the shell or the animal within.

Top shell snails immediately around the payload crater may also be buried by ejecta. The potential for burial, and the depth of the material under which a snail may be buried would likely decrease quickly with distance from the payload impact site. Mortality could result if the snail is

crushed, smothered, or permanently pinned beneath rubble. Non-lethal effects could include energetic costs and/or foraging impacts.

Exposure to intense ground borne shockwaves could injure the soft tissues of top shell snails. Mortality of the snail is possible if the injury is significant enough. The range to the onset of significant injuries for top shell snails exposed to a ground based payload impact shockwave is unknown, but it is likely much less than that estimated for corals (37.5 m). Top shell snails are not rigidly attached to the substrate as are corals. Instead, they adhere to the reef using a muscular foot. Whereas rigidly attached corals would be directly linked to the substrate such that the energy could readily travel into and along its skeletal structure, the muscular foot of the snail would act to isolate the snail's shell from the vibration, and to reduce the transfer of the energy to other soft tissues and organs. Non-lethal effects could include bruising of the foot and other tissues, which may have energetic costs and/or may have reproductive impacts.

As stated above, habitat suitability for the consultation species is lowest along the water's edge and typically increases with distance from shore. Therefore, top shell snail density would be lowest in the area immediately adjacent to the payload impact site, where ejecta effects and shockwave would be greatest. Conversely, in the areas where top shell snail density would be highest, ejecta would be slower, and it would have to penetrate several feet of water to impact the snails. Based on this, on the robust nature of snails (see Section 4), and the characteristics of its shell, most ejecta that may strike top shell snails is likely to be deflected without imparting any significant proportion of its kinetic energy to the shell or the animal within. In this situation, ejecta impact would result in little more than inducing the affected snail to briefly adhere more tightly to the substrate before resuming normal behaviors. The range to adverse effects from burial and shockwaves would likely be similarly restricted to the area along the water's edge. Therefore, we expect that the nine top shell snails that may be exposed to the combined effects of three payload land strikes (Table 7, above), would be adversely affected by the exposure. Further, this Opinion conservatively assumes that mortality would result for all exposed top shell snails. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the clams, the effects of exposure to ejecta and shockwave is expected to quickly diminish to insignificance with distance from the payload impact site. Impact by high-velocity dense ejecta (rock or metal) immediately around the crater could penetrate or fracture an exposed clam shell, or damage soft tissue that is exposed possibly killing the animal. Conversely, with movement away from the payload impact site, ejecta would become slower, and the ejecta would have to penetrate increasing water depth to impact the clams. Considering the thickness of a clam shell, most ejecta that may strike one that is under water and at any distance from the payload impact site is likely to be deflected without imparting a significant proportion of its kinetic energy to the shell or the animal within unless it is able to lodge itself in the shell opening.

Clams immediately around the payload crater may also be buried by ejecta. The potential for burial, and the depth of the material under which a clam may be buried would likely decrease quickly with distance from the payload impact site. Mortality could result if the clam is crushed, smothered, or permanently pinned beneath rubble. Non-lethal effects could include feeding impacts if the clam is unable to filter feed due to debris.

Exposure to intense ground borne shockwaves could injure the soft tissues of clams. Mortality is possible if the injury is significant enough. The range to the onset of significant injuries for

clams exposed to a ground based payload impact shockwave is unknown. Clams can be buried in substrate or attached to corals which means they would be directly linked to the substrate such that the energy could readily travel into the shell and affect the soft tissue and organs. Non-lethal effects could include bruising of the tissues, which may have energetic costs and/or may have reproductive impacts.

As stated above, habitat suitability for the consultation species is lowest along the water's edge and typically increases with distance from shore. Therefore, clam density would be lowest in the area immediately adjacent to the payload impact site, where ejecta effects and shockwave would be greatest. Conversely, in the areas where clam density would be highest, ejecta would be slower, and it would have to penetrate several feet of water to impact the clams. Based on this, on the robust nature of clams, and the characteristics of its shell, most ejecta that may strike clams is likely to be deflected without imparting any significant proportion of its kinetic energy to the shell or the animal within. In this situation, ejecta impact would result in little more than inducing the affected clam to close before resuming normal behaviors. The range to adverse effects from burial and shockwaves would likely be similarly restricted to the area along the water's edge. Therefore, we expect that 219 clams that may be exposed to the combined effects of a payload land strike (Table 7, above), would be adversely affected by the exposure. As described above, this number is based on the worst-case scenario and under the assumption that the three tests could impact a different area every time and result in mortality. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the humphead wrasse, it is estimated that there will be up to 300 juvenile, and 24 adult humphead wrasses in the area of impact (worst case scenario expecting mortality from each test). An individual animal could be exposed to ejecta hitting and traveling through the water and from the shock wave produced from the main projectile's impact. An animal subjected to a direct impact, concussive shock waves from the impact, ejecta, or a near miss of ejecta would result in wounding or death. Potential injuries may include cuts, gashes, bruises, broken bones, rupture or hemorrhage of internal organs, amputation, or other broken body parts; any of which could result in an animal's death. Since the arcs (the affected area on the lagoon and the affected area on the ocean) were drawn and estimated based on shoreline strikes on each side, the model assumes mishits on every test, which is highly unlikely to occur. Furthermore, it assumes that ejecta will uniformly spread, especially to the outer extents of those circles (~100 m away). Humphead wrasses were observed beyond the reef crest near the edges of those arcs. As mentioned in previous sections, the USASMDC/ARSTRAT observed the majority of ejecta stayed within a few meters of the impact area. The density of ejecta is expected to decrease with distance from the point of impact (USAFGSC and USASMDC/ARSTRAT 2015). Ejecta is also likely to lose velocity the further it travels from the source. The depth of the water in the 91 m radius is expected to be less than 3 m. Humphead wrasses are generally not surface-dwelling fish where they would be the most vulnerable to strikes. Graham et al. (2015) reports that humphead wrasse are most often encountered on outer reef slopes and reef passes/channels at depths of only a few meters to at least 60 m (Randall 1978); other reports document humphead wrasses to depths of up to 100 m (Russell 2004; Zgliczynski et al. 2013). Graham et al. (2015) further notes at that personal observations from NMFS biologists familiar with the species, documented observations on deep dives and that the species was caught at depths greater than 100 m and up to approximately 180 m by deep gillnet (G. Davis pers. comm. as cited in Graham et al. 2015). On impact, the parts of the payload and substrate will explode into numerous pieces from

"aerosolized" bits to mid-sized rocks. The largest sized ejecta is likely to travel through the air slower than smaller and lighter pieces, and fall closer to the source. When ejecta hits the water, it slows down quickly before falling to the reef or substrate. Furthermore, ocean conditions are dynamic in the nearshore (i.e. waves, currents, etc.) and projectiles would lose the majority of their energy within a few inches of the surface. Humphead wrasse, even juveniles, are large and mobile and will likely flee from falling debris as it hits the water.

6.4 Risk

This section analyzes the risk posed by the proposed action for populations of UES-protected marine species at USAKA due to exposure to direct impact and removal from the water as described above. Because this Opinion assumes mortality for all exposed individuals, regardless of the stressor, the risk assessment below focuses on the species impacts from the direct impact.

6.4.1 Risk for coral populations due to expected levels of action-related mortality

As described in the exposure analyses above, up to 31,224 colonies of seven UES-consultation coral species (Table 7) could experience mortality from the payload strikes on Illeginni Islet. This would be due to the combined exposure to direct payload impact, ejecta, and ground based shockwaves. This represents the maximum possible impact associated with this action.

Based on the best information available, we believe that these corals are all widely distributed around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of coral-occupied habitat at Illeginni, and likely below 1% of coral-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these coral species in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 31,224 colonies likely represent a tiny fraction of their species found at Illeginni and across USAKA. Therefore, based on the best available information, we consider the risk negligible that project-related effects from direct payload impact, ejecta, and ground based shockwave would eliminate any of these species at USAKA, or appreciably reduce the likelihood of their survival and recovery at USAKA and across their global range.

6.4.2 Risk for top shell snails due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to nine top shell snails could experience mortality as the result of the planned direct payload impacts, ejecta, and ground based shockwaves. We believe that top shell snails are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of top shell snail-occupied habitat at Illeginni, and likely below 1% of top shell snail-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these mollusks in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these nine top shell snails likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impacts, ejecta, and ground

based shockwaves would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

6.4.3 Risk for clams due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to 186 *H. hippopus* and 33 *T. squamosa* clams could experience mortality as the result of the planned direct payload impacts, ejecta, and ground based shockwaves. We believe that both species of clams are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of clam-occupied habitat at Illeginni, and likely below 1% of clam-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these mollusks in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 219 clams likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impacts, ejecta, and ground based shockwaves would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

6.4.4 Risk for humphead wrasses due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to 324 humphead wrasses could experience mortality as the result of direct payload impacts from all four payload strikes, ejecta, and ground-based shockwave, but more likely minor injury if any, will occur. We believe that humphead wrasse are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of habitat at Illeginni, and likely below 1% of humphead wrasse-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these fish in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 324 humphead wrasse likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impact, ejecta, and ground-based shockwave would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

7 CUMULATIVE EFFECTS

The UES does not specifically describe “cumulative effects” for a biological opinion. However, Section 161 of the Compact provides that for U.S. Government activities requiring the preparation of an environmental impact statement (EIS) under NEPA, the U.S. Government shall comply with environmental standards that protect public health and safety and the environment that are comparable to the U.S. environmental statutes, including the Endangered Species Act. Although not all USAKA actions that require formal consultation also require the preparation of an EIS, such as this action, we analyze cumulative effects in all USAKA consultations as that

term is defined in the ESA implementing regulations. Cumulative effects, as defined in the ESA, are limited to the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion (50 CFR 402.02). These effects do not include the continuation of actions described under the Environmental Baseline, and future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

The impacts of RMI coastal development, fisheries interactions, vessel groundings, direct take, marine debris, and global climate change are not only expected to continue, they are likely to intensify over time. The intensification of those impacts is expected to cause cumulative effects on UES-protected marine species at USAKA. Continued growth of the human population at Kwajalein Atoll would likely result in increased coastal development, fishing pressure, vessel traffic, and pollution of the marine environment.

Anthropogenic release of CO_2 and other greenhouse gases is considered the largest contributor to global climate change, and it is expected that the release of those gases is not only likely to continue, but the rate of their release is expected to increase during the next century (Brainard et al. 2011). Therefore, global climate change is expected to continue to impact UES-protected marine species and their habitats, especially on those species that are dependent on shallow coastal reefs and shorelines, such corals and marine mollusks.

There is uncertainty associated with the analysis of potential impacts of climate change on species and ecosystems (Barnett 2001). Effects of climate change will not be globally uniform (Walther et al. 2002) and information regarding the magnitude of future climate change is speculative and fraught with uncertainties (Nicholls and Mimura 1998). In particular, there is no comprehensive assessment of the potential impacts of climate change within the action area or specific to UES-protected marine species. In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Impact assessment models that include adaptation often base assumptions (about when, how, and to what conditions adaptations might occur) on theoretical principles, inference from observed observations, and arbitrary selection, speculation, or hypothesis (see review in Smit et al. 2000). Impacts of climate change and hence its 'seriousness' can be modified by adaptations of various kinds (Tol et al. 1998). Ecological systems evolve in an ongoing fashion in response to stimuli of all kinds, including climatic stimuli (Smit et al. 2000).

The effects of global climate change, the most significant of which for corals are the combined direct and indirect effects of rising sea surface temperatures and ocean acidification, are currently affecting corals on a global scale, particularly in parts of the Caribbean. The return frequency of thermal stress-induced bleaching events has exceeded the ability of many reefs and coral species to recover there. Brainard et al. (2011) report that those effects likely represent the greatest risk of extinction to ESA-candidate corals over the next century. Field observation and models both predict increasing frequency and severity of bleaching events, causing greater coral mortality and allowing less time to recover between events. However, predicting how global climate change may impact particular species remains poorly understood, especially in understudied areas such as USAKA.

The effects of global climate change could act synergistically on corals affected by the proposed action. The ability of impacted corals to respond to the effects of the proposed action could be

reduced due to the effects of elevated temperatures and increased ocean acidity, and the longer it takes for impacted corals to recover from the effects of the proposed action, the more likely it becomes that the effects of climate change would synergistically impact those corals. However, the degree to which those synergistic impacts may affect corals over the time required for them to recover from project impacts is unknown.

The effects of global climate change could also act synergistically on mollusks affected by the proposed action. However, no specific information is currently available to assess the impacts. Changes in ocean temperature and chemistry, and rising sea level may be affecting these species because they depend on an exoskeleton that is comprised primarily of calcium carbonate. We expect that minimally, increased acidity could have effects that parallel those described for corals above.

Given the small area and low numbers of individuals expected to be adversely affected by the proposed action, the possible synergistic impacts of climate change combined with the effects of the proposed action are not expected to be significant for the corals, mollusks, and fish considered in this Opinion.

8 INTEGRATION AND SYNTHESIS OF EFFECTS

The purpose of this Opinion is to determine if the proposed action is likely to jeopardize the continued existence of UES-protected marine species at USAKA. “Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a UES-protected marine species at USAKA by reducing the reproduction, numbers, or distribution of that species. This Opinion considers the Effects of the Action within the context of the Status of the Species, the Environmental Baseline, and Cumulative Effects as described in Section 7 under “Approach”.

We determine if reduction in fitness to individuals of marine consultation species that may result from the proposed action are sufficient to reduce the viability of the populations those individuals represent (measured using changes in the populations’ abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the risk of reducing the likelihood of survival and recovery of UES-protected species). In order to make that determination, we use the population’s base condition (established in the Status of Listed Species and Environmental Baseline sections of this Opinion), considered together with Cumulative Effects, as the context for the overall effects of the action on the affected populations at USAKA. The following discussion summarizes the probable risks the proposed action poses to corals, top shell snails, giant clams, and the humphead wrasse identified in Section 6.

8.1 Corals

As described in the Effects of the Action section, a total of up to 31,224 colonies of UES-consultation corals (seven species) could be killed through some combination of exposure to direct payload impact, ejecta, and ground based shock wave. Over 99% of the colonies are from two highly abundant and widely distributed species within USAKA; *P. meandrina* and *H. coerulea*.

As discussed in the Status of Listed Species, abundance and trend data are lacking for these corals at USAKA. However, they are all widely distributed around the atoll, with four of the seven corals being known to occur at all USAKA islets. Others are known to occur on at least half of the USAKA islets. All seven species have also been observed at survey sites in the MAC, with three found at over 30 of the 35 sites. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets and MAC has been surveyed, and surveys to specifically identify and quantify these species are yet to be done. A recent survey was completed at Illeginni Islet in the MM III reef impact area, which is also the area that has been analyzed for impacts from the ARRW payload and the results suggest that the estimate for corals in the area may be lower than what has been estimated (NMFS 2017a). Additionally, NMFS conducted a survey in 2018 at two launch sites in preparation of the THAAD test (NMFS 2018).

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, fisheries interactions, direct take, and climate change are expected to continue and likely worsen in the future for these corals. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1 testing will remove up to 10,417 coral colonies, the ARRW testing will remove up to 10,417 colonies, and the FE-2 testing will remove up to 10,404 colonies (for a total of up to 31,238 colonies cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in the mortality of up to 31,224 coral colonies at Illeginni Islet. These coral colonies represent an extremely small fraction of the total number of colonies found at Illeginni, and even less around USAKA. In the context of this action, the potential loss of these coral colonies is not expected to significantly impact reproduction or to impede the recovery of their species across USAKA and the MAC. Therefore, when taken in context with the status of these species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate any of the seven UES consultation corals considered in this Opinion from Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

8.2 Top Shell Snail

As described in the Effects of the Action section, a total of up to nine top shell snails could be killed through some combination of exposure to direct payload impact, ejecta, and ground based shock wave.

As discussed in the Status of Listed Species, top shell snails have been reported at all of the 11 USAKA islets as well as at 59 of 103 survey sites throughout Kwajalein Atoll including all four survey sites on Illeginni. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets has been surveyed, and surveys to specifically identify and quantify this species are yet to be done. As

such, it is possible that the distribution and abundance of top shell snails at USAKA is higher than the current information can confirm.

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and likely worsen in the future for this species. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1, ARRW, and FE-2 testing will remove up to four top shell snails for each project (for a total of up to 12 top shell snails cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in death of up to nine top shell snails at Illeginni. The affected snails would represent a small fraction of the total number of top shell snails found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of nine top shell snails across the area is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate top shell snails at Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

8.3 Giant Clams

As described in the Effects of the Action section, a total of up to 219 giant clams could be harassed, injured, or killed through some combination of exposure to direct payload impact, ejecta, and ground-based shock wave.

As discussed in the Status of Listed Species, the two clam species have been reported at most of the 11 USAKA islets, (nine for *H. hippopus* and six for *T. squamosa*) as well as at nine and 24 respectively of 35 survey sites in the mid-atoll corridor. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets has been surveyed, and surveys to specifically identify and quantify this species are yet to be done.

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and likely worsen in the future for this species. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1 testing will remove up to 90 giant clams, the ARRW testing will remove up to 90 giant clams, and the FE-2 testing will remove up to 75 giant clams (for a total of up to 255

giant clams cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in death of up to 219 (186 *H. hippopus* and 33 *T. squamosa*) at Illeginni. The affected clams would represent a small fraction of the total number of clams found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of giant clams across the area is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the mid-atoll corridor. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate giant clams at Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the mid-atoll corridor.

8.4 Humphead Wrasse

As described in the Effects of the Action section, a total of up to 342 humphead wrasses could be harassed, injured, or killed through some combination of exposure to direct payload impact, ejecta, and ground-based shock wave.

As discussed in the Status of Listed Species section, humphead wrasses are commonly observed at Kwajalein Atoll, and have been observed at 10 of the 11 surveyed islets since 2010. Observations suggest a broad but scattered distribution. It is important to recognize that survey data for USAKA is incomplete. Only a small portion of the total reef area around the USAKA islets have been surveyed, especially in deeper waters where humphead wrasse could live.

As discussed in the Environmental Baseline and Cumulative Effects section, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and for climate change in particular expect to worsen in the future. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1, ARRW, and FE-2 testing will remove up to 108 humphead wrasse for each project (for a total of up to 324 humphead wrasse cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in the injury or death of up to 324 humphead wrasse (300 juveniles and 24 adults) at Illeginni. The affected individuals would represent a small portion of the total number of humphead wrasse found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of humphead wrasses by the action is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate humphead wrasses at Illeginni, or

appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

9 CONCLUSION

After reviewing the current status of UES-protected marine species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our Opinion that the USAF/USASMDC's implementation of the GBSD weapon system testing at USAKA, RMI is not likely to jeopardize the continued existence of any of the UES-protected corals considered in this Opinion, the top shell snail, humphead wrasse, or two species of giant clams. No critical habitat has been designated or proposed for designation for any UES-protected marine species in the BOA or elsewhere in the RMI. Therefore, the proposed action would have no effect on designated or proposed critical habitat in the RMI.

10 INCIDENTAL TAKE STATEMENT

The UES does not specifically describe "take" for a biological opinion. However, under the ESA "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the reasonable and prudent measures and terms and conditions of the Incidental Take Statement (ITS). Although the ESA does not specifically apply to actions taken at USAKA, under section 161 of the Compact and the UES, the ESA provides the basis for determining the level of incidental take, so the ESA definitions will be used for this Opinion.

10.1 Anticipated Amount or Extent of Incidental Take

Based on the analysis in the accompanying Opinion, we conclude that the GBSD flight tests at USAKA would result in the take of seven species of UES consultation corals, top shell snails, humpback wrasse, and two clam species. As described above in the exposure and response analyses, we expect that up to 31,224 colonies of UES consultation corals (as quantified in Table 8, below) could experience complete mortality, up to nine top shell snail, up to 219 clams, and up to 324 humphead wrasse could be killed by the proposed action.

Table 8. Expected Take of Marine UES consultation species due to GBSD flight tests

Scientific Name	Species	Colonies or Individuals Affected
	Corals	
Acropora microclados	No Common Name	51
A. polystoma	No Common Name	51
Cyphastrea agassizi	No Common Name	42
Heliopora coerulea	No Common Name	14,049

Scientific Name	Species	Colonies or Individuals Affected
Pavona venosa	No Common Name	42
Turbinaria reniformis	No Common Name	42
Pocillopora meandrina	Cauliflower coral	16,947
	Mollusks	
Tectus niloticus	Top Shell Snail	9
Hippopus hippopus	Giant clam	186
Tridacna squamosa	Giant clam	33
	Fish	
Cheilinus undulates	Humphead wrasse	324 (24 adults/300 juveniles)

10.2 Effect of Impact of the Take

In this Opinion, we determined that this level of anticipated take is not likely to result in the jeopardy of any of the UES consultation species expected to be taken by the proposed action.

10.3 Reasonable and Prudent Measures

We believe the following reasonable and prudent measures, as implemented by the terms and conditions, are necessary and appropriate to minimize impacts of the proposed action and monitor levels of incidental take. The measures described below are non-discretionary and must be undertaken in order for the ITS to apply.

1. The USAF/USASMDC shall reduce impacts on UES-protected corals, top shell snails, clams, humphead wrasse and their habitats through the employment of best management practices and conservation measures.
2. The USAF/USASMDC shall record and report all action-related take of UES-consultation species.

10.4 Terms and Conditions

The USAF/USASMDC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To meet reasonable and prudent measure 1 above, the USAF/USASMDC shall ensure that their personnel comply fully with the conservation measures identified below.
    a. The USAF/USASMDC shall ensure that all relevant personnel associated with this project are fully briefed on the best management practices and the requirement to adhere to them for the duration of this project.

b. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action as soon as possible.
    i. Ejecta greater than six inches in any dimension shall be removed from the water or positioned such that it would not become mobilized by expected wave action, including replacement in the payload crater.
    ii. If possible, coral fragments greater than six inches in any dimension shall be positioned on the reef such that they would not become mobilized by expected wave action, and in a manner that would enhance its survival; away from fine sediments with the majority of the living tissue (polyps) facing up.
    iii. UES consultation coral fragments that cannot be secured in-place should be relocated to suitable habitat where it is not likely to become mobilized.
c. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to reduce impacts on top shell snails.
    i. Rescue and reposition any living top shell snails that are buried or trapped by rubble.
    ii. Relocate to suitable habitat, any living top shell snails that are in the path of any heavy equipment that must be used in the marine environment.
d. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to reduce impacts on clams.
    i. Rescue and reposition any living clams that are buried or trapped by rubble.
    ii. Relocate to suitable habitat, any living clams that are in the path of any heavy equipment that must be used in the marine environment.

2. To meet reasonable and prudent measure 2 above:
    a. The USAF/USASMDC shall assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.
    b. The USAF/USASMDC shall utilize digital photography to record any UES-consultation species found injured or killed in or near the ocean target areas and/or at Illeginni. As practicable: 1) Photograph all damaged corals and/or other UES-consultation species that may be observed injured or dead; 2) Include a scaling device (such as a ruler) in photographs to aid in the determination of size; and 3) Record the location of the photograph.
    c. In the event the payload impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to survey the ejecta field for impacted corals, top shell snails, and clams. Also be mindful for any other UES-consultation species that may have been affected.
    d. Within 60 days of completing post-test clean-up and restoration, provide photographs and records to the USAKA environmental office. USAKA and our biologists will review the photographs and records to identify the organisms to the lowest taxonomic level accurately possible to assess impacts on consultation species.

e. Within 6 months of completion of the action, USAKA will provide a report to us. The report shall identify: 1) The flight test and date; 2) The target area; 3) The results of the pre- and post-flight surveys; 4) The identity and quantity of affected resources (include photographs and videos as applicable); and 5) The disposition of any relocation efforts.

11 CONSERVATION RECOMMENDATIONS

The following conservation recommendations are discretionary agency activities provided to minimize or avoid adverse effects of a proposed action on UES-protected marine species or critical habitat, to help implement recovery plans, or develop information.

1. We recommend that the USAF/USASMDC continue to work with NMFS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species that are there.
2. We recommend that the USAF/USASMDC consider constructing a berm, artificial Hesco Bastion ("Concertainer"), or Bremer wall, around the perimeter of the island above the beach line (see start of grass line in Figure 2 for example) at the impact site in order to reduce the amount of potential ejecta material which can enter the ocean from an impacting projectile. We understand that depending on impact characteristics ejecta may arch at a higher angle than a berm's height. Additionally, consultation may be required with the USFWS for landbased activities. However, we believe it should be considered. This would reduce the risk to UES/ESA-listed species in the nearshore, allow for more precise definition of the target, and aid in the recovery of munition materials after impact.
3. We recommend the USAF/USASMDC equip USAG-KA personnel with metal detectors for recovery of projectile materials in the nearshore environment, if not already doing so. Furthermore, we recommend the USAF/USASMDC attempt to quantify the amount of recovered materials to determine the amount of tungsten that remains in the nearby environment.
4. We recommend that the USAF/USASMDC continue to work with NMFS staff to conduct marine surveys at additional sites around all of the USAKA islets and in the mid-atoll corridor to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
5. We recommend that the USAKA develop capacity and procedures for responding to marine mammal and turtle strandings.
    a. Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.
    b. Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.
    c. Develop mechanisms to collect and disseminate the information.

11.1 Reinitiation Notice

This concludes formal consultation on the implementation of the GBSD program at the USAKA, RMI. Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law, and if:

1. The amount or extent of anticipated incidental take is exceeded;

2. New information reveals that the action may affect UES-protected marine species or critical habitat in a manner or to an extent not considered in this Opinion;
3. The action is subsequently modified in a manner that may affect UES-protected marine species or critical habitat to an extent, or in a manner not considered in this Opinion; or
4. A new species is listed or critical habitat designated that may be affected by the action.

12 DATA QUALITY ACT DOCUMENTATION

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the DQA, and certifies that this Supplement has undergone pre-dissemination review.

12.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this Opinion is the USAF/USASMDC. Other interested users could include the citizens of RMI, USFWS, and NOAA. Individual copies of this Opinion were provided to the USAF/USASMDC. The format and naming adheres to conventional standards for style.

12.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

12.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with UES and ESA training and reviewed in accordance with Pacific Islands Region ESA quality control and assurance processes.

13 LITERATURE CITED

Anthony, K.R.N., D.I. Kline, G. Diaz-Pulido, S. Dove, and O. Hoegh-Guldberg. 2008. Ocean acidification causes bleaching and productivity loss in coral reef builders. Proceedings of the National Academy of Sciences 105:17442-17446.

Bagnis, R., P. Mazellier, J. Bennett, and E. Christian. 1972. Fishes of Polynesia. Les editions du Pacifique, Papeete, Tahiti. 368 p.

Barnett, Tim P., D.W. Pierce, and R. Schnur. "Detection of anthropogenic climate change in the world's oceans." Science 292.5515 (2001): 270-274.

Blidberg, E., Elfwing, T., Plantman, P., & Tedengren, M. (2000). Water temperature influences on physiological behaviour in three species of giant earns (Tridacnidae).

Bothwell, A. M. 1981. Fragmentation, a means of asexual reproduction and dispersal in the coral genus *Acropora* (Scleractinia: Astrocoeniida: Acroporidae) – A preliminary report. Proceedings of the Fouth International Coral Reef Symposium, Manila, 1981, Vol. 2: 137-144.

Bradley, D. L., and R. Stern. 2008. Underwater Sound and the Marine Mammal Acoustic Environment – A Guide to Fundamental Principles. Prepared for the U. S. Marine Mammal Commission. Spectrum Printing and Graphics, Rockville, Maryland. 67 pp.

Brainard, R. E., C. Birkeland, C. M. Eakin, P. McElhany, M. W. Miller, M. Patterson, and G. A. Piniak. 2011. Status Review Report of 82 Candidate Coral Species Petitioned Under the U.S. Endangered Species Act. NOAA Technical Memorandum NMFS-PIFSC-27. September 2011.

CBD (Center for Biological Diversity). 2018. Petition to list the cauliflower coral (Pocillopora meandrina) in Hawaii as endangered or threatened under the Endangered Species Act. Center for Biological Diversity, 52 pp.

Chambers, C.N.L. "Pasua (*Tridacna maxima*) size and abundance in Tongareva Lagoon, Cook Islands." SPC Trochus Information Bulletin 13 (2007): 7-12.

CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). 2004. *Tridacna squamosa*. AC22 Doc. 10.2 Annex 8g. URL:www.cites.org/eng/com/AC/22/E22-10-2-A8g.pdf.

CITES. 2019. Internet website: 1884 GBSD Test Program Activities at Kwajalein Atoll_BiOp.docx.

Colin, P. L. 2010. Aggregation and spawning of the humphead wrasse *Cheilinus undulatus* (Pisces: Labridae): general aspects of spawning behavior. Journal of Fish Biology 76(4):987-1007.

Donaldson, T. J. and Y. Sadovy. 2001. Threatened fishes of the world: *Cheilinus undulatus* Ruppell, 1835 (Labridae). Environmental Biology of Fishes 62:428.

Elfwing, T., Plantman, P., Tedengren, M., & Wijnbladh, E. (2001). Responses to temperature, heavy metal and sediment stress by the giant clam *Tridacna squamosa*. Marine & Freshwater Behaviour & Phy, 34(4), 239-248.

Ellis, S. 1997. Spawning and Early Larval Rearing of Giant Clams (Bivalvia: Tridacnidae) Center for Tropical and Subtropical Aquaculture, Publication No. 130.

Finneran, J.J. and A.K. Jenkins. 2012. Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. San Diego, California: SPAWAR Systems Center Pacific. http://www.dtic.mil/dtic/tr/fulltext/u2/a561707.pdf

Gilbert, A., et al. 2006. The giant clam *Tridacna maxima* communities of three French Polynesia islands: comparison of their population sizes and structures at early stages of their exploitation. ICES Journal of Marine Sciences 63:1573-1589.

Gilbert, A., et al. 2007. First observation of the giant clam *Tridacna squamosa* in French Polynesia: a species range extension. Coral Reefs 26:229.

Graham, K. S., C. H. Boggs, E. E. DeMartini, R. E. Schroeder, and M. S. Trianni. 2015. Status review report: humphead wrasse (*Cheilinus Undulatus*). U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-48, 126 p. + Appendices.

Hanser, S., E. Becker, L. Wolski, and A. Kumar. 2013. Pacific Navy Marine Species Density Database Technical Report. US Department of the Navy, Naval Facilities Engineering Command, US Department of the Navy, Naval Facilities Engineering Command.

Hastings, M.C., and A. N. Popper. 2005. Effects of sound on fish. Report prepared by Jones & Stokes for California Department of Transportation, Contract No. 43A0139, Task Order 1.

Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2009. Climate change and marine turtles. Endangered Species Research 7: 137-154.

Heslinga, G. A., O. Orak, and M. Ngiramengior. 1984. Coral reef sanctuaries for trochus shells. Mar. Fish. Rev., 46: 73–80 (1984).

Hernawan, U. 2010. Study on giant clams (Cardiidae) population in Kei Kecil waters, Southeast-Maluku. Widyariset 13:101-108.

IUCN (International Union for the Conservation of Nature and Natural Resources). 2015. The IUCN Redlist of Threatened Species. Version 2015. Internet website: http://www.iucnredlist.org/.

Jung, M.R., G.H. Balazs, T.M. Work, T.T. Jones, S.V. Orski, V. Rodriguez C., K.L. Beers, K.C. Brignac, K.D. Hyrenbach, B.A. Jensen, and J.M. Lynch. 2018. Polymer Identification of Plastic Debris Ingested by Pelagic-Phase Sea Turtles in the Central Pacific. Environ Sci Technol. 2018; 52: (20), 11535-11544. DOI: 10.1021/acs.est.8b03118

Kahle, W. J., and P. S. Bhandari. 2019. Analysis of FE-2 Sonic-boom and stage drop acoustics. Appendix A of the Biological Assessment for Flight Experiment-2.

Kinch, J., and A. Teitelbaum. (2010). Proceedings of the regional workshop on the management of sustainable fisheries for giant clams (Tridacnidae) and CITIES capacity building.

Kolinski, S. P. 2015. Electronic mail to summarize personal communication to discuss the likelihood of humphead wrasse occurring close to shore around Illeginni Islet, RMI. June 12, 2015.

Marshall, T. C. 1964. Fishes of the Great Barrier Reef and coastal waters of Queensland. Angus and Robertson, Sydney, 576 p.

Missile Defense Agency (MDA) and USASMDC/ARSTRAT. 2019. Flight Test THAAD (FTT)-23 at Roi-Namur Islet US Army Garrison – Kwajalein Atoll Republic of the Marshall Islands. 128 p.

Moody, D. M. 2004. Estimates of Underwater Noise Generated b the Sonic Boom from a Hypersonic Reentry Vehicle. Aerospace Report No. TOR-2004(8506)-3279. Prepared by the Aerospace Corporation under contract to the U.S. Air Force Space and Missile Systems Center. 10 March 2004.

Mooney, T. A., R. T. Hanlon, J. Christensen-Dalsgaard, P. T. Madsen, D. R. Ketten, and P. E. Nachtigall. 2010. Sound detection by the longfin squid (*Loligo pealeii*) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. Journal of Experimental Biology 213(21):3748-3759.

Munro, J.L. 1993. Giant clams. Suva, Fiji. Institute of Pacific Studies, University of the South Pacific. In A. Wright and L. Hill (eds.) Nearshore marine resources of the South Pacific: information for fisheries development and management. p. 431-449.

Myers, R. F. 1999. Micronesian Reef Fishes. 3rd Ed. Coral Graphics, Guam. 330 p.

National Aeronautics and Space Administration (NASA). 2017. NASA Armstrong Fact Sheet: Sonic Booms. https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-016-DFRC.html Accessed May 2017.

National Marine Fisheries Service (NMFS). 2014a. Preliminary Estimates of UES Consultation Reef Fish Species Densities in Support of a Biological Assessment of Potential Minuteman III Reentry Vehicle Impacts at Illeginni Islet, [USAKA, RMI] – Final Report. July 28, 2014. 16 pp.

NMFS. 2014b. Preliminary Estimates of UES Consultation Coral and Mollusk Distribution Densities in Support of a Biological Assessment of Potential Minuteman III Reentry Vehicle Impacts at Illeginni Islet, [USAKA, RMI] – Final Report. September 3, 2014. 9 pp.

NMFS. 2015. Formal Consultation under the Environmental Standards for the United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands Biological Opinion for Continued Implementation of the Minuteman III Intercontinental Ballistic Missile Testing Program. 29 July 2015.

NMFS. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

NMFS. 2017a. Biological Assessment of Coral Reef Resources at Risk when Targeting Illeginni Islet using Missile Reentry Vehicles, United States Army Kwajalein Atoll, Republic of the Marshall Islands. May 2017. 30 p.

NMFS. 2017b. Biological Assessment of Giant Clam Species at Risk when Targeting Illeginni Islet using Missile Reentry Vehicles, United States Army Kwajalein Atoll, Republic of the Marshall Islands. May 2017. 14 p.

NMFS. 2017c. Formal Consultation under the Environmental Standards for United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands Biological Opinion And Informal Consultation under Section 7 of the Endangered Species Act - Single Flight Experiment-1 (FE-1). 85 p.

NMFS. 2018. An Assessment of Coral Reef Resources in the Vicinity of Two Proposed Terminal High Altitude Area Defense System Launch Sites at Roi-Namur Islet, United States Army Kwajalein Atoll, Republic of the Marshall Islands. 24 p.

NMFS. 2019. Informal Consultation under the Environmental Standards and Procedures for U.S. Army Kwajalein Atoll Activities in the Republic of Marshall Islands on the effects of launching a Terminal High Altitude Area Defense (THAAD) missile and subsequent intercept of a medium-range ballistic missile over the Pacific Ocean. 26 p.

NMFS and USFWS (National Marine Fisheries Service and US Fish and Wildlife Service). 2018. Draft Data from the 2016 Biological and 2014 Slope Habitat Inventories at Ronald Reagan Ballistic Missile Defense Test Site US Army Kwajalein Atoll, Republic of the Marshall Islands. Draft: August 2018.

National Oceanic and Atmospheric Administration (NOAA). 2013. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals – Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. December 23, 2013. 76 pp.
Neo, M. L., W. Eckman, K. Vicentuan, S. L. M. Teo and P. A. Todd. 2015. The ecological significance of giant clams in coral reef ecosystems. Biol. Cons. 181: 111-123.

Neo, M.L., Todd, P.A., Teo, S.L.M. and L. M. Chou. 2009. Can artificial substrates enriched with crustose coralline algae enhance larval settlement and recruitment in the fluted giant clam (Tridacna squamosa)? Hydrobiologia *625*(1): 83-90.

Nicholls, R.J. and N. Mimura. 1998. Regional issues raised by sea level rise and their policy implications. Climate Research 11:5-18.

Norton, J.H., et al. 1993. Mortalities in the Giant Clam *Hippopus* Associated with Rickettsiales-like Organisms. Journal of Invert. Path. 62:207-209.

Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421: 37-42.

Pogonoski, J. J., D. A. Pollard, and J. R. Paxton. 2002. Conservation overview and action plan for Australian threatened and potentially threatened marine and estuarine fishes. Environment Australia. Canberra. 373 p. Available at: http://www.environment.gov.au/coasts/publications/marine-fishaction/pubs/marine -fish.pdf

Popper, A. N., A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Lokkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014, Sound exposure guidelines for fish and sea turtles: a technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. April 20, 2014.

Radford CA, Jeffs AG, Tindle CT, Cole RG, Montgomery JC. 2005. Bubbled waters: The noise generated by underwater breathing apparatus. Marine and Freshwater Behaviour and Physiology, 38(4), 259-267.

Randall, J.E., Head, S.M. and A. P. Sanders. 1978. Food habits of the giant humphead wrasse, *Cheilinus undulatus* (Labridae). Environmental Biology of Fishes *3*(2):235-238.

Russell, B. (Grouper & Wrasse Specialist Group). 2004. *Cheilinus undulatus*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. Downloaded on 25 July 2019. Available at: http://www.iucnredlist.org/details/4592/0

Sadovy, Y., M. Kulbicki, P. Labrosse, Y. Letourneur, P. Lokani, and T. J. Donaldson. 2003. The humphead wrasse, *Cheilinus undulatus*: synopsis of a threatened and poorly known giant coral reef fish. Reviews in Fish Biology and Fisheries 13:327-364.

Sadovy de Mitcheson, Y., A. Cornish, M. Domeier, P.L. Colin, M. Russell, K.C. Lindeman. 2008. A global baseline for spawning aggregations of reef fishes. Conservation Biology 22(5): 1233-1244.

Smit, B., I. Burton, R.J.T. Klein, and J. Wandel. 2000. An anatomy of adaptation to climate change and variability. Climatic Change 45: 223-251.

Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor and H. L. Miller (eds.). 2007. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdon and New York, NY, USA.

Soo, P. and R. A. Todd. 2014. The behavior of giant clams (Bivalvia: Cardiidae: Tridacninae). Marine Biology 161: 2699-2717.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, & P.L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33(4): 411-521.

Thaman, R. 1998. Our endangered variivoce. Fiji Times, January 10, pp. 4 and 7.

Tol, R.S.J., S. Fankhauser, and J.B. Smith. 1998. The scope for adaptation to climate change: what can we learn from impact literature? Global Environmental Change 8(2):109-123.

Tupper, M. 2007. Identification of Nursery Habitats for Commercially Valuable Humphead Wrasse (*Cheilinus undulatus*) and Large Groupers (Pisces: Serranidae) in Palau. Marine Ecology Progressive Series. 332:189-199.

USAF. 2004. Final Environmental Assessment for Minuteman III Modification. 9 December 2004.

USAF. 2013. Final Supplemental Environmental Assessment for Minuteman III Extended Range Flight Testing. August 2013.

USAF. 2015. United States Air Force Minuteman III Modification Biological Assessment. March 2015.

USAF. 2016. Hill AFB Integrated Natural Resources Management Plan (INRMP) for 2017-2021.

U.S. Air Force/USASMDC. 2020. Biological Assessment for Ground Based Strategic Defense Test Program Activities at Kwajalein Atoll.

USAF. 2020a. Ground Based Strategic Deterrent Test Program Environmental Assessment / Overseas Environmental Assessment Draft. October 2020.

USAF 2020b. Final Supplemental Environmental Assessment for Minuteman III Modification and Fuze Modernization. February 2020.

U.S. Army Kwajalein Atoll (USAKA). 2016. Environmental Standards and Procedures for USAKA Activities in the Republic of the Marshall Islands, Fourteenth Edition. September 2016.

USASMDC/ARSTRAT (United States Army Space and Missile Defense Command/Army Forces Strategic Command). 2011. Advanced Hypersonic Weapon Program Environmental Assessment. June 2011.

USASMDC/ARSTRAT. 2015. United States Air Force Minuteman III Modification Biological Assessment. Prepared for US Air Force Global Strike Command, Barksdale Air Force base, LA and US Army Space and Missile Defense Command/Army Forces Strategic Command, Huntsville, AL. Teledyne Brown Engineering, Inc., Huntsville, AL; Tetra Tech, San Francisco, CA; and LPES, Inc., Smithfield, VA. March 2, 2015. 148 pp.

USASMDC/ARSTRAT. 2017. Flight Experiment 1 (FE-1) Biological Assessment. Prepared for Department of the Navy Director, United States Navy Strategic Systems Programs and US Army Space and Missile Defense Command/Army Forces Strategic Command, Huntsville, AL. Teledyne Brown Engineering, Inc., Huntsville, AL. March 1, 2017. 174 pp.

USAFGSC and USASMDC/ARSTRAT (United States Air Force Global Strike Command and United States Army Space and Missile Defense Command/Army Forces Strategic Command). 2015. United States Air Force Minuteman III Modification Biological Assessment. March 2015.

U.S. Navy (US Department of the Navy). 2015a. Mariana Islands Training and Testing Activities Final Environmental Impact Statement/Overseas Environmental Impact Statement. May 2015.

U.S. Navy (US Department of the Navy) 2015b. Final Environmental Impact Statement/Overseas Environmental Impact Statement for Northwest Training and Testing Activities. October 2015.

US Navy (United States Department of the Navy). 2017. Final Biological Assessment for Flight Experiment-1. February 2017.

U.S. Navy (US Department of the Navy) Strategic Systems Programs (SSP). 2017. Biological Assessment for Flight Experiment-1. 174 p.

U.S. Navy. 2019. Final Biological Assessment for Flight Experiment-2. June 2019.

U.S. Navy Strategic Systems Programs (SSP). 2019. Biological Assessment for Flight Experiment-2. 201 p.

USFWS (United States Fish and Wildlife Service). 2011. Final 2008 Inventory Endangered Species and Other Wildlife Resources Ronald Reagan Ballistic Missile Defense Test Site US Army Kwajalein Atoll, Republic of the Marshall Islands.

USFWS and NMFS. 1998. Endangered species consultation handbook: procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act.

USFWS and NMFS. 2012. Final 2010 Inventory Report Endangered Species and Other Wildlife Resources Ronald Reagan Ballistic Missile Defense Test Site US Army Kwajalein Atoll, Republic of the Marshall Islands.

Veron, J.E.N. 2014. Results of an update of the Corals of the World Information Base for the Listing Determination of 66 Coral Species under the Endangered Species Act. Report to the Western Pacific Regional Fishery Management Council. Honolulu: Western Pacific Regional Fishery Management Council. 11pp. + Appendices.

Walther, G. R, E. Post, P. Convey, A. Menzel, C. Parmesan, T.J.C. Beebee, J. M. Fromentin, O. Hoegh–Guldberg, and F. Bairlein. 2002. Ecological responses to climate change. Nature 416:389-395.

Watson, S. A., Southgate, P. C., Miller, G. M., Moorhead, J. A., & Knauer, J. 2012. Ocean acidification and warming reduce juvenile survival of the fluted giant clam, *Tridacna squamosa*. Molluscan Research, 32, 177-180.

White, E.M., S. Clark, C.A. Manire, B. Crawford, S. Wang, J. Locklin, and B.W. Ritchie. 2018. Ingested Micronizing Plastic Particle Compositions and Size Distributions within Stranded Post-Hatchling Sea Turtles. Environmental Science & Technology 2018 52 (18), 10307-10316. DOI: 10.1021/acs.est.8b02776

Zgliczynski, B. J., I. D. Williams, R. E. Schroeder, M. O. Nadon, B. L. Richards, and S. A. Sandin. 2013. The IUCN Red List of Threatened Species: an assessment of coral reef fishes in the US Pacific Islands. Coral Reefs. 32(3):637-650.

March 22, 2021

Allen Holdaway
United States Air Force
6030 Gum Lane, Building 1217
Hill AFB, UT 84056

Re: Santa Barbara County Air Pollution Control District Comments on the Draft Finding of No Significant Impact Environmental Assessment for the Ground Based Strategic Deterrent Test Program

Dear Allen Holdaway:

The Santa Barbara County Air Pollution Control District (District) is a state-designated special district with regulatory authority over stationary sources of air pollution in the county. Under Title V of the Federal Clean Air Act, the District issues federal operating permits to the largest sources of air pollution in the County; Vandenberg Air Force Base (VAFB) is one such source. More information on the District's Title V Operating Permit program is available under Title V of the federal Clean Air Act is available at www.ourair.org/title-v-permits. In addition, the District reviews environmental documents prepared by other lead agencies to ensure that air quality impacts from mobile, stationary, and area sources are addressed and that any adverse impacts are adequately mitigated. The District has reviewed the Draft Environmental Assessment (EA) for the referenced project.

Summary of Project Description and the No Action Alternative:

The United States Air Force proposes to implement a Ground Based Strategic Deterrent (GBSD) Test Program. The GBSD system would eventually replace the ageing Minuteman III intercontinental ballistic missile system, although they would both operate simultaneously until the Minuteman III system is phased out. The proposed action would include missile testing with up to nine launches conducted annually from VAFB. This would require the development or modification of several GBSD facilities including two launch facilities; a launch pad; a 15,000 square foot (SF) launch control facility; a 148,400 SF maintenance facility; a 25,000 SF operation facility; a 16,400 SF vehicle processing facility; a 288,500 SF schoolhouse; and the renovation of approximately 162,000 SF of existing buildings for support facilities. The project proposes several diesel standby generators and associated fuel tanks including four 105 kW generators at the launch facilities; one 1,500 kW generator and one 250 kW generator at the launch control facility; a 200 kW portable generator at the processing facility; and a 200 kW portable generator and a 400 kW portable generator at renovated buildings. Several other buildings would be modified to relocate current VAFB operations that would be displaced by this program. Clearing and grading would result in 35 acres of ground disturbance and approximately 35 acres of impervious building and pavement areas. The new facilities would accommodate approximately 260 new personnel, 17 instructors, and 140 students. Test program actions would also occur at the Hill Air Force Base in Utah.

The No Action Alternative proposes the continuation of the Minuteman III Test Program. This involves ongoing monitoring and flight testing of four to five Minuteman III missiles annually for the remaining

life of the system, which is expected to occur till at least 2030. All installations and facilities currently supporting the Minuteman III test activities would continue their operation.

General Comments:

District staff have the following general comments on the Draft EA and the proposed project:

1. **District Permits Required/CEQA:** The proposed stationary standby diesel generators will require Authority to Construct (ATC) permits prior to installation. Therefore, the District is **a lead agency under the California Environmental Quality Act (CEQA)**, and the District's permit action will require CEQA review prior to issuance. When evaluating projects pursuant to CEQA, District staff compare project air pollutant emissions to District board-adopted CEQA significance thresholds (see *Environmental Review Guidelines for the Santa Barbra County APCD*, revised April 2015, www.ourair.org/land-use). We note that the analyses and findings in the Draft EA do not reference the District's CEQA significance thresholds. The District's CEQA significance thresholds are much lower than the Draft EA's significant indicator level of 250 tons per year. Additional CEQA analysis and documentation will be required, and such analysis must compare project emissions to the District's CEQA significance thresholds, including the threshold for greenhouse gas (GHG) emissions.

   The District may require a permit for solvent usage, abrasive blasting, fuel storage and transfer (non-diesel), and any other proposed combustion equipment such as large boilers. If other equipment or operations are proposed that require a District permit, please include a description of such equipment or operations in the EA. The description should include the equipment's rating (e.g. BTU, etc.), fuel type, and operational hours. The emissions for all equipment and operations requiring a District permit should be quantified and disclosed in the environmental document.

2. **Health Risk:** In the case of the diesel-fired emergency generators, the District will require Screening Health Risk Assessment(s) (HRA) as part of District permit issuance. The applicant should refer to the District's website at www.ourair.org/dice-atcm for more information on diesel engine permitting. Whenever an HRA is required, we recommend including the results in the environmental document to ensure that project-related equipment will not result in a significant impact.

Specific Comments:

District staff have the following specific comments on the Draft EA:

1. **Section 4.2.2.1 Air Quality - VAFB, Pages 4-20 to 4-24:** This document compares project emissions against the permitting threshold of 250 tons per year for new stationary sources in prevention of significant deterioration areas under the federal Clean Air Act. The significance threshold of 250 tons per year does not correspond to the District's significance thresholds for operational emissions, as documented in the District's Board-adopted *Environmental Review Guidelines*.

Since the project will require evaluation under CEQA with the District acting as lead agency, we recommend that the EA include a comparison of project impacts to the District's adopted thresholds. If impacts are found to be significant, mitigation should be applied to reduce those impacts as appropriate under CEQA. Any mitigation proposed to reduce emissions should be quantified and included in the environmental document. The EA should include a Mitigation Monitoring and Reporting Plan that explicitly states the required mitigation and establishes a mechanism for enforcement.

2. **Section 4.4.2.1 Air Quality - VAFB, Pages 4-19 to 4-24:** Emissions from the construction and operations of the new GBSD testing program are calculated using the Air Conformity Applicability Model, Version 5.0.17b (ACAM). When quantifying air quality impacts from land use projects located in California, the District recommends the use of the California Emissions Estimator Model (CalEEMod). This model can be used for a variety of situations where an air quality analysis is necessary or desirable, such as preparing CEQA or National Environmental Policy Act (NEPA) documents. The project's emissions would likely differ from the estimates in the draft EA if modeled using CalEEMod.

3. **Section 4.4.2.1 Air Quality – VAFB, Page 4-21:** The document states, "*Launch activities are conducted in compliance with all applicable SBCAPCD rules and regulations. Therefore, no significant impacts to air quality are anticipated from flight test*." The SBCAPCD does not regulate all aspects of launch activities. The District only regulates certain aspects of the launch activities that are under its jurisdiction, such as emissions from stationary equipment. Also, activities that are regulated by the District may still have emissions that exceed air quality thresholds and will therefore have a significant impact. Please revise this statement to clarify the scope of the District's oversight and the justification of the EA's determination that air quality impacts are not significant.

4. **Section 4.4.2.1 Air Quality – VAFB, Table 4-10 Annual Estimated Emissions for the Operations of Proposed Action at VAFB, Page 4-24:** It appears that the pollutant emissions for mobile travel, generators, and fuel tanks presented in Table 4-10 are overestimated due to a unit conversion error. The emissions from ACAM in Appendix D are presented in units of tons of emissions per lifetime of the equipment/operation, while the emissions in Table 4-10 are presented in units of tons per year. The emissions from ACAM should be converted to units of tons per year before being added to Table 4-10.

5. **Section 4.4.2.1 Air Quality – VAFB, Pages 4-25 to 4-26:** To mitigate the impacts of fugitive dust and ozone precursor emissions during construction, the District recommends that Section 4.2.2.1.4, Mitigation Measures, be revised to include the full list of mitigation measures as listed in the District's documents "Attachment A: Fugitive Dust Control Measures," and the required measures as well as any applicable recommended measures as listed in "Attachment B: Diesel Particulate and NOx Emission Reduction Measures." Particularly, the District recommends the use of Tier 3 or cleaner emission standards for off-road heavy-duty diesel engines.

6. **Section 4.4.2.3 Climate Change - VAFB, Page 4-46:** The document states "*Given the global nature of climate change and the current state of the science, it is not useful at this time to attempt to link the emissions quantified for local actions to any specific climatological change or resulting environmental impact.*" The California State CEQA Guidelines Section 15064.4 states

the following guidance when determining the significance of impacts from greenhouse gas emissions, "*In determining the significance of a project's greenhouse gas emissions, the lead agency should focus its analysis on the reasonably foreseeable incremental contribution of the project's emissions to the effects of climate change. A project's incremental contribution may be cumulatively considerable even if it appears relatively small compared to statewide, national or global emissions. The agency's analysis should consider a timeframe that is appropriate for the project. The agency's analysis also must reasonably reflect evolving scientific knowledge and state regulatory schemes*." Global climate change is a cumulative impact; a project participates in this potential impact through its incremental contribution combined with the cumulative increase of all other sources of GHG emissions. As the guidelines point out, even a small project or increase in emissions can be cumulatively considerable and result in an environmental impact. Please update the document to address climate change impacts as required under CEQA.

7. **Appendix D, Air Conformity Applicability Model (ACAM) – Estimated Air Emissions, Emergency Generator, Pages 69 to 76:** Please note that the proposed emergency generator engines will be required to comply with the state's Airborne Toxic Control Measure (ATCM) for stationary diesel engines. The ATCM will require the applicant to install cleaner engines than those assumed in these calculations. The Project Description should be updated to reflect the use of engines that meet the emission requirements of the ATCM. Please see www.ourair.org/dice-atcm/ for more information.

If you or the project applicant have any questions regarding these comments, please feel free to contact me at (805) 961-8878 or via email at WaddingtonE@sbcapcd.org.

Sincerely,

Emily Waddington
Air Quality Specialist
Planning Division

Attachments: Fugitive Dust Control Measures
Diesel Particulate and NOx Emission Reduction Measures

cc: David Harris, Manager, District Engineering Division
William Sarraf, Supervisor, District Engineering Division
Kim Harding, Environmental Protection Specialist, VAFB
Planning Chron File

air pollution control district
SANTA BARBARA COUNTY

ATTACHMENT A
FUGITIVE DUST CONTROL MEASURES

These measures are required for all projects involving earthmoving activities regardless of the project size or duration. Projects are expected to manage fugitive dust emissions such that emissions do not exceed APCD's visible emissions limit (APCD Rule 302), create a public nuisance (APCD Rule 303), and are in compliance with the APCD's requirements and standards for visible dust (APCD Rule 345).

- During construction, use water trucks or sprinkler systems to keep all areas of vehicle movement damp enough to prevent dust from leaving the site and from exceeding the APCD's limit of 20% opacity for greater than 3 minutes in any 60 minute period. At a minimum, this should include wetting down such areas in the late morning and after work is completed for the day. Increased watering frequency should be required when sustained wind speed exceeds 15 mph. Reclaimed water should be used whenever possible. However, reclaimed water should not be used in or around crops for human consumption.
- Onsite vehicle speeds shall be no greater than 15 miles per hour when traveling on unpaved surfaces.
- Install and operate a track-out prevention device where vehicles enter and exit unpaved roads onto paved streets. The track-out prevention device can include any device or combination of devices that are effective at preventing track out of dirt such as gravel pads, pipe-grid track-out control devices, rumble strips, or wheel-washing systems.
- If importation, exportation, and stockpiling of fill material is involved, soil stockpiled for more than one day shall be covered, kept moist, or treated with soil binders to prevent dust generation. Trucks transporting fill material to and from the site shall be tarped from the point of origin.
- Minimize the amount of disturbed area. After clearing, grading, earthmoving, or excavation is completed, treat the disturbed area by watering, OR using roll-compaction, OR revegetating, OR by spreading soil binders until the area is paved or otherwise developed so that dust generation will not occur. All roadways, driveways, sidewalks etc. to be paved should be completed as soon as possible.
- Schedule clearing, grading, earthmoving, and excavation activities during periods of low wind speed to the extent feasible. During periods of high winds (>25 mph) clearing, grading, earthmoving, and excavation operations shall be minimized to prevent fugitive dust created by onsite operations from becoming a nuisance or hazard.
- The contractor or builder shall designate a person or persons to monitor and document the dust control program requirements to ensure any fugitive dust emissions do not result in a nuisance and to enhance the implementation of the mitigation measures as necessary to prevent transport of dust offsite. Their duties shall include holiday and weekend periods when work may not be in progress. The name and telephone number of such persons shall be provided to the Air Pollution Control District prior to grading/building permit issuance and/or map clearance.

PLAN REQUIREMENTS: All requirements shall be shown on grading and building plans and/or as a separate information sheet listing the conditions of approval to be recorded with the map. **Timing**: Requirements shall be shown on plans prior to grading/building permit issuance and/or recorded with the map during map recordation. Conditions shall be adhered to throughout all grading and construction periods.

MONITORING: The Lead Agency shall ensure measures are on project plans and/or recorded with maps. The Lead Agency staff shall ensure compliance onsite. APCD inspectors will respond to nuisance complaints.

air pollution control district
SANTA BARBARA COUNTY

ATTACHMENT B
DIESEL PARTICULATE AND NO_x EMISSION REDUCTION MEASURES

Particulate emissions from diesel exhaust are classified as carcinogenic by the state of California. The following is a list of regulatory requirements and control strategies that should be implemented to the maximum extent feasible.

The following measures are required by state law:

- All portable diesel-powered construction equipment greater than 50 brake horsepower (bhp) shall be registered with the state's portable equipment registration program OR shall obtain an APCD permit.
- Fleet owners of diesel-powered mobile construction equipment greater than 25 hp are subject to the California Air Resource Board (CARB) In-Use Off-Road Diesel-Fueled Fleets Regulation (Title 13, California Code of Regulations (CCR), §2449), the purpose of which is to reduce oxides of nitrogen (NOx), diesel particulate matter (DPM), and other criteria pollutant emissions from in-use off-road diesel-fueled vehicles. Off-road heavy-duty trucks shall comply with the State Off-Road Regulation. For more information, see www.arb.ca.gov/msprog/ordiesel/ordiesel.htm.
- Fleet owners of diesel-fueled heavy-duty trucks and buses are subject to CARB's On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation (Title 13, CCR, §2025), the purpose of which is to reduce DPM, NOx and other criteria pollutants from in-use (on-road) diesel-fueled vehicles. For more information, see www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm.
- All commercial off-road and on-road diesel vehicles are subject, respectively, to Title 13, CCR, §2449(d)(3) and §2485, limiting engine idling time. Off-road vehicles subject to the State Off-Road Regulation are limited to idling no more than five minutes. Idling of heavy-duty diesel trucks during loading and unloading shall be limited to five minutes, unless the truck engine meets the optional low-NOx idling emission standard, the truck is labeled with a clean-idle sticker, and it is not operating within 100 feet of a restricted area.

The following measures are recommended:

- Diesel equipment meeting the CARB Tier 3 or higher emission standards for off-road heavy-duty diesel engines should be used to the maximum extent feasible.
- On-road heavy-duty equipment with model year 2010 engines or newer should be used to the maximum extent feasible.
- Diesel powered equipment should be replaced by electric equipment whenever feasible. Electric auxiliary power units should be used to the maximum extent feasible.
- Equipment/vehicles using alternative fuels, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane or biodiesel, should be used on-site where feasible.
- Catalytic converters shall be installed on gasoline-powered equipment, if feasible.
- All construction equipment shall be maintained in tune per the manufacturer's specifications.
- The engine size of construction equipment shall be the minimum practical size.
- The number of construction equipment operating simultaneously shall be minimized through efficient management practices to ensure that the smallest practical number is operating at any one time.
- Construction worker trips should be minimized by requiring carpooling and by providing for lunch onsite.
- Construction truck trips should be scheduled during non-peak hours to reduce peak hour emissions whenever feasible.
- Proposed truck routes should minimize to the extent feasible impacts to residential communities and sensitive receptors.
- Construction staging areas should be located away from sensitive receptors such that exhaust and other construction emissions do not enter the fresh air intakes to buildings, air conditioners, and windows.

PLAN REQUIREMENTS AND TIMING: Prior to grading/building permit issuance and/or map recordation, all requirements shall be shown as conditions of approval on grading/building plans, and/or on a separate sheet to be recorded with the map. Conditions shall be adhered to throughout all grading and construction periods. The contractor shall retain the Certificate of Compliance for CARB's In-Use Regulation for Off-Road Diesel Vehicles onsite and have it available for inspection.

MONITORING: The Lead Agency shall ensure measures are on project plans and/or recorded with maps. The Lead Agency staff shall ensure compliance onsite. APCD inspectors will respond to nuisance complaints.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 22, 2021

David C. Hasley
Chief, Environmental Division
Deputy Chief of Staff, Engineer
USASMDC/ARSTRAT
P.O. Box 1500
Huntsville, Alabama 35807-3801

Subject: Draft Environmental Assessment/Overseas Environmental Assessment, Ground Based Strategic Deterrent Test Program, February 2021

Dear David C. Hasley:

The U.S. Environmental Protection Agency has reviewed the above-referenced document pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

We are providing the following comments for your consideration in determining whether a Finding of No Significant Impact can be supported at the completion of the Final Environmental Assessment.

Operational Impacts Not Evaluated for Soil and Water Resources
The scope of the analysis for the target areas at the United States Army Garrison–Kwajalein Atoll (USAG-KA) is limited to biological resources and noise, and states that no significant impacts to other resources are anticipated. Specifically, for geology/soils and water resources, the DEA states that since there are no construction activities that would alter the landscape or require land disturbance, no impacts to geology/soils and water would be expected (p. 3-77). It is not clear why operational impacts to soils and water resources from the continued use of Illeginni Islet as a target were not included in this determination. The proposed action states that GBSD flight test activities would include target impacts at USAG-KA (p. 2-18); that up to three test RVs in total are expected to impact land on the western end of Illeginni Islet (p. 2-46); and that RV impacts from GBSD testing may occur on Illeginni Islet or in the waters southwest of Illeginni Islet for six tests per year (p. 4-88). We recommend including operational-phase impacts to soil and water resources from hazardous substances in the scope of the impact assessment in the FEA.

Disturbance of and Contributions to Existing Contamination Not Evaluated
Previous EA's[1] for weapon testing projects targeting Illeginni Islet have identified existing contamination including beryllium, tungsten, and depleted uranium that would be disturbed at the impact sites. In addition to disturbing existing contaminants, GBSD testing has the potential to contribute additional contaminants, although the DEA does not disclose the weapon components. For the ongoing Minutemen III tests (impacting ocean waters just east of Kwajalein Atoll), the DEA identifies RV's as typically including beryllium, cadmium, chromium, lead, depleted uranium and other heavy metals, and previous EAs have identified tungsten in the payloads of test RVs (Navy FE-1, Navy FE-2, ARRW), which has been detected in soil and groundwater on Illeginni.

[1] Navy Flight Experiment-1 (FE-1) (2017), Navy FE-2 (2019), Air-Launched Rapid Response Weapon (2019)

We recommend the FEA:

- include a description of the affected environment on Illeginni with respect to existing contamination, including results from the baseline uranium, beryllium, and tungsten concentrations in soil and groundwater from the bench study referenced in the Navy FE-2 DEA, and the soil and groundwater testing results obtained following Navy FE-1, FE-2 and ARRW tests that previous EAs said would occur;
- In assessing environmental consequences, describe the impact assessment methodology and identify the significance thresholds used to evaluate impacts to support a FONSI (40 CFR 1501.5(g)(2)); and
- Discuss impacts from disturbing existing contamination on Illeginni from the GBSD test weapon impacts and ejecta and the proposed program's potential to add to the contamination.

If the FEA concludes that no significant impacts are anticipated, this conclusion should be accompanied by sufficient evidence and analysis (40 CFR 1501.5c)(1)). If a FONSI will be prepared, ensure measures to mitigate impacts below the level of significance are included. We recommend remediation of existing contamination be discussed and committed to for contaminant levels that exceed significance thresholds, such as the use of phytoremediation for tungsten contamination that was referenced in previous EAs.

Impacts to Subsistence Fishers Not Evaluated

According to *Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, agencies shall collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish for subsistence and communicate the human health risks associated with the consumption of pollutant-bearing fish. The potential for additional fish contamination from hazardous substances was not disclosed in the DEA; we are concerned that nearby communities with potential environmental justice concerns in the vicinity of USAG-KA may be impacted, especially since Kwajalein Atoll already has fish consumption advisories in a number of geographic locations. Further, the DEA provides no rationale for dismissing this analysis.[2] We recommend the FEA discuss potential impacts to subsistence fishers at the atoll from the continued testing of the Minutemen III, which contain depleted uranium and are expected to occur until at least 2030, and from GBSD and other tests that target Illeginni Islet. Identify whether testing for depleted uranium or tungsten has been conducted in fish consumed by the local population and whether additional fish studies will be forthcoming. The EPA recommends such studies to inform the local subsistence fishing population.

Coordination for Monitoring/Mitigation at Illeginni Target Sites

We continue to have concerns regarding the lack of a comprehensive impact assessment and monitoring and mitigation program regarding the target impacts at Illeginni Islet. Because so many flight tests utilizing USAG-KA as a target are being evaluated in separate EAs,[3] we previously recommended a joint programmatic NEPA analysis be prepared to evaluate the impacts to Illeginni Islet from these various Department of Defense projects. According to DoD,[4] logistical difficulties to such an approach

[2] The rationale for dismissing socioeconomics, which often includes environmental justice as a subtopic, was that no impacts to socioeconomics are anticipated because the population would not increase. The presence of an existing subsistence fishing population in the region is sufficient reason to examine these impacts.

[3] We understand from previous EAs that a third flight test (FE-3) is being considered as a future action and that additional tests under a joint launch campaign are planned, all with multiple impact landings at Illeginni.

[4] personal communication, M. Hubbs, 12/10/19

include having different lead DoD agencies, time schedules, and funding sources; however, pursuing a coordinated monitoring and mitigation program could have fewer such barriers since it could be implemented by a single entity coordinated through the U.S. Army Space and Missile Defense Command. We continue to recommend a coordinated monitoring and mitigation program for target impacts on Illeginni Islet and nearshore waters that addresses contamination issues to soil and groundwater and potential impacts to nearby residents from subsistence fish consumption. In the FEA, identify reasonably foreseeable future actions targeting Illeginni Islet and nearby waters.

We appreciate the opportunity to review this DEA/OEA. If you have any questions, please contact me at (415) 947-4167, or contact Karen Vitulano, the lead reviewer for this project, at 415-947-4178 or vitulano.karen@epa.gov. When the FEA/OEA is released for public review, please send one electronic copy to Ms. Vitulano.

Sincerely,

JEAN PRIJATEL

Digitally signed by JEAN PRIJATEL
Date: 2021.03.22 13:29:47 -07'00'

Jean Prijatel
Manager, Environmental Review Branch

cc: John McCarroll, EPA Region 9 Pacific Islands Program
Steve Kolinski, National Marine Fisheries Services
Moriana Phillip, RMI Environmental Protection Authority Majuro
Kawa Jatios, RMI Environmental Protection Authority Ebeye
Kanalei Shun, U.S. Army Corps of Engineers
Dan Polhemus, U.S. Fish and Wildlife Service
Derek Miller, USAKA/RTS Environmental Management Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

22 March 2021

David Hasley
Space Missile Defense Command
P.O. Box 1500
Huntsville, AL 35807

Subject: Ground Based Strategic Detrrent (GBST) Test Program Draft EA/OEA

Dear sir:

The United States (U.S.) Fish and Wildlife Service (Service) is in receipt of your 19 February 2021 Notice of Availability to review of the U.S. Air Force (USAF) Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA), prepared in accordance with the Council on Environmental Quality and USAF regulations implementing the National Environmental Policy Act (NEPA) (40 CFR Section 1502.14 and 32 CFR Section 989.8, respectively). The Service previously provided initial review of the proposed action via Coordination procedures defined by the Environmental Standards and Procedures for U.S. Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands (16th ed.). Herein, the Service provides additional response to this request in accordance with the NEPA requirements.

Summary

The provided EA/EOA analyzes the proposed implementation of Ground Based Strategic Deterrent (GBSD) and Minuteman III Test Programs. Testing is expected to include missile launches from Vandenberg Air Force Base in California and flights across the Pacific Ocean. Physical disturbance and deposition of debris and heavy metal/chemical contaminants could occur in ocean and land locations, including Illeginni Islet and adjacent areas on Kwajalein Atoll, Republic of the Marshall Islands. As such, direct and indirect environmental impacts at Kwajalein Atoll are possible and activities must comply with the current UES.

Comments

The proposed action is an important exercise for national security. Resulting disturbance and contamination are expected to remain within legal limits, and some essential monitoring and cleanup mitigation plans are in place. Section 4.2.4.1.1.1 of the EA/EOA includes plans for

testing groundwater for beryllium, uranium, and other metals. If any exceedances of UES regulations occur, soil excavation will be conducted to clean up contaminated soil. However, no procedure is given for mitigating potential contamination of the groundwater itself.

Recommendations

1. If exceedances are reported in groundwater contamination, a plan should be developed for construction of extraction wells and pumping infrastructure in order to clean up the contaminated groundwater.

Conclusion

The Service concludes that the proposed actions are expected to impact relatively small areas of land and sea and are expected to achieve important tests relevant to national security. Excessive contamination or other negative environmental impacts are not expected. Mitigation of potential risks at Kwajalein Atoll is generally considered in the provided plans, with the exception of the recommendation listed above. The Service recommends continuing this project according to schedule, with consideration of the above recommendation.

We appreciate the opportunity to provide input on this correspondence. If you have questions regarding our comments, please contact Aquatic Ecosystem Conservation Program Biologist Jeremy Raynal (jeremy_raynal@fws.gov) or Michael Fry (michael_fry@fws.gov), or Program Manager Dan Polhemus (dan_polhemus@fws.gov or 808-792-9400).

Sincerely,

DAN POLHEMUS

Digitally signed by DAN POLHEMUS
Date: 2021.03.22 10:25:00 -10'00'

Dan Polhemus
Aquatics and Environmental Contaminants Program Manager

CALIFORNIA COASTAL COMMISSION
455 MARKET STREET, SUITE 300
SAN FRANCISCO, CA 94105
FAX (415) 904-5400
TDD (415) 597-5885

April 1, 2021

Beatrice L. Kephardt
Chief, Installation Management Flight
30 CES/CEI
1028 Iceland Avenue
Vandenberg Air Force Base, CA 93437

Attn: Samantha Kaisersatt

Re: Negative Determination for the Ground-Based Strategic Deterrent (GBSD) Test Program (ND-0004-21), Vandenberg Air Force Base

Dear Ms. Kephardt:

We have received your letter dated February 12, 2021, in which you described the above-referenced project and conducted an analysis of the potential for the project to affect coastal zone resources. The Coastal Commission staff **agrees** that the proposed project would not adversely affect coastal zone resources. We therefore **concur** with your negative determination made pursuant to Section 15 CFR 930.35(d) of the NOAA implementing regulations. Please contact me at (415) 904-5245 if you have any questions regarding this matter.
.

Sincerely,

John Weber
Energy, Ocean Resources,
and Federal Consistency Division

United States Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
Ecological Services
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2021-F-0062

April 5, 2021

Beatrice L. Kephart, Chief
Installation Management Flight
30 CES/CEI
1028 Iceland Avenue
Vandenberg Air Force Base, California 93437

Subject: Biological Opinion on the Ground Based Strategic Deterrent Test Program at Vandenberg Air Force Base, Santa Barbara County, California (2021-F-0062)

Dear Beatrice Kephart:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the Air Force's proposed construction of the Ground Based Strategic Deterrent (GBSD) Test Program's new facilities and associated infrastructure on Vandenberg Air Force Base (VAFB) and its effects on the federally endangered Gaviota tarplant (*Deinandra increscens* ssp. *villosa*), and the federally threatened California red-legged frog (*Rana draytonii*) and vernal pool fairy shrimp (*Brachinecta lynchi*). You also requested our concurrence that the construction of the GBSD Test Program's new facilities and associated infrastructure may affect but is not likely to adversely affect the federally endangered Lompoc yerba santa (*Eriodictyon capitatum*). The Air Force has determined that the proposed project will not affect designated critical habitat for any species. Your request and our response are in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

We have based this biological opinion on information that accompanied your November 19, 2020 request for consultation, including the biological assessment (KFS and MSRS 2020), information from correspondence with your staff, and information in our records. These documents, and others relating to the consultation, are located at the Ventura Fish and Wildlife Office.

Informal Consultation for the Lompoc Yerba Santa

The Air Force has determined that the proposed project may affect but is not likely to adversely affect the Lompoc yerba santa. A 3.1-acre stand of Lompoc yerba santa occurs immediately northwest of 35th Street and California Boulevard intersection, located near a small portion of the proposed project area. This site is referred to as the "35th Street population" and has declined in recent years from a total of 1,017 ramets in 2006 to 489 ramets in 2019 (KFS and MSRS 2020).

Lompoc yerba santa spreads vegetatively through the production of rhizomes and new stems emerging from these rhizomes are referred to as ramets.

The activities that could directly or indirectly affect Lompoc yerba santa include the movement of workers or vehicles in the vicinity of the 35th Street population to accomplish trenching for utility lines and off-road construction in the nearby vicinity. Trenching activities would occur within the paved roadbed of 35th Street or along the southern road shoulder across the street from the 35th Street population in unoccupied habitat. Ground disturbing activities would therefore occur at a minimum distance of 65 feet (ft) from the recorded population. Off-road construction north of 35th Street would occur at least 150 ft from the nearby known population and would impact up to approximately 8.5 acres of potentially suitable maritime chaparral habitat that was surveyed in 2019 and documented to be unoccupied by Lompoc yerba santa. There is potential that project activities may impact a previously undocumented soil seed bank if the population historically extended into these immediately adjacent areas of suitable habitat. Recent research suggests that seed germination of Lompoc yerba santa may require fire associated cues including smoke-induction (Schneider and Carson 2019) and consequently may lie dormant in these areas as a result of recent fire suppression. Although this may be a possibility, additional research indicates that Lompoc yerba santa is a self-incompatible species and that the 35th street population (CNDDB Occurrence 9) was determined to be uniclonal (Elam 1994), meaning they are genetically the same individual and cannot produce viable seed. Consequently, very poor seed set has ever been recorded or is anticipated for the known 35th Street population (Elam 1994, Jacks et al. 1984, H. Schneider, Santa Barbara Botanic Garden, pers. comm. 2020), making the existence of a viable soil seed bank very unlikely.

The Air Force will implement the following avoidance measures to reduce potential project effects on Lompoc yerba santa:

1. The Air Force will require that a qualified biologist survey all potentially impacted areas in or near suitable habitat prior to vegetation removal or other construction related impacts to ensure that no Lompoc yerba santa populations are present.

2. The Air Force will avoid any newly encountered Lompoc yerba santa populations to the maximum extent feasible and only proceed with work after coordination with the 30th Space Wing Installation Management Flight, Environmental Conservation (30 CES/CEIEA) and the Service.

3. The Air Force will demarcate the 35th Street Lompoc yerba santa population using a high-visibility temporary fence and signage to limit the potential for vehicles and workers to accidentally access the area.

4. The Air Force will require that a qualified biological monitor be present to verify that the distance between the 35th Street Lompoc yerba santa population and the construction activities north of 35th Street remain at least 150 ft. The Air Force will also require that the qualified biological monitor be present to verify that the distance between 35th Street Lompoc yerba santa population and the construction activities within and south of the existing 35th Street roadway remain at least 65 ft.

5. The Air Force will implement the following measures in the event Alternative 2 Munition Storage Area (MSA) Laydown Area is selected for the proposed action in its entirety or in part to preserve potential Lompoc yerba santa maritime chaparral habitat:

    - The Air Force will hand cut all chaparral shrubs in the Alternative 2 MSA Laydown Area during late summer or dormant period. The Air Force will properly prune shrubs with a sharp blade with a clean, smooth cut. The Air Force will not leave large shrubs, trunks, branches, or stumps with frays, incisions, or scars.
    - The Air Force will salvage any soil removed or graded in an area free of weeds. The Air Force will properly prepare the ground for native seed germination prior to replacing the soil.
    - The Air Force will use protective construction matting, such as Dura-Base mats, that are designed for vegetation protection in the entire laydown area and remove mats as soon as possible.
    - The Air Force will develop a restoration plan covering at least 2 years to be approved by 30 CES/CEIEA. The plan will, at a minimum, include weed control measures.

All portions of the action area within Lompoc yerba santa habitat were thoroughly surveyed in 2020 and the associated population's seed set is reported to be very poor making the existence of additional individual of Lompoc yerba santa, a perennial shrub, in or near the action area unlikely.

We concur with your determination that the project may affect but is not likely to adversely affect Lompoc yerba santa. Our concurrence is based on the following:

1. A biological monitor will verify that all ground disturbing activities will occur at a minimum distance of 65 ft away from occupied Lompoc yerba santa habitat.
2. A biological monitor will survey all potentially impacted areas in or near suitable Lompoc yerba santa habitat prior to vegetation removal or other construction related impacts. In the event a new population is found, work would only proceed after coordination with 30 CES/CEIEA and the Service.
3. With the implementation of the outlined minimization measures including shrub pre-treatment pruning, topsoil salvage, protective construction matting, and a restoration plan detailing weed control, the proposed project does not appreciably reduce available unoccupied habitat of Lompoc yerba santa.
4. The Air Force will install high-visibility temporary fence and signage adjacent to 35th Street to limit the potential for vehicles and workers to accidentally access the identified Lompoc yerba santa population in this area.
5. Very poor seed set has been recorded or is anticipated for the uniclonal 35th Street Lompoc yerba santa population making the potential existence of viable soil seed bank in the immediate adjacent area unlikely.

Our concurrence with the determination that the proposed action is not likely to adversely affect Lompoc yerba santa is contingent on the measures outlined above being implemented by the Air Force. If the Air Force fails to implement these measures, we will consider our concurrence invalid. If the proposed action changes in any manner or if new information reveals the presence of listed species in the project area, you should contact our office immediately and suspend all project activities until the appropriate compliance with the Act is completed.

Consultation History

We received your November 19, 2020, request for formal consultation in our office on November 19, 2020 (Kephart, in litt. 2020).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed GBSD Test Program project would be located on north VAFB, expanding north of San Antonio Terrace to south of the main Cantonment Area before reaching the Santa Ynez River.

Construction

Facility construction and renovation

For this project, the Air Force proposes the construction of new infrastructure as well as the renovation of existing facilities with the associated development of adjacent areas. The project incorporates the construction of 7 new facilities with associated infrastructure elements, 25.5 miles of utility lines, 9 temporary laydown areas (including 2 potential alternative sites), and 23 existing infrastructure renovations (Appendix A – Project Area Detailed Maps). All renovation of existing facilities and infrastructure would be within existing buildings, paved areas, or previously disturbed areas within existing facility fencelines. Additional office trailer staging, equipment storage, materials staging, and parking areas would also be required for the duration of construction and renovation. Project components details are provided in Table 1. In total, the proposed project area totals approximately 121.26 acres including approximately 87 acres of new construction, a maximum of 19.3 acres of laydown areas, and 2.7 acres of previously disturbed land adjacent to existing infrastructure. The proposed project area is located within both undeveloped areas and previously disturbed lands.

The Air Force anticipates that construction and modification of proposed GBSD Test Program project facilities would begin in 2021 and continue year-round for 4 years with planned completion of all facilities by 2025. Maps detailing the locations of proposed project features described in Table 1 are located in Appendix A of this biological opinion.

Table 1. New and existing facilities and infrastructure for the GBSD Test Program Project.

Facility/Building/ Lot Name and Function	New Impacted Acreage*	Summary of Site Modifications/Construction
New Facilities and Infrastructure to be Constructed		
Utility Lines	**3.09-acres (25.5 miles x 1 foot)**	The Air Force would install up to approximately 25.5 miles of utility lines throughout portions of North Base from the Main Cantonment area north to LF-26. The Air Force would install most of the new lines in trenches within 5 ft of existing road shoulders on either side of the roadway or within the roadway pavement. Trenches would be up 1 foot wide and 2 ft deep.
Buildings 1860/1861 Vehicle processing and training	**1.2 acres**	The Air Force would construct a new 0.5-acre prefabricated metal building on an existing concrete pad (approximately 2.5 acres) at Buildings 1860/1861 for the purpose of vehicle and equipment storage, and training. To support installation of a fire suppression system in the new metal building, the Air Force would install a water line between the existing pad and the existing waterline along Encelados Road.
GBSD Schoolhouse New integrated complex to consolidate intercontinental ballistic missile training	**27.5 acres**	The Air Force would construct a new 6.6-acre training facility, approximately 5.5 acres of paved roadways, parking, and sidewalks; and extend underground utilities to the site from the adjacent areas. All features would be located within the existing disturbed Cantonment area. Construction would take up to 18 months (Evans, pers. comm. 2021d). The Air Force would clear existing non-native vegetation for this component.
Temporary Contractor Test Support Facility	**0.7 acre**	The Air Force would clear approximately 5.6 acres of paved parking and open areas of non-native vegetation located in the developed Cantonment area. The Air Force would repave over 4.9 acres of previously paved areas and pave approximately 0.7 acre of non-paved areas. The Air Force would temporarily place an office trailer within the parking area outside Building 8339. The Air Force would install new underground utility connections (electrical, communications, and water) and tied them into the trailer.
Consolidated Maintenance Complex	**26.3 acres**	The Air Force would install a new approximately 3.4-acre facility, approximately 13.54 acres of paved roadways, parking, and sidewalks; and extend underground utilities to the site from adjacent areas. The Air Force would locate all features in the existing disturbed Cantonment area and clear non-native vegetation.

Facility/Building/ Lot Name and Function	New Impacted Acreage*	Summary of Site Modifications/Construction
Component Operations Facility	**4.7 acres**	The Air Force would construct a new approximately 0.6-acre facility, a paved roadway, parking, sidewalks, a perimeter chainlink fence; and extend underground utilities to the site from the adjacent Munitions Storage Area (MSA). The Air Force would also construct a temporary access road into the MSA and a stormwater retention basin. The Air Force would clear existing native vegetation (intact maritime chaparral) to construct the new features.
Additional MSA Parking	**0.5 acre**	The Air Force would grade and pave a 0.5-acre site to construct an additional parking area for 20 vehicles. The Air Force would clear existing disturbed vegetation adjacent to a previously paved parking to construct this feature.
Vehicle Processing Facility	**23.1 acres**	The Air Force would construct a new 0.4-acre facility, 0.9 acre of paved roadway, parking, sidewalks, a stormwater retention basin, and a septic system and leach field. The Air Force would extend underground utilities to the proposed feature from 13th Street. The Air Force would clear existing native vegetation (intact maritime chaparral) to construct this feature.
Total Acreage of New Construction: 87 acres		
Laydown Areas		
Launch Facility 26 (LF-26) Temporary Laydown Area	**2.5 acres**	The Air Force would create a 2.5-acre construction laydown area and temporarily place a double-wide office trailer on site. The Air force would clear existing vegetation and grade the site.
Launch Facility 04 (LF-04 Laydown) Temporary Laydown Area	**3.7 acres**	The Air Force would create a 3.7-acre construction laydown area and temporarily place a double-wide office trailer on site. The Air Force would clear existing vegetation and grade the site.
Globe Laydown Temporary Laydown Area	**0.06 acre**	The Air Force would create a 0.06-acre construction laydown area and temporarily place two double-wide office trailers on site. The Air Force would place the trailers adjacent to an existing paved parking area.
Point Sal Road Laydown Temporary Laydown Area	**0.8 acre**	The Air Force would create a 0.8-acre construction laydown area to store construction equipment, containers, and bulk material. The site is almost entirely on an existing gravel parking/storage area. The Air Force would clear existing vegetation.

Facility/Building/ Lot Name and Function	New Impacted Acreage*	Summary of Site Modifications/Construction
Brioso Laydown Temporary Laydown Area	**1.0 acre**	The Air Force would create a 1.0-acre construction laydown area to temporarily store construction equipment, containers, and bulk material. The Air Force would locate the site mostly within the existing fenceline of MAF-01E (Minuteman III Launch Control Facility) with the remainder of the feature adjacent to Brioso Road outside the fenceline. The Air Force would clear existing vegetation and not need to install utilities or other services.
Missile Alert Facility DO (MAF-DO) Laydown Temporary Laydown Area	**3.3 acres**	The Air Force would create a 3.3-acres construction laydown area and temporarily place a double-wide office trailer on site. The Air Force would clear existing vegetation and grade the site.
MSA Laydown Temporary Laydown Area	**1.8 acres**	The Air Force would create a 1.8-acre construction laydown area within the MSA fenceline to store equipment, materials, and possibly a double-wide office trailer. The Air Force would conduct minor clearing of previously disturbed vegetation and grade the site. The Air Force would draw electrical power from on-site connections.
Alternative 1 MSA Laydown Temporary Laydown Area	**0.8 acre**	The Air Force would create a 0.8-acre construction laydown area within the MSA fenceline to store equipment and materials if this alternative is selected. The Air Force would conduct minor clearing of disturbed vegetation and grade the site.
Alternative 2 MSA Laydown Temporary Laydown Area	**4.3 acres**	The Air Force would create a 4.3-acre construction laydown area east of the proposed Component Operations Facility to store equipment and materials if this alternative is selected. The Air Force would clear intact maritime chaparral vegetation.
Igloo Laydown Temporary Laydown Area	**1.5 acres**	The Air Force would create a 1.5-acre construction laydown area to store equipment, materials, and potentially a double-wide office trailer. The Air Force would clear existing vegetation and grade the site. The Air Force would draw electrical power from on-site connections.
13th Street Laydown Temporary Laydown Area	**2.1 acres**	The Air Force would create a 2.1-acre construction laydown area in a previously disturbed lot to locate up to three construction trailers. The Air Force would install a chain-link fence around the perimeter.
Total Acreage of Laydown Areas: Maximum 19.3 acres (utilizing Alternative 2 MSA laydown)		
Existing Facilities and Infrastructure Requiring Renovation and Development		

Facility/Building/ Lot Name and Function	New Impacted Acreage*	Summary of Site Modifications/Construction
Launch Facility 26 (LF-26)	**Approximately 1.5 acres**** (Within existing fenceline, excluding developed areas)	The Air Force will conduct modifications to the silo facility and infrastructure within the existing fenceline including external repairs to the concrete pad, abutment walls, utility lines, and perimeter fence. The Air Force has not actively managed vegetation within the site in recent years. The Air Force would begin vegetation management, including the establishment and maintenance of fire breaks surrounding the facility.
Launch Facility 04 (LF-04) Test Launch Silo	**Approximately 1.2 acres**** (Within existing fenceline, excluding developed areas)	The Air Force would conduct modifications to the silo facility and infrastructure within the existing fenceline as necessary including repairing concrete, waterproofing, diverting water, refurbishing/replacing launch tube liner and associated equipment, trenching for utilities, replacing towers and antennas, replacing diesel storage tanks, and repaving of the access road. The Air Force has not actively managed vegetation within the site in recent years. The Air Force would begin vegetation management, including the establishment and maintenance of fire breaks surrounding the facility.
Total Acreage of Existing Infrastructure: 2.7-acres		

*New Impact acreage is based on the potential limit of work in non-developed areas.

**Existing infrastructure containing previously disturbed areas where vegetation has re-established.

Additional existing facilities

Additional existing facilities are part of the proposed project but will have no effect on listed species. The Air Force plans to conduct either internal modifications within existing buildings or plans no substantial modifications for these features. Refer the BA for a discussion of those activities.

Habitat Enhancement Areas

The Air Force would establish habitat enhancement areas as a part of the proposed project to minimize impacts to Gaviota tarplant and vernal pool fairy shrimp. The amount of habitat enhancement will be calculated following project completion and is dependent on the project's potential effects to habitat (e.g. future Gaviota tarplant survey results, potential vernal pool hydrological impacts). Consequently, the Air Force has not yet determined the exact locations or overall extent of habitat enhancement areas but have provided proposed mitigation ratios and estimated the expected maximum extent of project impacts.

The Air Force will locate Gaviota tarplant habitat enhancement areas directly adjacent to occupied habitat along Point Sal Road near Casmalia Beach, Globe, and/or Oculto Roads. The Air Force will remove invasive plants. The Air Force will utilize a 2:1 ratio (habitat enhanced: occupied habitat affected) to determine the extent of habitat enhancement areas, which would be subsequently managed for a period of at least 5 years as funding is available (Evans, pers. comm. 2021a). The Air Force will seed enhancement areas with previously collected Gaviota tarplant seed as well as a native grass seed mix using a formulation approved by the VAFB botanist to prevent weed reinfestation. The Air Force will use historic Gaviota tarplant occurrence data in conjunction with future surveys of suitable Gaviota tarplant habitat located north of the Point Sal and El Ranch Road intersection to determine the extent of habitat enhancement required. The Air Force would potentially use a low level of herbicide within Gaviota tarplant enhancement areas to aid in weed abatement (Evans, pers. comm. 2021a).

The Air Force will locate vernal pool fairy shrimp enhancement areas generally between New Mexico Avenue and California Boulevard and/or along Nevada Avenue on VAFB. The Air Force will remove invasive trees and other invasive plant species within occupied or potentially occupied vernal pool fairy shrimp habitat. The Air Force will utilize a 3:1 ratio (habitat enhanced: suitable habitat affected) to determine the extent of habitat enhancement. The Air Force would utilize a low level of herbicide within vernal pool fairy shrimp enhancement areas to aid in invasive tree/weed abatement. The Air Force will remove invasive tree species within vernal pool fairy shrimp enhancement areas. The Air Force would perform mechanical removal of invasive tree species (e.g. chainsaws) with cut stumps left in place to reduce soil disturbance (Evans, pers. comm. 2021b).

Maintenance/Operations

Stormwater retention basins

The Air Force would install two stormwater retention basins as part of the proposed project in association with the construction of the Components Operation Facility and the Vehicle Processing Facility. The Air Force would design basins to be the minimum size and depth necessary to contain site stormwater runoff from these associated facilities during a 5-year storm event. The Air Force would design basins to allow for natural infiltration of water with at least one side having a slope of no more than 45 degrees.

New Facility Lighting

The Air Force proposed to incorporate permanent artificial night lighting into new facility construction (Evans, pers. comm. 2021f).

Irrigation and Herbicide Usage

The Air Force would include landscaping maintenance with associated irrigation and herbicide application as a part of the proposed project (S. Kaisersatt, Air Force, pers. comm. 2020a). The Air Force would conduct all maintenance at new and existing project facilities in compliance with VAFB policies and only use herbicides approved by the Department of Defense and the

Armed Forces Pest Management Board. The Air Force would submit all herbicides requested to be used to the VAFB entomology shop 15 working days prior to application or at the beginning of the contract. The Air Force would require that only certified personnel apply herbicides and that the project be in compliance with the EPA injunction on pesticides for California red-legged frogs.

AVOIDANCE AND MINIMIZATION MEASURES

The Air Force will implement the measures described below to avoid and/or minimize adverse effects from the proposed project on biological resources including Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp.

General Project Avoidance and Minimization Measures:

1. The Air Force will require a qualified biological monitor to be present during construction when a VAFB biologist or a project specific biologist determines that impacts to protected species are possible. Qualified biological monitors will be responsible for delineating areas where special-status species are located or concentrated, relocating special-status species out of harm's way during construction activities, and inspecting equipment and equipment laydown areas for cleanliness and chemical leaks. Qualified biological monitors will be individuals who are familiar with and possess necessary qualifications to identify special status species that may occur within the proposed Action Area and, when needed, some will be authorized to capture, handle, and relocate California red-legged frog. The Service and 30 CES/CEIEA will approve qualified biological monitors. Prior to the onset of construction activities, the Air Force will submit the name(s) and credentials of the biologist(s) tasked with monitoring, surveying, species relocation, and other biological field activities to the Service for their approval.
2. The Air Force will require that the qualified biological monitor(s) brief all project personnel prior to participating in construction activities. The Air Force's training will include a description of the listed species and sensitive biological resources occurring in the area, the general and specific measures and restrictions to protect these resources during project implementation, the provisions of the Act and the necessity of adhering to the provisions of the Act, and the penalties associated with violations of the Act.
3. The Air Force will keep disturbances to the minimum extent feasible to accomplish project objectives.
4. The Air Force will remove and transport all excess soil/materials excavated to a designated waste or fill site.
5. The Air Force will only utilize erosion control materials from weed-free sources. The Air Force will use materials that are 100 percent biodegradable (e.g., erosion blankets, wattles, etc.), if materials are to be left in place following project completion.
6. The Air Force will dispose of all human generated trash at project sites properly at the end of each workday. The Air Force will maintain large dumpsters at laydown areas,

cover dumpsters secured against animal incursion, and remove all construction debris and trash from the work areas upon completion of the project.

7. The Air Force will clean all project related equipment and vehicles (dozers, mowers, etc.) to be free of weed seeds prior to use in the project area. Prior to site transport, the Air Force will remove and clean any skid plates. A biological monitor will provide a briefing detailing measures required to prevent the introduction and spread of weeds on VAFB and inspect vehicles and equipment for weed seeds prior to initial site activities. The Air Force will clean equipment of weed seeds daily with attention to equipment wheels, undercarriages, and bumpers. Prior to leaving the project area, the Air Force will clean vehicles with caked-on soil or mud with hand tools such as bristle brushes and brooms at a designated exit area; vehicles may subsequently be washed at an approved wash area. The Air Force will thoroughly brush vehicles with dry dusted soil (not caked-on soil or mud) prior to leaving a site at a designated exit area; vehicles may alternatively be air blasted on site.
8. The Air Force will fuel equipment in predesignated locations within the laydown areas and place spill containment materials around the equipment before refueling.
9. The Air Force will require a qualified biological monitor to inspect any equipment left overnight prior to the start of work. The Air Force will check equipment and nearby areas for presence of special status species and for fluid leaks.
10. The Air Force will directly access utility lines installed in or adjacent to sensitive habitats, such as maritime chaparral, from existing roadways and trails to the maximum extent feasible. The Air Force will require construction and support vehicles to stay on roadways, trails, and mowed ruderal zones to the maximum extent feasible.
11. The Air Force will keep stormwater retention basins to the minimum size and depth necessary to contain site storm water runoff from the facility during a 5-year storm event. The Air Force will design basins to allow natural infiltration of water; at least one side will have a slope of no more than 45 degrees to allow easy exit of animals and no fencing will be placed around basins that would impede the movement of small animals such as amphibians. The Air Force will not use any chemicals harmful to amphibians or invertebrates for management or maintenance of basins and will not introduce non-native species (e.g., mosquito fish [*Gambusia affinis*]) into basins.

Species-specific Avoidance and Minimization Measures:

Gaviota Tarplant

12. The Air Force will clear vegetation in areas known to support or with potential to support Gaviota tarplant after seed has set (October) and before the rainy season to the maximum degree feasible. A Service-qualified biologist will determine when a particular area has gone to seed and inform project proponents and contractors of the optimal period to work in the subject area. However, the Air Force may conduct project activities at any time of year, including while the ground is wet or while the plants are flowering.
13. The Air Force will require that a qualified biologist collect and properly store available Gaviota tarplant seed, if present, where construction activities create temporary soil disturbance in known occupied Gaviota tarplant habitat. The qualified biologist will then

monitor a bulldozer equipped with a flat scraper that will preserve Gaviota tarplant seed bank by lightly scraping the topsoil and set it aside. The Air Force will store salvaged topsoil for up to 12 months (Evans, pers. comm. 2021f). The Air Force will enhance Gaviota tarplant habitat by removing invasive plants in areas adjacent to occupied Gaviota tarplant habitat along Point Sal Road near Casmalia Beach, Globe, and/or Oculto Roads. The Air Force will utilize a 2:1 ratio (habitat enhanced: occupied habitat affected) and subsequently manage these areas for a period of at least 5 years, as funding is available (Evans, pers. comm. 2021a). The Air Force will seed sites with previously collected Gaviota tarplant seed as well as a native grass seed mix using a formulation approved by the VAFB botanist to prevent weed reinfestation.

14. The Air Force will utilize historic Gaviota tarplant occurrence data in conjunction with surveys of suitable Gaviota tarplant habitat conducted north of the Point Sal and El Rancho Road intersection to determine the location(s) and extent of Gaviota tarplant and seed bank within the action area. The Air Force will conduct surveys during the summer/fall preceding construction and will use these data to identify areas requiring topsoil preservation and the extent of Gaviota tarplant habitat enhancement required.

California Red-legged Frog

15. The Air Force will require that a qualified biological monitor conduct surveys for California red-legged frog one day prior to any vegetation removal within 0.1 mile of Shuman Creek and the drainage northwest of the GBSD Schoolhouse location as well as within or adjacent to areas subject to seasonal inundation and/or dominated by riparian vegetation. The Air Force will require that the biological monitor capture any California red-legged frog present if feasible and release them at the nearest suitable habitat outside vegetation removal areas. The biological monitor will be present during vegetation removal activities to capture and relocate any California red-legged frog observed to the extent that safety precautions allow. The biological monitor will also search for injured or dead California red-legged frog after vegetation removal to document take.
16. The Air Force will securely cover any open holes or trenches with plywood or metal sheets if left overnight to minimize the risk of entrapment of California red-legged frog. The Air Force will ensure that covers remain in place without gaps with weights or sandbags. The Air Force will require that a qualified biological monitor search any open holes and trenches the following morning for entrapped animals.
17. The Air Force will require that a qualified biological monitor capture any California red-legged frogs encountered during construction activities and relocate them to the nearest suitable habitat. The Air Force will reduce the risk of introducing or spreading chytrid fungus by requiring implementation of the Declining Amphibian Populations Task Force (DAPTF) Fieldwork Code of Practice (DAPTF 1998).
18. The Air Force will limit work activities to occur during daylight hours when no rainfall is forecast for the duration of the proposed construction (Evans, pers. comm. 2021d).
19. The Air Force will implement the following measures during construction of the facilities at LF-04, the GBSD Schoolhouse location west of California Boulevard, and the Component Operations Facility and adjacent laydown areas:

- The Air Force will encircle each of the aforementioned proposed facility construction sites and laydown areas with fencing to prevent California red-legged frogs from entering the area. The Air Force will require that a biological monitor inspect the fence daily and direct maintenance to ensure its efficacy.
- The Air Force will require that a qualified biological monitor survey the site, including any open holes or trenches, each day prior to initiation of work for California red-legged frogs.

Vernal Pool Fairy Shrimp

20. The Air Force will place appropriate sedimentation barriers down-slope of the project site as well as high visibility construction fencing (or other appropriate protective fencing) around preserved pools 24-108 and 24-110 where project equipment and/or personnel are situated near vernal pool fairy shrimp habitat. The Air Force will avoid work within vernal pool fairy shrimp habitats until the soil is dry to the touch. The Air Force will not place any fill material into vernal pool fairy shrimp habitats.
21. The Air Force expects that potential impacts to pool hydrology will be restricted to two vernal pools (24-108 and 24-110) adjacent to the proposed Component Operation Facility. The Air Force will conduct wet season surveys in these vernal pool features prior to construction to document baseline conditions. The Air Force will collect hydroperiod data in these areas for two seasons with average or above average rainfall within a 2 to 5-year period post construction. The Air Force will analyze hydroperiod data collected during pre- and post-construction survey efforts in conjunction with VAFB rainfall data to determine if indirect project related hydrological impacts to vernal pool features have occurred.
22. The Air Force will remove the cyst bank within vernal pool features that would be impacted by the proposed project before the project begins. During the dry season, the Air Force will require that a qualified biologist use a hand trowel to collect one-liter volume sample per pool/swale of the top 0.4 to 1.2 inches of pool sediment. Whenever feasible, the qualified biologist will collect soil samples in chunks to best protect the cysts. The Air Force will allow soil samples containing any residual moisture to air dry thoroughly before storing them. The Air Force will keep the bags containing the soil samples out of direct sunlight to avoid excessively heating the sample. The Air Force will retain samples to be utilized to reinoculate the impacted pool or for use in other impacted pools.
23. In the event proposed project activities impact a vernal pool feature during the wet season, the Air Force will survey the impacted pool for two wet seasons with at least average rainfall to determine vernal pool fairy shrimp presence. If, after 2 years of survey, no vernal pool fairy shrimp are detected, the Air Force will collect seed cysts from a nearby occupied pool to be used to restore the impacted pool. The Air Force will survey the pool for another two seasons to monitor occupancy.
24. The Air Force will enhance habitat at a 3:1 ratio (habitat enhanced: suitable habitat affected) if permanent loss or impacts occur vernal pool fairy shrimp habitat. The Air Force will enhance habitat through the removal of invasive trees and other invasive plant

species adversely affecting occupied or potentially occupied vernal pools between New Mexico Avenue and California Boulevard and/or along Nevada Avenue on VAFB.

This biological opinion only analyzes the construction of program support facilities as described above. Effects related to the subsequent use (i.e. launches) of these facilities are activities covered in the Programmatic Biological Opinion, VAFB, Santa Barbara County, California (2013-F-0430).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the current rangewide condition of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp; (3) the Effects of the Action, which determines all consequences to the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp caused by the proposed action that are reasonably certain to occur in the action area; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area, on the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the current status of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp in the wild by reducing the reproduction, numbers, and distribution of that species.

STATUS OF THE SPECIES

Gaviota Tarplant

Legal Status

Gaviota tarplant was federally listed as endangered on March 20, 2000 (65 FR 14888). We designated critical habitat for Gaviota tarplant on November 7, 2002 (67 FR 67968). The State of California listed this taxon as endangered in 1990 (CNDDB 2020). We completed a 5-year review for the taxon in 2011 (Service 2011). Gaviota tarplant does not yet have a recovery plan.

Natural History

Gaviota tarplant is a self-sterile annual plant in the Asteraceae (or sunflower) family (Tanowitz 1982, p. 331-332; Tanowitz et al. 1987, p. 304; Keil 1993, p. 283; Baldwin 2012, p. 296). Plants generally range from 12-35 inches tall with stems that generally branch near the base. The inflorescence is typically rounded to flat-topped with the flower heads in tight groups or pairs. Most of the flower heads have 13 ray flowers per head, but this can vary between eight and 15 ray flowers per head. Each flower head generally has 16 to 32 disk flowers per head (Keil 1993, p. 283; Baldwin 2012, p. 299). Gaviota tarplant typically germinates in response to the first heavy rainfall event at the onset of the wet season. On VAFB, Gaviota tarplant germinates in mid to late December depending on rainfall. Peak blooming and seed set occurs from July through September. Plants are typically senescent by late November (KFS and MSRS 2020).

Gaviota tarplant occurs in grasslands habitats comprised of native needlegrass (*Stipa* spp.), nonnative wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), and other forbs and grasses. These grasslands intergrade with coastal sage scrub communities composed of California sagebrush (*Artemisia californica*), coyote brush (*Baccharis pilularis*), sawtooth golden bush (*Hazardia squarrosa*), and California buckwheat (*Eriogonum fasciculatum*) (Service 2011, pp. 11-12; CNDDB 2019a, 26 pp.). Gaviota tarplant is found on sandy soils associated with marine terraces and uplifted marine sediments that range in elevation from 40 ft along the lowest coastal terraces to 1500 ft at inland uplifted marine terraces (Howald 1989, p. 2; Hendrickson et al. 1998, pp. 8-12; Service 2011, p. 12; Consortium of California Herbaria (CCH) 2013; CNDDB 2019a, 26 pp.). At the higher elevations (above 700 ft, the taxon occurs in grasslands and sparsely vegetated openings dominated by grasslands among coastal scrub and oak (*Quercus* spp.) woodland communities (CNDDB 2019a, 26 pp.; Dudek 2019a, p. 41, Dudek 2019b, pp. 49-50). It has been documented to occur in along roadsides and other areas that have been subjected to disturbance (CNDDB 2021).

Each flower head of Gaviota tarplant (and other species in the Asteraceae family) produce one-seeded fruits called achenes. The achenes of *Deinandra* species are dimorphic (of two forms) and are referred to as disc and ray achenes. Ray achenes are most likely dispersed by adhesion of the sticky bracts that clasp them, to animal fur or feathers; while the disk achenes are likely wind dispersed (Tanowitz et al. 1987, p. 310; Baldwin, in litt. 2001, p. 2). No specific studies have been done on seed viability or seed banks for Gaviota tarplant, but these types of studies have been done for other closely related tarplant species (such as, *D. increscens* subsp. *increscens*, *D.*

conjugens, and *Holocarpha macradenia*). These studies indicate that the ray achenes in most *Deinandra* species and other closely related genera are strongly dormant at maturity and likely provide the basis for a seed bank of Gaviota tarplant. The precise length of time Gaviota tarplant seed banks remain viable is unknown.

Seed banks are of critical concern for annual plant species (Satterthwaite et al. 2007, p. 58; Service 2009, p. 13), such as Gaviota tarplant. This is because seed banks contribute to the long-term persistence of a species by sustaining them through periods when conditions are not conducive to adequate germination, growth, and subsequent reproduction (including periods of drought) (Rees and Long 1992, pp. 485, 502-503; Adams et al. 2005, pp. 426, 432, 434; Satterthwaite et al. 2007, p. 58.

As is typical of annual plant species, the number of Gaviota tarplant individuals present aboveground from one year to the next is highly variable and most likely depends on climatic conditions, such as the amount and timing of annual rainfall and temperature regimes during critical stages of germination and seedling growth. Based on the information we have for Gaviota tarplant (i.e., achene dormancy, self-incompatibility, fluctuating population numbers and distributions), similar information for other closely related tarplants (e.g., *D. conjugens*, *H. macradenia*), and other seed bank studies (Rees and Long 1992, pp. 485, 502-503; Adams et al. 2005, pp. 426, 432, 434; Satterthwaite et al. 2007, pp. 57-58, 63-65; Service 2009, p. 13), Gaviota tarplant seed banks are likely to be important for its long-term persistence and population resiliency. Stressors associated with extended periods of drought and warming temperatures may deplete the species seed bank reserves and impact the amount of viable seed produced, further reducing its abundance (Basto et al. 2018 p.1-7).

Rangewide Status

Gaviota tarplant was first described in 1982 (Tanowitz 1982, p. 12-17). It was known only from marine terraces in the immediate vicinity of the community of Gaviota, in southern Santa Barbara County with plants occurring up to only a few miles in either direction along the immediate coast (Tanowitz 1982, p. 331). Currently, it is recognized as having a highly localized distribution in western Santa Barbara County, California, with seven main populations: Lion's Head (near Point Sal), Point Arguello, Tranquillon Mountain/Sudden Peak, Point Conception, Hollister Ranch, Santa Ynez Mountains, and Gaviota (Baldwin 2007, pp. 1, 20-29; Baldwin 2009, pp. 19-24; 2012, p. 299; Service 2011, pp. 5-6, 8-11; CCH 2013; CNDDB 2013, 51 pp., 2019, 26 pp.). Populations may also occur in other locations that provide suitable habitat.

Because of the species annual life history and fluctuations in expression of above-ground plants, it is difficult to accurately quantify the total number of individuals in a given occurrence or population. Considering this, the largest population of Gaviota tarplant is thought to be the Tranquillon Mountain/Sudden Peak population with approximately 6,644,767 plants reported. It contains CNDDB element occurrence (EO) numbers 18, 24, 25, 26, 27, 28, 29, and 30. Most of the occurrences within this population occur on private lands that currently lack regulatory protections. The remaining six populations contain an additional 14 CNDDB EO and collectively comprise approximately 73,263 reported plants. These additional occurrences are located on a

combination of federal and state managed lands, which afford the species some degree of regulatory protection, as well as on private lands that lack protections.

Threats

The main threats to Gaviota tarplant identified in the final listing rule include: (1) habitat fragmentation and alteration of species composition and vegetation structure; (2) reduced distribution resulting from (a) the loss of habitat; (b) the development and alteration of habitat from petroleum extraction, water and petroleum pipeline installation and maintenance, recreational pathways and facilities; and (c) the introduction, invasion, or encroachment by invasive weed species; and (3) additional habitat modifications due to continued energy-related operations, including maintenance activities, hazardous waste cleanup, and other commercial development (65 FR 14888). Additional threats that have been recognized since the time of original listing include: (1) loss of habitat and indirect effects from wind energy development (2) loss of habitat due to sea level rise resulting from climate change, and (3) the development and alteration of habitat from mission operations at VAFB (Service 2011 p. 12-13).

Recovery

Gaviota tarplant does not yet have a recovery plan. Therefore, prevalent recovery actions need to promote general conservation of the species and its habitat. The most recent five year review includes several recovery recommendations for the species including the establishment of conservation easements at occupied sites and acquisition of lands that support occurrences, conduct updated range-wide surveys of the species, and site specific management activities including invasive weed control and refining grazing regimes (Service 2011). Gaviota tarplant faces imminent threats throughout its range. Activities to reduce or eliminate threats to the species are also warranted. In addition, implementation of research to fill data gaps will aid species recovery. These might include: seed bank and seed viability studies, genetics work, outplanting endeavors to establish new occurrences, pollination studies, and research to consider the range of the species ecological tolerances.

California red-legged frog

Legal Status

The California red-legged frog was federally listed as threatened on May 23, 1996 (61 Federal Register (FR) 25813). Revised critical habitat for the California red-legged frog was designated on March 17, 2010 (75 FR 12816). The Service issued a recovery plan for the species on May 28, 2002 (Service 2002b).

Natural History

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. They have been found at elevations ranging from sea level to approximately 5,000 ft. California red-legged frogs use the environment in a variety of ways, and in many cases, they may complete their entire life cycle in a particular area without using other

components (i.e., a pond is suitable for each life stage and use of upland habitat or a riparian corridor is not necessary). Populations appear to persist where a mosaic of habitat elements exists, embedded within a matrix of dispersal habitat. Adults are often associated with dense, shrubby riparian or emergent vegetation and areas with deep (greater than 1.6 ft) still or slow-moving water; the largest summer densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Hayes and Jennings 1988, p. 147). Hayes and Tennant (1985, p. 604) found juveniles to seek prey diurnally and nocturnally, whereas adults were largely nocturnal.

California red-legged frogs breed in aquatic habitats; larvae, juveniles, and adult frogs have been collected from streams, creeks, ponds, marshes, deep pools and backwaters within streams and creeks, dune ponds, lagoons, and estuaries. They frequently breed in artificial impoundments such as stock ponds, given the proper management of hydroperiod, pond structure, and control of exotic predators, and can proliferate in a wide range of edge and emergent cover amounts, including ponds devoid of emergent vegetation (Service 2002). The breeding season typically occurs from late November to April. Adult males call at night in the air and underwater. Calls can be easily missed because of their low volume and calling lasts only one to two weeks at a location (Nafis 2020). Eggs will hatch after approximately 4 weeks and tadpoles will typically metamorphose between 4-7 months, although they have been reported to overwinter at some sites (Nafis 2020). While frogs successfully breed in streams and riparian systems, high spring flows and cold temperatures in streams often make these sites risky egg and tadpole environments. Egg masses quantities are variable but are reported to consist between 300 to 4,000 eggs with an average of 2,000 and hatch after approximately 4 weeks (Service 2002, Nafis 2020). Two studies reviewed the natural survivorship of the closely related northern red-legged frog (*Rana aurora*) and found very low survival rates (<1-5%) between embryonic and tadpole lifestages (Licht 1974, Calef 1973). Subsequent lifestage survivorship of California red-legged frog is also reported to be relatively low, indicating that one egg mass may result in only one breeding pair of individuals (Tatarian and Tatarian 2018). An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed and can be a factor limiting population numbers and distribution.

During periods of wet weather, starting with the first rains of fall, some individual California red-legged frogs may make long-distance overland excursions through upland habitats to reach breeding sites. In Santa Cruz County, Bulger et al. (2003, p. 90) found marked California red-legged frogs moving up to 1.7 miles through upland habitats, via point-to-point, straight-line migrations without regard to topography, rather than following riparian corridors. Most of these overland movements occurred at night and took up to 2 months. Similarly, in San Luis Obispo County, Rathbun and Schneider (2001, p. 1302) documented the movement of a male California red-legged frog between two ponds that were 1.7 miles apart in less than 32 days; however, most California red-legged frogs in the Bulger et al. (2003, p. 93) study were non-migrating frogs and always remained within 425 ft of their aquatic site of residence (half of the frogs always stayed within 82 ft of water). Rathbun et al. (1993, p. 15) radio-tracked three California red-legged frogs near the coast in San Luis Obispo County at various times between July and January; these frogs also stayed close to water and never strayed more than 85 ft into upland vegetation. Scott (2002, p. 2) radio-tracked nine California red-legged frogs in East Las Virgenes Creek in

Ventura County from January to June 2001, which remained relatively sedentary as well; the longest within-channel movement was 279 ft and the farthest movement away from the stream was 30 ft.

After breeding, California red-legged frogs often disperse from their breeding habitat to forage and seek suitable dry-season habitat. Cover within dry-season aquatic habitat could include boulders, downed trees, and logs; agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks, and industrial debris. California red-legged frogs use small mammal burrows and moist leaf litter (Rathbun et al. 1993, p. 15; Jennings and Hayes 1994 p. 64); incised stream channels with portions narrower and deeper than 18 inches may also provide habitat (61 FR 25814). This type of dispersal and habitat use, however, is not observed in all California red-legged frogs and is most likely dependent on the year-to-year variations in climate and habitat suitability and varying requisites per life stage.

Although the presence of California red-legged frogs is correlated with still water deeper than approximately 1.6 ft, riparian shrubbery, and emergent vegetation (Jennings and Hayes 1994, p. 64), California red-legged frogs appear to be absent from numerous locations in its historical range where these elements are well represented. The cause of local extirpations does not appear to be restricted solely to loss of aquatic habitat. The most likely causes of local extirpation are thought to be changes in faunal composition of aquatic ecosystems (i.e., the introduction of non-native predators and competitors) and landscape-scale disturbances that disrupt California red-legged frog population processes, such as dispersal and colonization. The introduction of contaminants or changes in water temperature may also play a role in local extirpations. These changes may also promote the spread of predators, competitors, parasites, and diseases.

Rangewide Status

The historical range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Storer 1925, p. 235; Jennings and Hayes 1985, p. 95; Shaffer et al. 2004, p. 2673). The California red-legged frog has sustained a 70 percent reduction in its geographic range because of several factors acting singly or in combination (Davidson et al. 2001, p. 465).

Over-harvesting, habitat loss, non-native species introduction, and urban encroachment are the primary factors that have negatively affected the California red-legged frog throughout its range (Jennings and Hayes 1985, pp. 99-100; Hayes and Jennings 1988, p. 152). Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s. Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquito fish (*Gambusia affinis*), red swamp crayfish (*Procambarus clarkii*), and signal crayfish (*Pacifastacus leniusculus*). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations, and is considered a threat to California red-legged frog populations.

A 5-year review of the status of the California red-legged frog was initiated in May 2011, but has not yet been completed.

Recovery

The 2002 final recovery plan for the California red-legged frog (Service 2002b) states that the goal of recovery efforts is to reduce threats and improve the population status of the California red-legged frog sufficiently to warrant delisting. The recovery plan describes a strategy for delisting, which includes: (1) protecting known populations and reestablishing historical populations; (2) protecting suitable habitat, corridors, and core areas; (3) developing and implementing management plans for preserved habitat, occupied watersheds, and core areas; (4) developing land use guidelines; (5) gathering biological and ecological data necessary for conservation of the species; (6) monitoring existing populations and conducting surveys for new populations; and (7) establishing an outreach program. The California red-legged frog will be considered for delisting when:

1. Suitable habitats within all core areas are protected and/or managed for California red-legged frogs in perpetuity, and the ecological integrity of these areas is not threatened by adverse anthropogenic habitat modification (including indirect effects of upstream/downstream land uses).
2. Existing populations throughout the range are stable (i.e., reproductive rates allow for long-term viability without human intervention). Population status will be documented through establishment and implementation of a scientifically acceptable population monitoring program for at least a 15-year period, which is approximately 4 to 5 generations of the California red-legged frog. This 15-year period should coincide with an average precipitation cycle.
3. Populations are geographically distributed in a manner that allows for the continued existence of viable metapopulations despite fluctuations in the status of individual populations (i.e., when populations are stable or increasing at each core area).
4. The species is successfully reestablished in portions of its historical range such that at least one reestablished population is stable/increasing at each core area where California red-legged frog are currently absent.
5. The amount of additional habitat needed for population connectivity, recolonization, and dispersal has been determined, protected, and managed for California red-legged frogs.

The recovery plan identifies eight recovery units based on the assumption that various regional areas of the species' range are essential to its survival and recovery. The recovery status of the California red-legged frog is considered within the smaller scale of recovery units as opposed to the overall range. These recovery units correspond to major watershed boundaries as defined by U.S. Geological Survey hydrologic units and the limits of the range of the California red-legged frog. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit.

Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species

such as bullfrogs. The goal of designating core areas is to protect metapopulations that combined with suitable dispersal habitat, will support long-term viability within existing populations. This management strategy allows for the recolonization of habitat within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of the California red-legged frog.

Vernal pool fairy shrimp

Legal Status

The Service listed vernal pool fairy shrimp (*Branchinecta lynchi*) as a threatened species on September 19, 1994 (59 FR 48136). We first designated critical habitat for four vernal pool crustaceans (inclusive of vernal pool fairy shrimp) and 11 vernal pool plants in 34 counties in California and one county in southern Oregon on August 6, 2003 (68 FR 46683). We published a revised designation of critical habitat, with a re-evaluation of non-economic exclusions, on August 11, 2005 (70 FR 46924). On February 10, 2006, the Service published a final rule providing species-specific unit descriptions and maps identifying the critical habitat for each of the 15 species. The recovery plan for vernal pool ecosystems of California and southern Oregon also addresses vernal pool fairy shrimp (Service 2005, pp. 11-19 1 to 11-203). The Service published its most recent 5-year review for vernal pool fairy shrimp in 2007 (Service 2007, 75 pp.).

Natural History

The vernal pool fairy shrimp is a small (generally less than 1 inch) freshwater crustacean in the order Anostraca. Like other anostracans, it has stalked compound eyes and eleven pairs of phyllopods (swimming legs that also function as gills). This species is genetically distinct from other *Branchinecta* species and distinguished by the morphology of the male's second antenna and the female's short, pear-shaped brood pouch (Service 2005, p. 11-9 1). It is a non-selective filter-feeder and, like other species of fairy shrimp, serves as a food source for a diversity of wildlife, including insects, tadpoles, frogs, salamanders, shorebirds, ducks, and even other fairy shrimp.

Vernal pool fairy shrimp occur in vernal pools and other seasonally inundated features. It is a short-lived species and, as with other fairy shrimp, spends the majority of its life cycle as a resting egg (often referred to as a cyst) in the dried soils of the seasonally inundated features in which it occurs. The number of eggs produced per clutch and how many clutches can be generated during a female's lifetime is unknown (Erikson and Belk, p. 93). Resting eggs fall to the basin bottom or remain in the brood sac until the female dies and sinks (68 FR 46687). Fairy shrimp resting eggs are capable of withstanding heat, cold, and prolonged desiccation and persist in the soil for an unknown number of years to hatch when conditions are favorable (68 FR 46687).

As a cool-water species, vernal pool fairy shrimp resting eggs hatch when vernal pools or other depressional features fill during winter storms and water temperatures are approximately 100 Centigrade (C)/50° Fahrenheit (F) (Eriksen and Belk 1999, p. 93). The time to maturity and

reproduction is dependent on water temperature and varies from as little as 18 days under optimal conditions (20° C/68° F) to 139 days, with 41 days being typical when water temperatures approximate 150 C/59° F (Eriksen and Belk, p. 93). The ability to mature quickly allows vernal pool fairy shrimp to occupy shallow pools that experience short periods of inundation. Immature and adult shrimp typically die when water temperatures rise to 24° C/ 750 F (Helm 1998, p. 137). Vernal pool fairy shrimp may experience more than one hatch in a feature during a single wet season if conditions are appropriate. Not all of the resting eggs hatch simultaneously and this provides a mechanism for survival if an inundation period is interrupted or too short in a given year (Gallagher 1996, p. 326).

Adult shrimp and resting eggs disperse by passively adhering to waterfowl and other migratory birds, domestic animals (e.g., cattle), and native wildlife as well as through water movement between suitable habitat and by adhering to wind-blown dust (Eriksen and Belk 1999, p. 62).

Rangewide Status

The vernal pool fairy shrimp is endemic to California with the exception of a single isolated population in the Agate Desert of Jackson County in southern Oregon. It has the widest geographic range of the federally listed vernal pool crustaceans; however, is seldom abundant when it occurs with other fairy shrimp species (Eriksen and Belk 1999, p. 93). Vernal pool fairy shrimp co-occur with the federally endangered Conservancy fairy shrimp (*Branchinecta conservatio*) and longhorn fairy shrimp (*B. longiantenna*) as well as several unlisted fairy shrimp species (e.g., *B. lindahli, B. mackini, Linderiella occidentalis*) (Eriksen and Belk 1999, p. 45).

The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB) identifies 791 occurrences for the vernal pool fairy shrimp (CNDDB 2021, unpaginated). In California, the range of the species is discontinuous and extends from Riverside County and the Coast Ranges, north through Central Valley to Tehama County (Service 2007). On California's central coast, the species is known to occur in vernal pools and other features at the following locations: at least 55 features on Fort Hunter Liggett, at least 46 features at Camp Roberts, approximately 60 features at the Chevron Tank Farm in San Luis Obispo, at least 12 complexes on VAFB, at least 2 features on Santa Maria Airport, and 2 features in the Los Padres National Forest. Vernal pool fairy shrimp also occur in and around Soda Lake in the Carrizo Plain National Monument and in the City of Paso Robles. Some of these occurrences were unknown or undocumented at the time of the final listing and critical habitat rules and completion of the recovery plan (Service 2005a, p. vii).

Maintaining the integrity of surrounding upland habitat is essential to support ecological conditions necessary for vernal pool fairy shrimp to complete their life cycle. Habitat loss and fragmentation represent the largest threats to the survival and recovery of vernal pool fairy shrimp and other species restricted to vernal pools and other ephemerally ponded habitats typically the result of urbanization and habitat conversion to agriculture. Other activities that can degrade habitat include altered hydrology, water contamination, competition from nonnative and invasive species, incompatible grazing regimes, energy development, infrastructure Projects (e.g., roads, utility conveyance), recreational activities (e.g., off-highway vehicles), erosion, mosquito abatement activities, and a changing climate (Service 2007, p. 34). Approximately 75

percent of vernal pool fairy shrimp habitat was in the Central Valley was lost by 1997 (Holland 1998, pp. 7 1-75) and continued habitat loss for vernal pool and other listed fairy shrimp is estimated at a rate of 2 to 12 percent annually, depending on the region (Holland 2003, all). Habitat loss is generally a result of urbanization, agricultural conversion, and mining, although loss also occurs in the form of habitat alteration and degradation as a result of changes to natural hydrology, competition from invasive species, incompatible grazing regimes (including overgrazing), energy development, infrastructure projects (e.g., roads, water storage and conveyance, utilities), recreational activities (e.g., off-highway vehicles, hiking), erosion, mosquito abatement activities, climatic and environmental change, and contamination (Service2007).

Recovery

The Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon addresses 33 species, including the vernal pool fairy shrimp (Service 2005a). The goal of the recovery plan is to achieve and protect in perpetuity self-sustaining populations of vernal pool fairy shrimp throughout the species' range and delist the species. The decline of the vernal pool fairy shrimp is attributed primarily to habitat loss and fragmentation resulting from development and agricultural expansion, although invasive species and aquatic contaminants also have contributed to the species' decline. A primary component of the species' recovery is protecting vernal pool habitat in conservation areas and reserves.

The recovery plan specifies that the vernal pool fairy shrimp may be considered for delisting when:

1. At least 80 percent of occurrences and 85 percent of suitable habitat have been protected;
2. The species has been reintroduced to vernal pool regions and soil types where surveys indicate the species has been extirpated;
3. Appropriate long-term management and monitoring are secured;
4. Status surveys show that populations are stable or increasing and threats have been reduced or eliminated;
5. Research has been conducted on genetic structure, population viability, and additional recovery actions; and
6. Recovery teams and working groups are established to oversee recovery efforts and conduct outreach and incentive programs to develop partnerships.

The Service's 5-year review (Service 2007) reported that delisting criterion 1 (reintroduction and protection of habitat) and 2 (habitat management and monitoring) have been partially met, including at least 13,000 acres of habitat protected; however, most recovery criteria have not been met. The Service does not have information indicating population or abundance trends for the vernal pool fairy shrimp. Surveys for the species have increased the number of known occurrences, including occurrences in San Luis Obispo and Santa Barbara Counties; however, concurrent habitat loss and fragmentation has occurred around some populations. The 5-year review documents extensive habitat loss, including more than 50,000 acres lost between 1994 and 2005 as a result of human population expansion and conversion of vernal pool habitat to agriculture. The 5-year review also discusses future habitat loss from anticipated development

around quickly growing urban areas. The indirect effects of development (e.g., pesticides, altered hydrology) on remaining habitat increasingly compound the effects of habitat loss on the species. The status review acknowledges that the threats to the species have not decreased since listing and recommends that the Service maintain the species' threatened status (Service 2007).

ENVIRONMENTAL BASELINE

The implementing regulations for section 7(a)(2) (50 CFR 402.02) define the environmental baseline as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline."

Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). The action area for this biological opinion includes all proposed building sites and locations of temporary and permanent ground disturbance in addition to habitat enhancement areas. This encompasses approximately 121.26 acres including 87 acres of new construction, 19.3 acres of laydown areas, 2.7 acres of previously disturbed habitat adjacent to existing infrastructure, and an anticipated 12.4 acres of habitat enhancement areas. The action area also includes the surrounding habitat which may be indirectly impacted by project related effects including increased noise, artificial night light, and human activity during project construction and operation. The Service defines the indirect impact area as an approximate 1,000 ft buffer beyond the permanent impact area where noise levels from project construction may exceed 75 dB and artificial night lighting from project operations may be newly present.

Habitat Characteristics of the Action Area

The action area for the proposed project is located in the northern section of VAFB, north of the Santa Ynez River. The action area lies within the greater Burton Mesa and incorporates various land usage and habitat types. The action area encompasses areas of both native and non-native vegetation including portions of maritime chaparral, central coast scrub, central dune scrub, small areas of riparian and vernal pool habitat, as well as large areas of non-native iceplant cover. Developed roadways and structures, including the highly developed Cantonment area on north VAFB, are also present in the action area.

Existing Conditions in the Action Area

The action area for the proposed project contains large portions of previously disturbed lands including developed areas and non-native vegetation (e.g. ice plant mats) as well as portions of native habitat including intact maritime chaparral. Existing paved roads currently serve to connect proposed and existing project features. A total of 23 existing features including support facilities, buildings, and storage areas will be utilized for the proposed project. Approximately 25.5 miles (3.09 acres) of utility lines would be installed in trenches along existing road shoulders or within existing roadway pavement.

The proposed project includes a total of seven new construction features. New construction features including the GBSD Schoolhouse, the Consolidated Maintenance Complex, and the Temporary Contractor Test Support Facility would be located in the developed Cantonment area, the majority of which has been previously disturbed and contain large areas of non-native vegetation. The proposed project footprint contains no permanent aquatic features but contains or is located directly adjacent to approximately 4 acres of ephemeral aquatic habitat. The GBSD Schoolhouse building footprint is located 213 ft south of an unnamed drainage. The proposed new construction of the Vehicle Processing Facility footprint is located along 13th Street and contains two identified vernal pool features. The proposed new construction of the Component Operations Facility is located south west of the Cantonment area within intact maritime chaparral and is located directly adjacent to two vernal pool features (identified as 24-108 and 24-110). The proposed construction of buildings 1860/1861, located to the north off of Encelados road, as well as the proposed development of the additional MSA parking, located south west of the Cantonment area, are both located within previously disturbed lands.

The proposed project includes a total of 9 identified laydown areas, including 2 alternative options, which are located across the extent of the proposed action area. Laydown areas include a combination of native and non-native vegetation as well as portions of previously developed and disturbed areas.

The project proposes to utilize 40 acres of existing facilities (Kaisersatt, pers. comm. 2021). Of these 40 acres, approximately 2.7 acres encompassed within the existing fenceline of LF-26 and LF-04 contain previously disturbed areas where vegetation has re-established.

Previous Consultations in the Action Area

The Service has previously consulted on the effects of routine operations and maintenance activities at VAFB on the Programmatic Biological Opinion (Service 2015), which includes the action area. The Service concluded that these routine operations and maintenance activities would not jeopardize the continued survival or recovery of federally listed species, including Lompoc yerba santa, California red-legged frog, and vernal pool fairy shrimp.

The Service issued a biological opinion to the Air Force for the National Reconnaissance Office Western Processing Facility in October 2019, we determined that the proposed action was not likely to jeopardize the continued existence of the California red-legged frog.

The Service issued a biological opinion to the Air Force for the MQ-9 Beddown Project in September 2020, we determined that the proposed action was not likely to jeopardize the continued existence of the California red-legged frog, vernal pool fairy shrimp, and Lompoc yerba santa.

The Service issued a biological opinion to the Air Force for the Blue Origin Orbital Launch Site at Space Launch Complex-9 Project in November 2020, we determined that the proposed action was not likely to jeopardize the continued existence of the California least tern (*Sterna antillarum browni*), beach layia (*Layia carnosa*), western snowy plover (*Charadrius nivosus nivosus*), and the California red-legged frog.

Condition (Status) of the Species in the Action Area

Gaviota tarplant

The Lion's Head area encompasses a portion of the proposed action area north of Shuman Creek. Within this location, Gaviota tarplant is known to intergrade with the more common grassland tarplant (*Deinandra increscens* ssp. *increscens*). Annual variation in the proportion of plants that conform to the accepted Gaviota tarplant phenotype is known to occur and consequently the number and extent of distribution has also experienced notable annual fluctuation (MSRS 2017). In the Lion's Head area, a total of 3,354 individual Gaviota tarplant were documented to occupy 1.3 acres in 2011 while 4,980 individuals occupying 170 acres were documented in 2015 (KFS and MSRS 2020).

Two stands of Gaviota tarplant have been documented to occur within the LF-04 laydown area, comprising approximately 0.3-acre total with an estimated 192 individuals (KFS and MSRS 2020). The southernmost of these two stands is located within a maintained firebreak. The associated disturbance regime may have allowed the population to persist by suppressing non-native species competition. Furthermore, Gaviota tarplant is an annual species that, based on historic occurrence data, has demonstrated ability and affinity to colonize disturbed habitats (CNDDB 2021, KFS and MSRS 2020). Consequently, Gaviota tarplant has the potential to occur within all vegetation types that support low growing herbaceous species in the action area north of Shuman Creek. An additional 18.3 acres of unoccupied but suitable Gaviota tarplant habitat is located within the proposed project footprint (Kaisersatt, pers. comm. 2021).

California Red-legged Frog

California red-legged frogs have been reported throughout the extent of the action area. Occurrence locations include the drainage north of LF-04, southwest of Combar Road, within the vicinity of Shuman Creek, in ephemeral aquatic habitat in the vicinity of El Rancho Oeste and Pega Roads, in the vicinity of Umbra Road, in vernal pool habitat along New Mexico Avenue, and in vernal pool habitat adjacent to the Munitions Storage Area facility on 35th Street. The unnamed ephemeral drainage approximately 213 ft northwest of the proposed GBSD Schoolhouse facility footprint contains multiple California red-legged frog records. The Air Force has indicated that this feature does not support a resident population or breeding habitat (Evans, pers. comm. 2021e) and that no suitable breeding habitat is located within the proposed

project footprint. The Air Force identified approximately 4 acres of suitable ephemeral aquatic habitat that does not support breeding within or directly adjacent to the proposed project footprint (Kaisersatt, pers. comm. 2021). The majority of the remaining non-developed portions of the action area are within the dispersal distance of known California red-legged frog locations and may serve as upland dispersal habitat.

Vernal pool fairy shrimp

During 2020 surveys, two new vernal pools were found within the proposed construction footprint of the Vehicle Processing Facility (MSRS 2020). These new pools comprise approximately 0.04 acre. Although they have not been surveyed for vernal pool fairy shrimp, these pools provide suitable habitat and the Air Force assumes they are occupied. Vernal pool features 24-108 and 24-110 (see Figure 2-6 in Biological Assessment; KFS and MSRS 2020) encompass 3.86 acres are located directly adjacent to the Component Operations Facility. Features 24-108 and 24-110 were assessed during the 2018-2019 wet season (MSRS 2019b). Vernal pool fairy shrimp were not detected during 2018-2019 wet season surveys at pools 24-108 and 24-110, but their lack of presence may have been due to environmental conditions rather than actual absence. Vernal pool fairy shrimp were also not detected in adjacent known occupied control pools sampled concurrently (MSRS 2019b). Additional previously mapped potential and occupied vernal pool fairy shrimp habitat is located along 13th Street, New Mexico Avenue, 35th Street, and El Rancho Oeste Road. There are 160 vernal pools encompassing 83.9 acres on VAFB known to support vernal pool fairy shrimp, and an additional 152 vernal pools encompassing 42.6 acres of potential habitat.

Individual project feature locations in relation to known sensitive resource records within the action area are provided in summary Table 2 below.

Table 2. Proposed Project features in relation to known sensitive resource records.

Feature Name	Feature location in relation to known sensitive resources
New Facilities and Infrastructure to be Constructed	
Utility Lines	The Air Force would place utility lines adjacent to multiple California red-legged frog occurrences and historically occupied Gaviota tarplant habitat. The Air Force would conduct utility trenching within the existing roadway across Shuman Creek as well as in areas adjacent to documented vernal pool habitat, including areas along New Mexico Avenue and 13th street.
Buildings 1860/1861	Multiple California red-legged frog occurrences are located near the proposed facility's footprint.
GBSD Schoolhouse	Multiple California red-legged frog occurrences are documented adjacent (within 215 ft) to the proposed facility's footprint.
Temporary Contractor Test Support Facility	A single vernal pool is in the near vicinity of the proposed facility's footprint.

Feature Name	Feature location in relation to known sensitive resources
Consolidated Maintenance Complex	Multiple vernal pools are in the near vicinity of the proposed facility's footprint.
Component Operations Facility	The proposed facility's footprint is adjacent to two vernal pool features (24-108, 30 ft; and 24-110, 80 ft), and a single California red-legged frog record.
Additional MSA Parking	The proposed facility's footprint is located near vernal pool feature 24-108 and a single California red-legged frog record.
Vehicle Processing Facility	Two vernal pools are located within the proposed facility's footprint.
Laydown Areas	
Launch Facility 26 (LF-26)	The proposed laydown area's footprint is in the vicinity of historic Gaviota tarplant occurrences.
Launch Facility 04 (LF-04 Laydown)	The proposed laydown area's footprint contains approximately 0.3 acre (192 individuals) of Gaviota tarplant occupied habitat. The location is also within the vicinity of a single California red-legged frog occurrence.
Globe Laydown	No known sensitive resources are located within the immediate vicinity of the proposed laydown area's footprint.
Point Sal Road Laydown	The proposed laydown area's footprint is in the vicinity of historic Gaviota tarplant occupied habitat and California red-legged frog occurrences.
Brioso Laydown	No known sensitive resources are located within the immediate vicinity of the proposed laydown area's footprint.
Missile Alert Facility DO/ (MAF-DO) Laydown	No known sensitive resources are located within the immediate vicinity of the proposed laydown area's footprint.
MSA Laydown	The proposed laydown area's footprint is adjacent to a California red-legged frog occurrence and two identified vernal pool features.
Alternative 1 MSA Laydown	The proposed alternative laydown area's footprint is adjacent to a California red-legged frog occurrence and 190 ft from vernal pool feature 24-108.
Alternative 2 MSA Laydown	This proposed alternative laydown area's footprint is located in the near vicinity of a California red-legged frog occurrence and 75 ft from vernal pool feature 24-108.
Igloo Laydown	No known sensitive resources are located within the immediate vicinity of the proposed laydown area's footprint.
13th Street Laydown	Two identified vernal pools are located to the west of the proposed laydown area's footprint.
Existing Facilities and Infrastructure Requiring Renovation and Development	

Feature Name	Feature location in relation to known sensitive resources
Launch Facility 26 (LF-26)	The feature is in the vicinity of historically occupied Gaviota tarplant habitat. Unoccupied suitable habitat for Gaviota tarplant is included within the undeveloped portions of the existing facility's footprint.
Launch Facility 04 (LF-04)	The feature is in the vicinity of historically occupied Gaviota tarplant habitat. Unoccupied suitable habitat for Gaviota tarplant is included within the undeveloped portions of the existing facility's footprint.

Recovery

Gaviota tarplant

We have not developed a recovery plan for Gaviota tarplant to assess its recovery status. The 5-year review (Service 2011) also does not specify the recovery function of Gaviota tarplant within the VAFB Lion's Head population. In the absence of a recovery plan or other stated recovery objectives, we default to general conservation measures for the species. For a species like Gaviota tarplant that has threats throughout its range, the most important recovery actions would likely include conserving as much of the remaining habitat that supports the species as possible. In addition, priority actions would include reducing or removing threats to the species in areas where it still exists as well as conducting restoration activities in suitable habitat. Lastly, efforts to reestablish the species in previously occupied habitat would contribute to its recovery.

California red-legged frog

In the recovery plan for California red-legged frog, we revised recovery units and identified core areas that are watersheds, or portions thereof, that have been determined to be essential to the recovery of the California red-legged frog. VAFB is located within the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit and Core Area 24, Santa Maria River-Santa Ynez River. This core area is important because it is currently occupied, contains a source population, and provides connectivity between source populations (Service 2002, pp. 6, 146).

In this Recovery Unit, the lower drainage basin of San Antonio Creek, the adjacent San Antonio Terrace, and San Antonio Lagoon are considered to be among the most productive areas for California red-legged frogs in Santa Barbara County (Christopher 1996, as cited in Service 2002, p. 10). Most of this area occurs on VAFB.

Recovery task 1.24 identifies the conservation needs in Core Area 24 to protect existing populations; reduce contamination of habitat (e.g., clean contaminated ponds on VAFB); control non-native predators; implement management guidelines for recreation; cease stocking dune ponds with non-native, warm water fish; manage flows to decrease impacts of water diversions; implement guidelines for channel maintenance activities; preserve buffers from agriculture (e.g., in lower reaches of Santa Ynez River and San Antonio Creek) (Service 2002, p. 75).

Vernal pool fairy shrimp

The action area lies within the Santa Barbara vernal pool region and is located outside of any core area defined in the Recovery Plan for Vernal Pool Ecosystems of California and Southern California (Service 2005). Vernal pool regions and core areas were defined through a multiple-species ecosystem-level approach rather than being based on recovery needs of individual species, thus the recovery status of the vernal pool fairy shrimp within each vernal pool region and core area is not specified in the plan. Core areas were chosen to encompass viable populations of plan species or support habitat connectivity and dispersal between populations.

The five-year review indicates that within the Santa Barbara vernal pool region, the VAFB vernal pool fairy shrimp population exists along the edge of the species' range (Service 2007, p. 18). Many vernal pool features on VAFB are considered artificial in that they are ponded water on roadways or along railroad toe drains. The majority of sites within the cantonment area contained in the action area are thought to be unoccupied and numerous sites appear to be degraded (Service 2007, p. 25).

The recovery plan indicates that for each vernal pool species, permanent protection of populations and habitat in all vernal pool regions and core areas will be necessary to preserve its geographic range and genetic diversity and achieve recovery. Recovery (delisting) criteria for the vernal pool fairy shrimp like other species in the plan are defined in terms of range-wide population protection targets and core area-specific land protection targets. The vernal pool fairy shrimp may be delisted when 80 percent of all occurrences present at the time of the plan are protected, unless additional occurrences are found, and when defined percentages of suitable habitat are permanently protected within each core area. Other recovery actions include reintroducing the species to vernal pool regions and soil types from which status surveys indicate the species has been extirpated, development of habitat management and monitoring plans for all protected habitat, status surveys, research, and outreach.

EFFECTS OF THE ACTION

The implementing regulations for section 7(a)(2) define effects of the action as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

In conducting this analysis, we have considered factors such as previous consultations; Federal Register rules; 5-year reviews; other Service documents; published scientific studies and literature; professional expertise of Service personnel, particularly dealing with aspects directly related to the sensitive species involved, or other related scientific fields in determining whether effects are reasonably certain to occur. We have also determined that certain consequences are not caused by the proposed action, such as the increase or spread of disease, poaching/collecting, because they are so remote in time, or geographically remote, or separated by a lengthy causal chain, so as to make those consequence not reasonably certain to occur.

Effects of the Proposed Action on the Gaviota Tarplant

Activities that could directly or indirectly affect Gaviota tarplant include the construction of laydown areas and trenching, the potential introduction and spread of non-native plants within the project area, herbicide application within Gaviota tarplant enhancement areas, and unintentional damage by workers. Potential impacts associated with these activities include the damage of individual Gaviota tarplant, seed bank, and the loss of suitable habitat.

Effects of Construction

Construction of project facilities will impact approximately 0.3 acre of occupied Gaviota tarplant habitat as well as 18.3 acres of unoccupied suitable habitat (See Summary of Effects Table 3). The construction of the LF-04 laydown area includes vegetation clearing and grading that would impact an estimated 192 Gaviota tarplant individuals. The Air Force may conduct project activities at any time of year, including while the plants are flowering. To reduce effects, the Air Force proposes to attempt to collect seed (if present) and will salvage topsoil containing the associated seed bank in impacted areas that are known to support Gaviota tarplant. To further minimize effects, the Air Force will implement Gaviota tarplant habitat enhancement. Habitat enhancement will occur at a 2:1 ratio (habitat enhanced: occupied habitat impacted). The Air Force will remove non-native plant species in areas directly adjacent to occupied Gaviota tarplant habitat along Point Sal Road near Casmalia Beach, Globe, and/or Oculto Roads. Being that Gaviota tarplant is an annual species that readily colonizes recently disturbed sites, the placement of habitat enhancement areas directly adjacent to occupied Gaviota tarplant habitat will create new suitable habitat and may enhance the existing population as a result of project implementation. The Air Force will attempt to seed these sites with previously collected Gaviota tarplant seed and a native grass seed mixture to help prevent future reinfestation of weeds. With the implementation and the continued management of habitat enhancement areas, the Service expects adverse effects on Gaviota tarplant individuals and its habitat loss from the construction of the proposed project to be low.

Gaviota tarplant individuals and their associated seed bank in work areas may be damaged during initial topsoil salvage efforts if soil is collected at an improper time or depth. The Air Force will store salvaged topsoil for up to 12 months (Evans, pers. comm. 2021f). The seed bank may also be damaged during potential long-term topsoil storage if they are stored under improper conditions (e.g. subjected to solarization, erosion, weed introduction). The precise length of time Gaviota tarplant seed banks remain viable is unknown and consequently the duration of topsoil storage may also affect seed viability. To reduce effects, the Air Force will attempt to salvage topsoil following seed set under the direction of a qualified biologist. The qualified biologist will determine when a particular area has gone to seed and inform project proponents and contractors of the optimal period to work in the subject area, helping to ensure topsoil salvage efforts occur at the proper time. The Air Force will use a qualified biological monitor to oversee and instruct equipment operators during initial topsoil salvage efforts which will help ensure topsoil is collected at a proper depth. As described, some level of loss may be associated with the proposed project's Gaviota tarplant topsoil salvage and storage efforts; however, the Service anticipates that the potential negative effects of topsoil salvage and storage would be overall lower than if no topsoil salvage was conducted. We anticipate that topsoil salvage will be conducted at the

optimal time following seed set, however we still consider salvage beneficial if it is performed outside of seed set window to help reduce effects to any existing seed bank present. The total area of topsoil salvage is anticipated to be a very small percentage of the known Gaviota tarplant population in the Lion's Head area. Consequently, the Service expects adverse effects on Gaviota tarplant from the proposed project's topsoil salvage and storage efforts to be low.

The movement of vehicles into and within the proposed action area, particularly along Point Sal Road near Casmalia Beach, Globe, and/or Oculto Roads adjacent to occupied Gaviota tarplant habitat may result in adverse effects to Gaviota tarplant as a result of the introduction and spread of non-native weed species. To reduce effects of non-native weed seed introduction, the Air Force will clean all project related equipment and vehicles to be free of weed seeds prior to use in the project area. A biological monitor will provide a briefing to crews detailing measures required to prevent the introduction and spread of weeds on VAFB and inspect vehicles and equipment for weed seeds prior to initial site activities. To reduce effects of non-native weed transport within the project site, the Air Force will clean equipment of weed seeds daily. Prior to leaving the project area, vehicles will be cleaned at designated exit areas and may be washed at approved wash stations. With the implementation of the proposed avoidance and minimization measures, the Service expects adverse effects on Gaviota tarplant from the introduction and spread of non-native weed species within the project area to be low.

Adverse effects from invasive plant removal and any associated herbicide treatment within habitat enhancement areas could occur if herbicides are applied in a manner and under conditions that could inadvertently kill adjacent populations of Gaviota tarplant. Invasive plant removal activity near Gaviota tarplant could also result in adverse effects due to workers trampling or crushing Gaviota tarplant individuals if they are not known or detected in those areas. The Air Force will minimize these effects by requiring that only certified personnel be permitted to apply herbicides. Additionally, the Air Force will require that a qualified biological monitor delineate areas where Gaviota tarplant are historically known to be located and brief all project personnel with an environmental training. With implementation of the proposed avoidance and minimization measures, the Service believes that the effects of worker activity and associated herbicide use within Gaviota tarplant habitat enhancement areas will be low. Overall, the Service believes that Gaviota tarplant habitat enhancement areas will result in an overall net benefit to Gaviota tarplant.

Effects of the Proposed Action on California red-legged frog

The construction and maintenance of the proposed project may have adverse effects on the California red-legged frog through trampling and crushing by personnel or vehicles, entrapment, habitat loss, capture and relocation, disturbance due to construction noise, the creation of potential ephemeral breeding habitat (stormwater retention basins), exposure to artificial night lighting, and potential contact with herbicides. The proposed project is within known dispersal distance of California red-legged frog occupied habitat.

Effects of Construction

Ground disturbance would occur for utility line trenching, new facility, and associated infrastructure construction. If ground disturbance occurs in the wet season (between November 15 and March 31), mortality and injury could occur to juveniles and adults due to entrapment or trampling and crushing by vehicles or personnel when California red-legged frogs are expected to be moving across the landscape. The Air Force will minimize these effects by conducting work activities during daylight hours and in dry conditions. The Air Force will install silt exclusionary fencing with the intention of inhibiting California red-legged frogs from entering work areas at LF-04, GBSD Schoolhouse, and the Component Operations Facility/laydown as a result of their proximity to known California red-legged frog records. A qualified biological monitor will survey these sites and the associated fencing daily prior to the start of work to minimize associated effects to California red-legged frogs. Additionally, the qualified biological monitor will relocate any California red-legged frog encountered during work activities that need to be moved out of harm's way to the nearest suitable habitat. With the implementation of the proposed avoidance and minimization measures, we conclude that adverse effects on the California red-legged frog from ground disturbance activities are low.

Work activities may create open holes or trenches that could entrap California red-legged frogs if left open overnight and lead to subsequent work-related injury or mortality. The Air Force will minimize effects by securely covering any open holes or trenches with plywood or metal sheets if left overnight, as well as having a qualified biological monitor search any open holes and trenches the following morning for entrapped animals. We conclude that adverse effects on the California red-legged frog from being buried or trapped are low.

Vegetation removal conducted in the vicinity of Shuman Creek and the drainage northwest of the GBSD Schoolhouse as well as potential hydrological impacts associated with vernal pools 24-108 and 24-110 may reduce approximately 4 acres of ephemeral aquatic habitat for the California red-legged frog (Summary of Effects Table 3). Proposed impacted areas do not currently support resident populations or breeding habitat (Evans, pers. comm. 2021e). The construction of the remaining six new facilities occur within the dispersal distance of known California red-legged frog records and may result in reduced quality or complete loss of suitable upland and foraging habitats. Equipment use in work areas may further reduce habitat quality by introducing contaminants, such as fuels and lubricants. The effects of vegetation removal would be magnified during the wet season when California red-legged frogs are more active and more likely to come into contact with equipment or potential contaminants. Reduction of vegetative cover in ephemeral aquatic habitats may also temporarily increase California red-legged frog exposure to predation. The Air Force would minimize these impacts by requiring that a qualified biological monitor conduct surveys for the California red-legged frog one day prior to any vegetation removal within 0.1 mile of Shuman Creek, the drainage northwest of GBSD Schoolhouse location, and within or adjacent to any areas subject to seasonal inundation and/or dominated by riparian vegetation. The Air Force will require that the biological monitor capture any California red-legged frogs present, if feasible, and release them at the nearest suitable habitat outside vegetation removal areas. The monitor will also search for injured or dead California red-legged frogs after vegetation removal. With the implementation of the proposed

avoidance and minimization measures, we conclude that adverse effects on the California red-legged frog from habitat loss are low.

Capture and relocation of California red-legged frogs could result in injury or death as a result of improper handling, containment, transport, or release into unsuitable habitat. Although we do not have an estimated survivorship for translocated California red-legged frogs, survivorship of translocated wildlife in general is reduced due to intraspecific competition, lack of familiarity with the location of potential breeding, feeding, and sheltering habitats, and increased risk of predation. The Air Force will minimize effects by using qualified biologists as proposed, limiting the duration of handling, requiring proper transport of individuals, and identifying suitable relocation sites. The relocation of individuals from work areas is expected to greatly reduce the overall level of injury and mortality, if any, which would otherwise occur if individuals were not removed. The Air Force will also reduce any associated risk of spreading chytrid fungus during capture and relocation activities by requiring the implementation of DAPTF. We conclude that adverse effects on the California red-legged frog from capture and relocation activities are low.

The proposed project may produce both temporary and persistent elevated noise levels during the construction and renovation of features. Elevated noise levels may disturb California red-legged frog and has the potential to alter California red-legged frog behavior and induce physiological effects. The proposed construction of the GBSD schoolhouse facility would last for up to 18 months (Evans, pers. comm. 2021b) and occur approximately 213 ft from an ephemeral drainage feature that contains multiple California red-legged frog observations. The Air Force indicates that this feature does not support a resident California red-legged frog population or suitable breeding habitat (Evans, pers. comm. 2021e) but California red-legged frog individuals may utilize this feature and adjacent upland habitat for dispersal. Using guidance provided by the Federal Transit Administration (FTA), the Service assumes the proposed project's new facility construction would result in intermittent noise produced by pile driving equipment of 101 dB and persistent noise with average levels of 85 dBA (at 50 feet from the source) across an 8-hour period (FTA 2006). Utilizing this assumption, noise attenuation levels were estimated to reach a maximum of 88 dB with an average of 72 dB at 213 ft. We have no specific data on the response of California red-legged frog to varying levels or duration of construction noise exposure and consequently use research conducted on related anurans as a surrogate. Traffic noise playback experiments using noise levels between 75-87 dB have demonstrated physiological (Troianowski et al. 2017; Tennessen et al. 2014) responses including increased level of stress hormone in *Hyla* and *Lithobates*. Prolonged elevated stress hormone concentrations can have deleterious effects on survival and subsequent reproduction (reviewed in Tennessen et al. 2014). California red-legged frogs may face increased risk of predation if they are found to move away from noisy areas, with increased activity potentially making them more noticeable to predators. The Air Force will minimize potential noise related impacts on California red-legged frog by limiting work activities associated with proposed new facility construction to occur outside of peak vocalization periods during daylight hours and dry weather. Although individual California red-legged frogs may disperse through the work areas, the Air Force has clarified that no resident frog populations or breeding habitat occur adjacent to work areas which the Service expects will preclude most associated effects. We conclude that adverse effects on the California red-legged frog from construction-related noise exposure will be low.

Effects of New Facility Operations and Maintenance

The proposed project includes the construction of two stormwater retention basins. The Air Force would design basins to be the minimum size and depth necessary to contain site stormwater runoff during a 5-year storm event but is unable to provide the specific size or expected hydroperiod of these features. The Air Force provides that basins would be constructed to allow for natural infiltration of water and expect they will drain quickly (Evans, pers. comm. 2021c). For the purposes of this analysis, the Service assumes that basin features would only fill during large storm events in which they have the potential to hold water for at least a 24-hour period and naturally drain shortly thereafter (within no more than 4 weeks). Consequently, the proposed basin features may infrequently serve as ephemeral breeding habitat for California red-legged frog. If filled, California red-legged frogs may utilize basin features for breeding and basin drainage has the potential to result in the injury or death of any present egg masses through desiccation. The Service also assumes that basin features would require ongoing maintenance including sediment and associated vegetation removal. Depending on when basin maintenance is performed, maintenance activities could result in the injury or death of both adult California red-legged frog and egg mass life stages if present. The Air Force would minimize effects to adult California red-legged frog by constructing basins to contain at least one side having a slope of no more than 45 degrees to allow easy exit of animals. We conclude that adverse effects on the California red-legged frog from stormwater retention basin construction and ongoing maintenance are moderate.

Artificial night lighting associated with new facility construction could have adverse physiological and behavioral effects on California red-legged frogs. The Air Force indicates that artificial night lighting will be incorporated into new facility construction (Evans, pers. comm. 2021f) but was unable to provide the proposed project's specific lighting designs for the Service to review. The Service assumes new facilities will include ultra-violet artificial night lighting features that will illuminate adjacent natural habitats over the course of project operations. Although we have no specific data on the response of California red-legged frogs to artificial night lighting exposure, laboratory and field studies indicate artificial lighting can result in changes in hormone production, growth, as well as alter activity levels including movement and foraging in related anurans (May et al 2019; Hall 2016; Wise 2007; Baker and Richardson 2006). The introduction of artificial night lighting may increase anuran predation rates. Predators may have an increased ability to detect dispersing adult frogs that may move more in newly lit environments. Numerous anurans have been shown to increase foraging activity surrounding permanent light sources (reviewed in Buchanan 2006), likely attributed to increased concentrations of prey levels resulting from insects' attraction to ultraviolet light (Longcore 2017). Permanent lighting adjacent to roadways or parking lots may result in increased vehicle strikes if California red-legged frogs increase foraging levels in these areas. Based on a review of individual feature footprint locations within or adjacent to suitable ephemeral aquatic and upland dispersal habitat, and their proximity to known California red-legged frog records, long-term introduced artificial lighting may have adverse effects on California red-legged frog. However, the total number of records adjacent to new construction features across the extent of the action area indicates the number of individuals that may be affected would be relatively low. We conclude that adverse effects on the California red-legged frog from artificial night light exposure may be low.

New facilities would have landscaping that requires maintenance, including the use of herbicide application (Kaisersatt, pers. comm. 2021). The proposed GBSD Schoolhouse footprint is located approximately 213 ft from a nearby drainage that contains multiple California red-legged frog records. The Component Operations Facility is located within approximately 50 ft from vernal pool feature 24-108 that contains one California red-legged frog occurrence. The remaining five new facilities are located within upland habitat within the known dispersal distance of California red-legged frog. California red-legged frogs utilizing ephemeral aquatic habitat adjacent to facilities or those dispersing through adjacent upland areas could be exposed to herbicides. The Air Force has not provided a list of herbicides that will be used during the proposed project. Certain herbicides, including azoxystrobin and bifenthrin have the potential to cause lethal or sub-lethal toxicity to all life stages of California red-legged frogs if these chemicals were to enter occupied aquatic habitat. Many risk assessments conducted for herbicides do not have any data, or very little data, on terrestrial-phase amphibians and use birds as a surrogate to assess toxicity to amphibians in their terrestrial habitat. Without the ability to assess individual herbicides to be used, the Service assumes herbicide usage adjacent to aquatic habitat as well as in associated upland and dispersal habitat may be toxic to California red-legged frogs and result in injury or mortality. To minimize risks associated with herbicide exposure to California red-legged frogs, the Air Force will incorporate guidelines detailed in the Base-wide Best Management Practices and require that only certified personnel be permitted to apply herbicides. The Air Force will also comply with the EPA injunction on pesticides for California red-legged frogs which puts in place buffer areas (200 ft by air and 60 ft by ground) around California red-legged frog aquatic and upland habitat, and disallows use of certain pesticides within those habitats and buffer zones (EPA 2006). We conclude that adverse effects on the California red-legged frog from ongoing operational landscaping herbicide usage may be moderate.

Effects of the Proposed Action on vernal pool fairy shrimp

While presence of the vernal pool fairy shrimp has not been confirmed in all vernal pool features within the action area, suitable habitat is present and the Air Force assumes that vernal pool features in the project footprint are occupied. The construction and operation of the proposed project may have adverse effects on the vernal pool fairy shrimp through habitat loss (direct and indirect), trampling and crushing of egg cysts by personnel or vehicles, entombment, alteration of hydrology, sedimentation, invasive plant introduction, exposure to chemicals/herbicide, and irrigation runoff.

Effects of Construction

Ground disturbance would occur during construction of new facilities, associated infrastructure, and utility line trenching. Impacts from construction would result in the permanent loss of 2 presumed occupied vernal pools features, with both features totaling approximately 0.04 acre within the proposed footprint of the Vehicle Processing Facility. The proposed project's utility line trenching activities located along New Mexico Ave and 13th Street also have the potential to affect additional vernal pool features. The Air Force will minimize effects by installing fencing in locations where project equipment and personnel are working near vernal pool habitat. The Air Force proposes to offset project effects through the creation of vernal pool habitat

enhancement areas at 3:1 ratio (habitat enhanced: suitable habitat affected), which if successful, may provide a net benefit by improving and potentially increasing the area of suitable habitat. The area of direct suitable vernal pool habitat loss is anticipated to be a small percentage of the known available habitat on VAFB. We conclude that adverse effects on the vernal pool fairy shrimp from ground disturbance and associated direct habitat loss would be low.

All vernal pool fairy shrimp that occur in the action area could be adversely affected by project activities. Cysts within existing vernal pool features could be crushed or entombed by vehicles, heavy equipment, fill, or worker foot traffic during the dry season when work would be conducted. To minimize effects, the Air Force will clearly mark the limits of work areas with fencing, will not place any fill into vernal pool habitats, and salvage excavated topsoil to reinoculate impacted pools. The Air Force will also provide worker awareness training. With the implementation of these avoidance and minimization measures, we conclude that adverse effects on the vernal pool fairy shrimp from trampling and crushing by personnel or vehicles would be low.

The Air Force has identified that project construction has the potential to indirectly alter the hydrology of two existing pool features, 24-108 and 24-110, located adjacent to the Component Operations Facility that total 3.86 acres. The construction of this feature may disrupt impermeable soil layers, change the pattern of runoff, or alter the topography and drainage patterns of adjacent uplands. The Air Force proposes to collect hydroperiod data prior to and following construction to determine if hydrological impacts result from the implementation of the proposed project. The Air Force will offset project effects through the creation of vernal pool habitat enhancement areas at a 3:1 ratio, which may provide a net benefit to vernal pool fairy shrimp. We conclude that adverse effects on the vernal pool fairy shrimp from indirect habitat loss would be low.

Construction may also indirectly reduce habitat quality by increasing erosion and sedimentation into vernal pool features, overall reducing their volume. Increased sedimentation may entomb resting vernal pool fairy shrimp cysts. To minimize effects, the Air Force will install sedimentation barriers down-slope of vernal pools and ensure no fill is located within these features. With the implementation of avoidance and minimization measures, we conclude that adverse effects on the vernal pool fairy shrimp from entombment would be low.

Invasive plants present in the action area could be introduced during project related activities and their overgrowth could adversely affect hydrologic function of vernal pool features. To reduce effects of non-native weed seed introduction, the Air Force will clean all project related equipment and vehicles to be free of weed seeds prior to use in the project area and continue to clean equipment daily. We conclude that adverse effects on the vernal pool fairy shrimp from invasive plant introduction would be low.

Accidental spills of hazardous materials, careless fueling or oiling of vehicles and equipment, and associated runoff could degrade water quality in vernal pool features to a degree where vernal pool fairy shrimp are harmed or killed. Vernal pool feature 24-108 is located approximately 75 ft from Alternative 2 MSA Laydown area and approximately 190 ft from Alternative 1 MSA Laydown. To minimize effects, the Air Force will place sedimentation

barriers down-slope of vernal pool features and inform workers of the importance of preventing hazardous materials from entering the environment. We conclude that adverse effects on the vernal pool fairy shrimp from chemical runoff during construction would be low.

Adverse effects from invasive plant removal and associated herbicide treatment within vernal pool fairy shrimp habitat enhancement areas could occur if herbicides are applied in a manner and under conditions that could inadvertently injure or kill populations of vernal pool fairy shrimp. Enhancement work in vernal pool habitats could also result in adverse effects due to workers trampling or crushing vernal pool fairy shrimp cysts that may be present. The Air Force will minimize these effects by conducting work when soil is completely dry. The Air Force will require that only certified personnel be permitted to apply herbicides within these sensitive environments. With implementation of the proposed avoidance and minimization measures, the Service believes that adverse effects on vernal pool fairy shrimp from worker activity and herbicide use in enhancement areas will be relatively low. The Service believes that invasive plant removal within enhancement areas will result in an overall net benefit to improve the quality and potentially quantity of suitable vernal pool fairy shrimp habitat.

Effects of Facility Maintenance

New facilities would have landscaping that requires maintenance, including the use of herbicide application (Kaisersatt, pers. comm. 2021). The Air Force has not provided a list of herbicides that will be used during the proposed project. The proposed Component Operations Facility footprint is located within approximately 30 ft from vernal pool feature 24-108 and approximately 80 ft from feature 24-110. If these features are occupied, vernal pool fairy shrimp may be exposed to herbicide as a result their adjacency to the new facility. Although little information exists on the effects of pesticides to the vernal pool fairy shrimp, studies have considered the effects on other crustaceans, including other fairy shrimp species (Service 2007). Chemical exposure may include sub-lethal deleterious effects for a variety of species including interference with reproductive (endocrine) systems. Sub-lethal behavioral effects can include erratic swimming, lethargy, decreased predator avoidance, altered foraging, and reduced response to survival cues, although the extent to which vernal pool fairy shrimp exhibit specific effects is not known (Service 2007). To minimize risks associated with herbicide exposure during project operations to vernal pool fairy shrimp, the Air Force will incorporate guidelines detailed in the Base-wide Best Management Practices and only certified personnel will be permitted to apply herbicides. The Air Force will also comply with the EPA injunction on pesticides for California red-legged frogs which disallows use of certain pesticides within aquatic habitats and buffer zones (EPA 2006). We conclude that adverse effects on the vernal pool fairy shrimp from ongoing operational landscaping herbicide usage may be low.

Introduction of water to vernal pool habitats during the dry season (e.g. runoff associated with landscaping irrigation) throughout project operations could cause hatching of vernal pool fairy shrimp cysts at a time of year when the species would not be able to complete their life cycle. Irrigation or wetting of unpaved areas within the project area could also expose cysts present in the soil to fungus if soil in the pools is prevented from drying. This could reduce the size of the local population and subsequent reproductive capacity. We conclude that adverse effects on the vernal pool fairy shrimp from irrigation runoff during project operations may be moderate.

Effects on Recovery

Gaviota tarplant

Adverse effects would occur as a result of the proposed action including removal of approximately 192 individuals in 0.3 acre of habitat in the action area. This would constitute a loss of approximately 0.04 percent of the estimated 4,980 individuals and 0.002 percent of the estimated 170 acres of occupied habitat that was known to support Gaviota tarplant in the Lion's Head area in 2015 (KFS and MSRS 2020). The Air Force will minimize or offset these effects by implementing proposed avoidance and minimization measures including topsoil salvage to attempt to preserve the associated seed bank. The Air Force will also remove invasive plant species adjacent to occupied Gaviota tarplant habitat at a 2:1 ratio.

The amount and quality of habitat potentially lost relative to the distribution of the species on VAFB and within its larger range would not result in a substantial reduction in the sustainability of the species. With incorporation of replacement and enhancement actions, the magnitude of effects on the local distribution of the species would be further reduced.

We expect the measures to enhance Gaviota tarplant habitat would offset any losses, and that the Air Force would continue to contribute toward recovery priority actions by implementing management of invasive plants and attempting to establish the species in currently unoccupied habitat. Based on these factors, we anticipate adverse effects from the proposed action will not diminish the ongoing contributions of the VAFB Gaviota tarplant population toward overall recovery.

California red-legged frog

The action area is within the Northern Transverse Ranges and Tehachapi Mountains Recovery Unit for the California red-legged frog. The action area is also within the Santa Maria River-Santa Ynez River Core Area defined in the recovery plan. The recovery unit was described in the recovery plan as having a "high recovery status," meaning the unit supports many populations of the species and has many areas of high habitat quality.

The proposed project would not appreciably increase the threats currently impacting the California red-legged frog in the Santa Maria River-Santa Ynez River core area or preclude the Service's ability to implement recovery actions. The project would remove a portion of suitable California red-legged frog non-breeding ephemeral aquatic and upland habitat and may reduce the local population if the species is present; however these losses would represent a small portion of the habitat and individuals present at VAFB, in this unit, and in this core area. With the proposed incorporation of species-specific measures to avoid and/or minimize effects to the species, the potential for effects to recovery is low.

Vernal pool fairy shrimp

The proposed project would not appreciably increase the threats currently impacting the vernal pool fairy shrimp in the Santa Barbara vernal pool region or preclude the Service's ability to

implement recovery actions. The project would permanently remove a small portion of vernal pool habitat (0.04 acre) and may indirectly impact an additional 3.86 acres due to potential hydrological effects, totaling 3.9 acres. The project may reduce the local population of vernal pool fairy shrimp if the species is present. However, these losses would represent a small portion of the habitat and individuals present in this vernal pool region. The Air Force proposes the enhancement of vernal pool fairy shrimp habitat which could contribute to recovery goals if successful. With the proposed incorporation of species-specific measures to avoid and/or minimize effects to the species, the potential for effects to recovery is low.

Summary of Effects

Gaviota tarplant

The proposed project could affect Gaviota tarplant and their associated seed bank within the action area. The proposed project may remove approximately 192 individual Gaviota tarplant and the associated seed bank occupying a combined 0.3 acres within the LF-04 footprint. The project will impact approximately 18.3 acres of suitable Gaviota tarplant habitat. Impacts may occur to all Gaviota tarplant individuals and associated seed bank within the project footprint. Adjacent populations may also be impacted as a result of herbicide application in enhancement areas, trampling by workers, and the potential introduction and spread of non-native invasive plants. The Air Force will minimize these effects by implementing proposed avoidance and minimization measures. The Air Force will attempt to preserve Gaviota tarplant seed bank by salvaging topsoil in impacted areas and proposes to enhance Gaviota tarplant habitat a 2:1 ratio (habitat enhanced: occupied habitat impacted).

We do not expect that the project would affect the Lion's Head Gaviota tarplant populations to a magnitude that would prevent them from sustaining themselves. With continued management of habitat enhancement areas, an overall net increase in available suitable habitat for the species may occur as a result of project implementation.

California red-legged frog

The proposed project could affect California red-legged frogs (adults, juveniles, and egg masses) within the action area given the known occurrence of the species, presence of suitable habitat, and the overlap of proposed project activities with the species' breeding season. The proposed project includes impacts to ephemeral aquatic and dispersal habitat as well as the creation and maintenance of stormwater retention basins, which may serve as potential breeding habitat and could cause adverse effects to California red-legged frog adults and egg masses. California red-legged frogs inhabiting the action area could be impacted during construction activities as well as during operation as a result of the introduction of artificial night lighting and continued herbicide application during landscaping maintenance. Despite implementation of the proposed conservation measures described previously, based on the spatial and permanent extent of proposed project impacts, we conclude that some California red-legged frogs may be killed or injured as a result of project implementation. We do not expect that local populations would be affected to a magnitude that would prevent them from sustaining themselves. We do not expect that the project would affect the ability of the Santa Maria River-Santa Ynez River core area to

remain occupied by the species, nor would it prevent connectivity between occupied areas or prevent dispersing individuals from colonizing other areas.

Vernal pool fairy shrimp

The proposed project could affect all vernal pool fairy shrimp present within the action area. Two pools that encompass approximately 0.04 acre and are assumed occupied will be permanently removed. Two additional vernal pool features, 24-108 and 24-110 totaling 3.86 acres, may be subject to potential indirect hydrological impacts as a result of project implementation. Consequently, an anticipated total of 3.9 acres may be impacted by the proposed project. Based on the relatively small area of impacts and the proposed conservation measures, we conclude that a small proportion of the local vernal pool fairy shrimp population across VAFB is likely to be killed or injured, if present. To minimize effects, the Air Force proposes to enhance vernal pool fairy shrimp habitat a 3:1 ratio. Vernal pool fairy shrimp habitat quality within the area would be improved as a result of the implementation of the proposed habitat enhancement efforts. The project would not appreciably increase threats to the species in the Santa Barbara vernal pool region or preclude the Service's ability to implement recovery actions. If habitat enhancement is successful, the project would likely support identified recovery goals, including the protection and management of suitable habitat. We do not anticipate any long-term effects to the overall population, reproductive capacity, or recovery of the vernal pool fairy shrimp as a result of the proposed project's implementation.

Table 3. Approximate Coverage (acres) of Suitable Habitat for Listed Species with the Potential to be Impacted by the Proposed Action.

Total Suitable Habitat Impacted	**Acres of Suitable Habitat Potentially Impacted**		
	Gaviota Tarplant	**Vernal Pool Fairy Shrimp**	**California Red-legged Frog**
	18.3*	3.9**	4.0***

*0.3 acres of occupied habitat and 18 acres of suitable unoccupied habitat located within proposed project footprint.
**3.86 acres subject to potential hydrological impacts, 0.04 acres subject to physical impacts (destruction of pools).
***Ephemeral aquatic habitat including vernal pools and arroyo willow riparian forest that do not support breeding. Does not include loss of suitable upland/dispersal habitat.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. We do not consider future Federal actions that are unrelated to the proposed action in this section because they require separate consultation pursuant to section 7 of the Act. We are unaware of any future State, tribal, local or private actions that are reasonably certain to occur in the action area.

CONCLUSION

The regulatory definition of "to jeopardize the continued existence of the species" focuses on assessing the effects of the proposed action on the reproduction, numbers, and distribution, and their effect on the survival and recovery of the species being considered in the biological opinion. For that reason, we have used those aspects of the Gaviota tarplant, California red-legged frog, and vernal pool fairy shrimp respective statuses as the basis to assess the overall effect of the proposed action on the species.

Gaviota tarplant

Reproduction

Though adverse effects would occur from removal of occupied habitat, we anticipate project-related adverse effects to the reproductive capacity of Gaviota tarplant would be minimized by the species-specific measures proposed by the Air Force including topsoil salvage and seed collection if these activities are conducted following seed set. Even if activities are not conducted at the proper time, we still expect that the adverse effects of the proposed action would not appreciably reduce the reproductive capacity of Gaviota tarplant on base or rangewide.

Numbers and Distribution

Approximately 0.3 acre containing 192 individuals of Gaviota tarplant may be lost as a result of the proposed project. The Air Force will attempt to salvage the associated seed bank to create potential for future propagation. The exact number of individuals that may be lost will vary being that Gaviota tarplant is an annual species that is known to undergo notable seasonal fluctuation in its extent and spatial distribution. Additionally, annual variation in the proportion of plants that conform to the accepted Gaviota tarplant phenotype is known to occur in the Lion's Head area. The number of Gaviota tarplant we expect to be affected by the proposed activities is small relative to the Lion's Head area population, which was documented to contain 170 acres comprising 4,980 individuals in 2015, as well as those in the entirety of the species' range. Therefore, we conclude that the proposed project would not significantly reduce the number in the action area or the rangewide population.

Similarly, we expect that effects of the proposed action would have a low to immeasurable effect on the distribution of Gaviota tarplant. We expect that the proposed action would not appreciably reduce the distribution of Gaviota tarplant on base or rangewide. The implementation of proposed habitat enhancement areas at a 2:1 ratio may create new suitable habitat that serves to enhance the existing population as a result of project implementation.

Recovery

The Air Force would contribute toward recovery priority actions by implementing management of invasive plants and attempting to establish Gaviota tarplant in currently unoccupied habitat within enhancement areas. We expect conditions for Gaviota tarplant at VAFB would not decline

measurably by the effects of the proposed action, and consequences of the proposed action would not appreciably interfere with the overall recovery of Gaviota tarplant.

After reviewing the current status of Gaviota tarplant, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Gaviota tarplant because:

1. The Project would affect a small number of Gaviota tarplant individuals and would not appreciably reduce its population numbers at the local level, or rangewide.
2. The Project would not appreciably reduce reproduction of the species either locally, or rangewide.
3. The Project would not appreciably reduce the species' distribution either locally (Lion's Head population on VAFB), or rangewide.
4. The Project would not cause any effects that would appreciably preclude our ability to recover the species.

California Red-legged Frog

Reproduction

The proposed project would not result in a loss of California red-legged frog breeding habitat. However, the construction of the two stormwater retention basins could result in the creation of ephemeral breeding habitat which may impact California red-legged frog breeding efforts and result in associated loss of egg masses. Overall, these basins would constitute a very small portion of suitable breeding habitat across VAFB and are not anticipated to fill frequently. The Air Force would implement measures to minimize the risk of adverse effects to California red-legged during dispersal, breeding season, or during above-average wet conditions. Consequently, we do not expect that breeding efforts for the California red-legged frogs would be measurably affected by the proposed activities and conclude that the proposed project would not appreciably reduce successful California red-legged frog reproduction in the action area, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Units, or rangewide.

Numbers and Distribution

We are unable to determine the number of California red-legged frogs that could occur in the action area that may be affected by proposed project because existing survey data are insufficient to estimate population numbers, and the numbers of individuals in the action area likely vary from year to year. Proposed project activities could affect individual California red-legged frogs to the point of injury or death, although we expect injury or mortality to be low based on the avoidance and minimization measures the Air Force has proposed and being that the action area is largely upland dispersal habitat where California red-legged frog are less frequently encountered. The number of California red-legged frogs we expect to be affected by the proposed activities is very small relative to VAFB populations and those in the entirety of the species' range. Therefore, we conclude that the proposed project would not appreciably reduce

the number of California red-legged frog in the action area, in the Northern Transverse Ranges and Tehachapi Mountains Recovery Units, or rangewide.

Similarly, we expect that effects of the proposed action would have a low to immeasurable effect on the distribution of California red-legged frog. We expect that the proposed action would not appreciably reduce the distribution of California red-legged frog on base or rangewide.

Recovery

The proposed action would not result in any appreciable change in reproduction, population numbers, or distribution of the California red-legged frog and would not preclude the Service's ability to implement any of the measures identified in the recovery plan for the species. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the California red-legged frog in the Northern Transverse Ranges and Tehachapi Mountains Recovery Units, or rangewide.

Conclusion for the California Red-legged Frog

After reviewing the current status of the California red-legged frog, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the California red-legged frog, because:

1. The Project would not appreciably reduce reproduction of the species either locally, or rangewide.
2. The Project would affect a very small number of individuals and would not appreciably reduce numbers of the California red-legged frog at the local level, or rangewide.
3. The Project would not appreciably reduce the species' distribution either locally (on VAFB), or rangewide.
4. The Project would not cause any effects that would appreciably preclude our ability to recover the species.

Vernal pool fairy shrimp

Reproduction

We expect no appreciable effects on reproduction of vernal pool fairy shrimp as a result of the implementation of the proposed project. Two vernal pool features comprising 0.04 acre will be permanently lost and two additional pool features (24-108 and 24-110, 3.86 acres) are subject to potential project hydrological impacts. Construction activities may result in the destruction of potential resting cysts and could result in a reduced carrying capacity of vernal pool features within the action area as a result of sedimentation or the alteration of pool hydrology. However, the effects on reproduction are expected to be low due the relatively small size of the vernal pools that will be permanently lost or potentially impacted by the proposed project. The Air Force will minimize effects by removing the cyst bank in impacted areas before the project

begins if excavation is required within occupied vernal pool fairy shrimp habitat. This will reduce the number of vernal pool fairy shrimp cysts that would be destroyed or removed. The Air Force will also compensate for habitat loss by enhancing nearby vernal pool habitat at a 3:1 ratio. Therefore, we conclude that the proposed project will not appreciably reduce the reproduction of the vernal pool fairy shrimp locally or rangewide.

Numbers

The proposed project would likely have a low effect on the numbers of the vernal pool fairy shrimp. Vernal pool fairy shrimp resting cysts, if present, may be destroyed as a result of proposed project construction activities. The population of vernal pool fairy shrimp in the action area, if present, is likely to be small being that the majority of features are subjected to existing disturbance being situated in the VAFB Cantonment area and are considered of low quality. The Air Force has proposed avoidance and minimization measures which should minimize the number of vernal pool fairy shrimp cysts destroyed by project activities. The Air Force has also proposed vernal pool habitat enhancement which may increase the carrying capacity of nearby vernal pool features. Therefore, we conclude that the loss of a small proportion of the local vernal pool fairy shrimp population, if present, would not appreciably reduce the local or rangewide population of the species.

Distribution

We expect no appreciable effects on the distribution of the vernal pool fairy shrimp. The project would result in a permanent total loss of 2 pools (0.04 acre) with potential hydrological impact to 2 additional pools (3.86 acres) of assumed occupied vernal pool fairy shrimp habitat. There are 160 vernal pools (83.9 acres) on VAFB known to support vernal pool fairy shrimp with an additional 152 vernal pools (42.6 acres) of potential habitat. If currently present, the species is expected to continue to occupy the action area. Only a small portion of the available vernal pool habitat would be removed, and indirect adverse effects to the remaining habitat are expected to be minimized by the proposed conservation measures. In addition, the Air Force would enhance nearby vernal pool habitat at a 3:1 ratio. Therefore, we conclude that the proposed action will not appreciably reduce the distribution of the vernal pool fairy shrimp locally or rangewide.

Recovery

We do not anticipate that the proposed action would appreciably affect recovery of the vernal pool fairy shrimp in the Santa Barbara vernal pool region or rangewide. The project would affect a small area of suitable habitat relative to the species' range and may injure or kill a small proportion of any individuals present locally. The project would not increase the threats currently impacting the vernal pool fairy shrimp nor preclude the Service's ability to implement recovery actions. The Air Force proposes to enhance vernal pool habitat at a 3:1 ratio to minimize project effects, which if successful may contribute to recovery goals. Therefore, we conclude that the proposed action would not appreciably reduce the likelihood of recovery of the vernal pool fairy shrimp.

Conclusion for the vernal pool fairy shrimp

After reviewing the current status of the vernal pool fairy shrimp, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the vernal pool fairy shrimp, because:

1. The Project would not substantially reduce reproduction of the species either locally (on VAFB), or rangewide.
2. The Project may affect a small number of potentially occupied pools but would not appreciably reduce numbers of the vernal pool fairy shrimp at the local level, or rangewide.
3. The Project would not appreciably reduce the species' distribution either locally (on VAFB), or rangewide.
4. The Project would not cause any effects that would appreciably preclude our ability to recover the species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

AMOUNT OR EXTENT OF TAKE

California red-legged frog

We anticipate that some California red-legged frogs could be taken as a result of the proposed action. We expect the incidental take to be in the form of capture, injury, and mortality. We cannot quantify the precise number of California red-legged frogs that may be taken as a result of the actions that Air Force has proposed because California red-legged frogs move over time; for example, animals may have entered or departed the action area over time. The protective measures proposed by Air Force are likely to prevent mortality or injury of most individuals during construction. In addition, finding a dead or injured California red-legged frog is unlikely. Consequently, we are unable to reasonably anticipate the actual number of California red-legged frogs that would be taken by the proposed project; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects

Analysis sections of this biological opinion indicate that adverse effects to California red-legged frog would likely be low given the implementation of proposed avoidance and minimization measures, and we, therefore, anticipate that take of California red-legged frogs would also be low. We also recognize that for every California red-legged frog found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

Similarly, for estimating the number of California red-legged frogs that would be taken by capture, we cannot predict how many may be encountered for reasons stated earlier. While the benefits of relocation (i.e., minimizing mortality) outweigh the risk of capture, we must provide a limit for take by capture at which consultation would be reinitiated because high rates of capture may indicate that some important information about the species' in the action area was not apparent (e.g., it is much more abundant than thought). Conversely, because capture and relocation can be highly variable, depending upon the species and the timing of the activity, we do not anticipate a number so low that reinitiation would be triggered before the effects of the activity were greater than what we determined in the Effects Analysis. Therefore, if 2 adult or juvenile California red-legged frog is found killed or wounded, including during capture and relocation, annually (or 4 over the course of the construction and maintenance); 5 adults or juveniles are captured annually (or 20 over the course of the construction and maintenance); or 1 egg mass is killed or wounded in the stormwater retention basin, the Air Force must contact our office immediately to reinitiate formal consultation (Table 4). We do not anticipate any take of tadpole life stage in association with basin features being that California red-legged frog egg masses take four weeks to hatch and we assume these features will hold water for less than four weeks. Project activities that are likely to cause additional take should cease as the exemption provided pursuant to section 7(o)(2) may lapse and any further take could be a violation of section 4(d) or 9.

Table 4. Summary of Incidental Take

Life Stage	*Quantity (per calendar year)*	*Maximum limit over the duration of the project*	*Type of Take*
Adults or juveniles	2	4	Killed or wounded (including during capture and relocation)
Adults or juveniles	5	20	Captures
Egg masses	1*	1*	Killed or wounded (crushed or damaged)

*Take associated with construction and maintenance of stormwater retention basins

Vernal pool fairy shrimp

We anticipate that an indeterminable number of vernal pool fairy shrimp present in the action area could be taken as a result of the proposed action. We expect the incidental take to be in the form of direct injury or mortality from destruction or entombment resting cysts during construction activities, and indirect injury or death of cysts, juveniles, or adults resulting from a reduction in the quantity or quality of habitat in the vernal pool or its adjacent watershed.

We cannot quantify the precise number of vernal pool fairy shrimp that may be taken as a result of the action that the Air Force has proposed because the species is difficult to detect and unevenly distributed in the environment. Also, populations may vary in size between years and may not be observed at all in some years due to environmental conditions. Finding a dead or injured vernal pool fairy shrimp individual is unlikely due to their small size and their microscopic resting eggs are not detectable in the field. The protective measures proposed by the Air Force are likely to limit mortality or injury to a small proportion of the individuals present.

Consequently, we are unable to reasonably anticipate the actual number of vernal pool fairy shrimp that would be taken by the proposed action; however, we must provide a level at which formal consultation would have to be reinitiated. The Environmental Baseline and Effects Analysis sections of this biological opinion indicate that adverse effects to vernal pool fairy shrimp would likely be low given the nature of the proposed activities, and we, therefore, anticipate that take of vernal pool fairy shrimp would also be low. We also recognize that for every vernal pool fairy shrimp found dead or injured, other individuals may be killed or injured that are not detected, so when we determine an appropriate take level we are anticipating that the actual take would be higher and we set the number below that level.

Regulations allow for Incidental Take Statements to rely on the use of "surrogates" for estimating the amount of take that is reasonably certain to occur as a result of the proposed action in certain circumstances. To use a surrogate to estimate take, the following criteria must be met: (1) the Incidental Take Statement must describe the causal link between the surrogate and the take of the listed species; (2) the Incidental Take Statement must explain why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and (3) the Incidental Take Statement must set a clear standard for determining when the level of anticipated take of the listed species has been exceeded.

Due to the difficulty of detecting incidental take of vernal pool fairy shrimp, we quantify take by adopting impacts to their habitat as a surrogate. We have determined that if the proposed action directly affects more than 0.04 acre and indirectly affects more than 3.86 acres of vernal pool fairy shrimp habitat in the action area (totaling of 3.9 acres), the Air Force must contact our office immediately to reinitiate formal consultation. Project activities conducted outside the 3.9-acres total area are likely to cause additional take and should cease as the exemption provided pursuant to section 7(o)(2) would lapse, and any further take could be a violation of section 4(d) or 9.

Gaviota tarplant

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species; however, limited protection of listed plants is provided at section 9(a)(2) to the extent that the Act prohibits the removal and reduction to possession of federally listed plants from areas under Federal jurisdiction, the malicious damage or destruction of such plants on areas under Federal jurisdiction, and the destruction of listed plants on non-Federal areas in violation of State law or regulation or in the course of a violation of a State criminal trespass law.

REASONABLE AND PRUDENT MEASURES

The measures described below are non-discretionary, and must be undertaken by the Air Force or made binding conditions of any grant or permit issued to the Air Force as appropriate, for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force (1) fails to assume and implement the terms and conditions or (2) fails to require the Air Force to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Air Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)]. The Service's evaluation of the effects of the proposed action includes consideration of the measures developed by the Air Force and repeated in the Description of the Proposed Action portion of this biological opinion, to minimize the adverse effects of the proposed action on the California red-legged frog and vernal pool fairy shrimp. Any subsequent changes in the minimization measures proposed by the Air Force may constitute a modification of the proposed action and may warrant re-initiation of formal consultation, as specified at 50 CFR 402.16.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the incidental take of California red-legged frog and vernal pool fairy shrimp:

1. The Air Force must ensure that biologists used for survey, monitoring, training, and capture and relocation tasks are skilled and experienced.
2. The Air Force must reduce potential for injury or mortality of California red-legged frogs and vernal pool fairy shrimp.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Air Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following term and condition implements reasonable and prudent measure 1:

1. The Air Force must request Service approval of any biologist who will conduct activities related to this biological opinion at least 30 days prior to any such activities being conducted. A qualified biologist(s) is more likely to reduce adverse effects based on their expertise with the covered species. Please be advised that possession of a 10(a)(1)(A) permit for the covered species does not substitute for the implementation of this measure. Authorization of Service-approved biologists is valid for this consultation only.

The following terms and conditions implement reasonable and prudent measure 2:

2. To further reduce the time a California red-legged frog is in captivity, the Air Force must identify areas to relocate individuals (receiver sites) prior to surveys. California red-legged frogs that are relocated must be maintained in a manner that does not expose them to temperatures or any other environmental conditions that could cause injury or undue stress.
3. To reduce effects to California red-legged frog egg masses, the Air Force must monitor stormwater retention basins during storm events for a period of 5 years to determine if the basins are properly draining and that they do not hold water for more than a 24-hour period. If basin features are found to hold water for over 24 hours at any point following their construction, the Air Force must survey for California red-legged frog egg masses and relocate them to suitable habitat prior to basin drainage.
4. The Air Force must develop a management plan in coordination with the Service to form guidelines to reduce the potential injury or mortality of California red-legged frog egg masses resulting from desiccation. The management plan must ensure that any California red-legged frog egg masses present are collected and relocated prior to basin drainage.
5. Any required maintenance conducted within the two stormwater retention basins (e.g. sediment removal or vegetation clearance), must be conducted when basins are completely dry to avoid incidental take of adult California red-legged frog that could inhabit these features. The Air Force must survey the two stormwater retention basins for California red-legged frogs prior to any maintenance and monitor work activities.
6. The Air Force must limit all project artificial night lighting on adjacent natural habitats. The Air Force must shield lights in a manner to ensure that light falls only on intended surfaces. Light design considerations must include use of embedded lights, cutoff shields, and light timers to decrease light intensity and duration. The Air Force must use lighting with no ultraviolet emissions that attract insects (Longcore et al. 2017).
7. The Air Force must design irrigation systems associated with landscaping in a way that minimizes the potential for sedimentation and water runoff into adjacent vernal pool features. The Air Force must also ensure that any leaks associated with water systems leaks are promptly identified and addressed to reduce impacts to vernal pool fairy shrimp resting cysts (e.g. early hatching or fungus introduction).
8. To reduce potential injury of California red-legged frog and vernal pool fairy shrimp, the Air Force must not apply herbicides/pesticides within 48 hours of a predicted (greater than 50 percent chance forecast) significant rain event (0.2 inch or greater with 24-hour period). The National Weather Service 72-hour forecast must be consulted for the project area (https://www.wpc.ncep.noaa.gov/kml/kmlproducts.php#qpf). The Air Force must require that 30 CES/CEIEA staff familiar with California red-legged frog biology review and approve all individual chemical to be used within suitable California red-legged habitat. All chemical label specifications must be followed. Marker dyes must be utilized in all herbicide mixtures so workers can readily see spills, drift, or misapplication. To avoid chemical drift, no foliar spray applications may be conducted when wind speeds

exceed 12-mph. Foliar spray applications must use directed sprayers with low-pressure, large droplet nozzles (Cal-IPC 2015).

9. The Air Force must not refuel equipment or wash concrete or paint in areas that may drain into vernal pool fairy shrimp habitat. The Air Force must use secondary containment such as drip pans to prevent spills of potential contaminants. The Air Force must develop a spill containment and cleanup plan prior to the start of work. The Air Force must require that workers have spill kits available to them at all times.

REPORTING REQUIREMENTS

Pursuant to 50 CFR 402.14(i)(3), the Air Force must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement. The Air Force must notify the Service within three days of finding an injured or dead California red-legged frog. The Air Force must provide a written report due by January 30 for each fiscal year (October – September) that activities are conducted pursuant to this biological opinion. The report must state the impacts to habitat for Gaviota tarplant and vernal pool fairy shrimp. The report must include datasheets detailing Gaviota tarplant seed collection and storage information, subsequent topsoil salvage and storage methods, the locations of habitat enhancement sites in relation to the extent of known Gaviota tarplant populations, and the results of habitat enhancement area seeding, weed removal, and topsoil salvage efforts. The report must also disclose the number of days proposed stormwater retention basins are found to hold water for over a 24-hour period per year and the total number of California red-legged frog killed or injured, including a description of the circumstances of the mortalities or injuries if known. The report must also document the number and size of any California red-legged frogs and egg masses relocated from the action area, the date and time of relocation, and a description of relocation sites. The report must contain a brief discussion of any problems encountered in implementing minimization measures, results of biological surveys, and any other pertinent information. These reports will assist us in evaluating future measures for the protection of federally listed species in the action area. We encourage you to submit recommendations regarding modification of or additional measures that would improve or maintain protection of listed species, while simplifying compliance with the Act.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Within three working day of locating a dead or injured California red-legged frog the Air Force must make initial notification by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766). The notification must include the time and date, location of the carcass, a photograph, cause of death if known, and any other pertinent information.

Care must be taken in handling injured animals to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis. Injured animals must be transported to a qualified veterinarian. If any injured California

red-legged frog survive, the Air Force should contact us regarding their final disposition. The remains of California red-legged frog must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321).

The Service assumes that remains of any vernal pool fairy shrimp killed by project activities will be entombed and therefore inaccessible. If the Air Force comes into possession of any dead or injured vernal pool fairy shrimp, the Air Force must contact the Service regarding further disposition of these specimens.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend the Air Force consider utilizing the previously disturbed lots immediately west of the proposed Components Operations Facility in place of the proposed Alternative 2 MSA Laydown to reduce disturbance of intact maritime chaparral that serves as unoccupied suitable Lompoc yerba santa habitat.
2. We recommend the Air Force develop their proposed Lompoc yerba santa management plan in coordination with the Service to preserve the species into perpetuity.
3. We recommend that any herbicide application be limited within Gaviota tarplant habitat enhancement areas. If herbicide must be used, application should occur outside of Gaviota tarplant's bloom window and after vegetation has senesced (late November).
4. We recommend that the Air Force conduct Gaviota tarplant topsoil salvage and seed collection at the proper time following seed set. We recommend that the Air Force coordinate with our office when planning topsoil salvage and seed collection efforts to ensure best practices are implemented.
5. Being that Gaviota tarplant's seed viability characteristics are unknown, we recommend that the Air Force limit the duration of Gaviota tarplant topsoil storage to the extent practicable to help reduce potential damage to the associated seed bank. We also recommend that topsoil piles are spread to the depth at which they were collected, be surrounded by waddles (made from weed-free materials) to reduce potential erosion, and not be covered by any tarp to prevent solarization. We recommend that topsoil storage locations not be located immediately adjacent to high weed infestation areas.
6. To promote Gaviota tarplant recovery goals, we recommend that the Air Force use the project's topsoil salvage and habitat restoration efforts as research opportunities involving seed bank viability and outplanting success. We recommend that the Air Force

collect additional Gaviota tarplant data that would help inform recovery efforts including information on the species' ecological tolerances, genetics, pollinators, and other restoration efforts.

7. We recommend that the Air Force minimize movement of work equipment to the degree possible across the project area to further reduce transport of weeds. We recommend that the Air Force designate equipment to work in specific areas and stage vehicles in laydown areas as close as possible to respective work areas.
8. We recommend that the Air Force advise Service-approved biologist(s) to relocate all other native reptiles or amphibians found within work areas to suitable habitat outside of project areas if such actions are in compliance with State laws.
9. We recommend that the Air Force survey for and lethally remove introduced non-native predatory species, including American bullfrog (*Lithobates catesbeianus*) and crayfish (*Cambarus* spp.), found within California red-legged frog habitat during surveys and other project related inspection activities.
10. We recommend that the Air Force investigate the efficacy of capture and moving of California red-legged frogs to determine if use of this minimization measure reduces adverse effects of project actions on the species. As part of this, information on repeat capture and behavior of individuals post-movement should be noted.
11. We recommend that when collecting soil within impacted vernal pools, the Air Force collect multiple samples spatially distributed within each pool between the depths of 2 to 4 inches rather than the proposed 0.4 to 1.2 inches.
12. We recommend that during post-construction hydrological analysis of potentially impacted vernal pool features (24-108 and 24-110) that the Air Force include the use of reference site locations to facilitate evaluation of changes observed.
13. We recommend that the Air Force install approved mufflers on mechanized equipment (particularly when using impact/pile drivers capable of generating over 100dB noise levels) or install a temporary sound wall during construction to reduce noise disturbance to California red-legged frogs and other wildlife in the near vicinity.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or

extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) may have lapsed and any further take could be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending reinitiation.

If you have any questions about this biological opinion, please contact Sarah Termondt of my staff at 805-677-3334, or by electronic mail at sarah_termondt@fws.gov.

Sincerely,

STEPHEN HENRY Digitally signed by STEPHEN HENRY
Date: 2021.04.05 16:24:02 -07'00'

Stephen P. Henry
Field Supervisor

LITERATURE CITED

Adams, V. M., D. M. Marsh, and J. S. Knox. 2005. Importance of the seed bank for population viability and population monitoring in a threatened wetland herb. Biol. Conserv. 124: 425-436.

Baker B.J., and Richardson, J.M.L. 2006. The effect of artificial light on male breeding-season behaviour in green frogs, *Rana clamitans melanota*. Canadian Journal of Zoology. 84(10): 1528-1532.

Baldwin, B. G. 2007. A systematic investigation of *Deinandra increscens*, with special reference to subsp. *villosa*. Final report on file at Ventura Fish and Wildlife Office. 19 pp. + Appendices.

Baldwin, B. G. 2009. Morphological and molecular reconsideration of *Deinandra increscens* subsp. *villosa*. Final report on file at Ventura Fish and Wildlife Office. 18 pp. + Appendices.

Baldwin, B. G. 2012. *Deinandra*. Pp. 296-301. In: B. G. Baldwin, D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds), The Jepson manual: Vascular plants of California, second edition. U.C. Press, Berkeley, California.

Basto, S., Thompson, K., Grime, J.P. et al. 2018. Severe effects of long-term drought on calcareous grassland seed banks. Climate and Atmospheric Science 1:1-7.

Buchanan, B. W. 2006. Observed and potential effects of light pollution on anuran amphibians. Chapter 9 in Longcore, T. and C. Rich (Eds). Ecological Consequences of Artificial Night Lighting. Island Press; pp. 192-220.

Bulger, J. B., N. J. Scott, and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California red-legged frogs (*Rana aurora draytonii*) in coastal forests and grasslands. Biological Conservation 110:85-95.

Calef, G.W. 1973. Natural mortality of tadpoles in a population of *Rana aurora*. Ecology 54:741–758.

Caorsi, V.Z., Both, C., Cechin S., Antunes, R., Borges-Martins, M. 2017. Effects of traffic noise on the calling behavior of two Neotropical hylid frogs. PLoS One. 12(8):1-14.

[Cal-IPC] California Invasive Plant Council. 2015. Best management practices for wildland stewardship: Protecting wildlife when using herbicides for invasive plant management. Cal-IPC Publication 2015-1. California Invasive Plant Council, Berkeley, CA. Available: www.cal-ipc.org

[CCH] Consortium of California Herbaria. 2013. Information regarding *Deinandra increscens* subsp. *villosa* herbarium specimens deposited in the following herbaria: CAS, DS, JEPS, NY, POM, RSA, SBBG, SD, SDSU, UC, UCR, UCSB. http://ucjeps.berkeley.edu/chc_form.html. April 19, 2013.

Christopher, S.V. 1996. Reptiles and amphibians of Vandenberg Air Force Base, Santa Barbara County, California. 1195: A focus on sensitive species. Unpublished report to Department of the Air Force, Cooperative Agreement no. 1445-0007-94-8133. 145 pp. + appendices.

[CNDDB] California Natural Diversity Data Base. 2013. Data for *Deinandra increscens* subsp. *villosa*. Rarefind: A database application for the California Department of Fish and Wildlife, Natural Heritage Division data, California Natural Diversity Data Base, Sacramento. 51 pp. Dated April 19, 2013.

[CNDDB] California Natural Diversity Data Base. 2019a. Data for *Deinandra increscens* subsp. *villosa*. Rarefind: A database application for the California Department of Fish and Wildlife, Natural Heritage Division data, California Natural Diversity Data Base, Sacramento. 26 pp. Dated August 19, 2019.

[CNDDB] California Natural Diversity Database. 2019b. California Department of Fish and Wildlife. Element Occurrence Query for *Branchinecta lynchi*. September 5. Unpaginated.

[CNDDB] California Natural Diversity Data Base. 2020. State and Federally Listed Endangered, Threatened, and Rare Plants of California. California Department of Fish and Wildlife. Sacramento, CA. September.

[CNDDB] California Natural Diversity Database, California Department of Fish and Game. 2021. Rarefind application v. 5.2.14. Accessed December 5-20, 2021.

Davidson, C., H. B. Shaffer, and M. R. Jennings. 2001. Declines of the California red-legged frog: climate, UV-B, habitat, and pesticides hypotheses. Ecological Applications 11:464–479.

Dudek. 2019a. Biological Assessment for the Strauss Wind Energy Project; Santa Barbara County, California. Dated July 2019. 244 pp. + Appendices.

Dudek. 2019b. Geographic information system (GIS) files for the Strauss Wind Energy Project, including *Deinandra increscens* subsp. *villosa* survey data for the 2018 survey year. Dated August 26, 2019. Unpaginated.

Elam, D.R. 1994. Genetic variation and reproductive output in plant populations: effects of population size and incompatibility (*Lilium parryi, Lilium humboldtii, Raphanus sativus, Eriodictyon capitatum*). Ph. D. dissertation, University of California, Riverside. 221 pp.

[EPA] Environmental Protection Agency v. Center for Biological Diversity. 2006. Stipulated Injunction and Order; Case No.: 02-1580-JSW (JL). October 20, 2006. Available: https://www.epa.gov/sites/production/files/2015-07/documents/stipulated-injunction.pdf

Eriksen, C. H. and D. Belk. 1999. Fairy shrimps of California's puddles, pools, and playas. Mad River Press, Eureka, California.

[FTA] Federal Transit Administration. 2006. Transit noise and vibration impact assessment. Office of Planning and Environment FTA-VA-90-1003-06. May 2006. 261 pp. with appendices.

Gallagher, S. P. 1996. Seasonal occurrence and habitat characteristics of some vernal pool branchiopoda in northern California, USA. J. Crustacean Biologist 16(2): 323-329.

Hall, A. 2016. Acute Artificial Light Diminishes Central Texas Anuran Calling Behavior. The American Midland Naturalist. 175:183-193.

Hayes, M. P., and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): Implications for management. Pages 144-158 in R. Sarzo, K.E. Severson, and D.R. Patton (technical coordinators). Proceedings of the Symposium on the Management of Amphibians, Reptiles, and Small Mammals in North America. USDA Forest Service General Technical Report RM-166.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog *Rana aurora draytonii* (Ranidae). The Southwestern Naturalist 30:601-605.

Helm, B. P. 1998. Biogeography of eight large branchiopods endemic to California. Pages 124-139 *in*: C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr. and R. Ornduff, editors. Ecology, conservation, and management of vernal pool ecosystems--Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Hendrickson, B., W. R. Ferren Jr., and T. Klug. 1998. Botanical resources of the Hollister Ranch, Santa Barbara County, California. Prepared for Hollister Ranch Conservancy. Museum of Systematics and Ecology, Department of Ecology, Evolution, and Marine Biology, University of California Santa Barbara. Environmental report No. 10

Holland, R. F. 1998. Great Valley vernal pool distribution, photo-revised 1996. Pages 71-75 *in*: C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr. and R. Ornduff, editors. Ecology, conservation, and management of vernal pool ecosystems--Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, California.

Holland, R. F. 2003. Distribution of vernal pool habitats in five counties of California's southern coast ranges. Report to U.S. Fish and Wildlife Service. Ventura, California. 23 pages.

Howald, A. 1989. Report to the Fish and Game Commission on the status of Gaviota tarplant (*Hemizonia increscens* subsp. *villosa*). California Department of Fish and Game. Sacramento. 14 pp.

Jacks, P., Scheidlinger, C., and P.H. Zedler. 1984. Response of Eriodictyon capitatum to prescribed fire on Vandenberg AFB, California. Prepared for U.S. Fish and Wildlife Service, Sacramento, California. Order #11310-0263-81. San Diego State University, San Diego.

Jennings, M. R., and M. P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): The inducement for bullfrog (*Rana catesbeiana*) introduction. Herpetological Review 31:94-103.

Jennings, M. R., and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. Report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

Keil, D. J. 1993. *Hemizonia*. Pp. 280-284. In: J. L. Hickman (ed.), The Jepson manual: higher plants of California. University of California Press, Berkeley, California.

KFS and MSRS (KFS LLC and ManTech SRS Technologies, Inc). 2020. Biological Assessment for the Ground Based Strategic Deterrent Test Program at Vandenberg Air Force Base, California. Prepared for U.S. Air Force Nuclear Weapons Center Kirtland Air Force Base, New Mexico and U.S. Army Space and Missile Defense Command Huntsville, Alabama. 48 pp

Licht, L.E. 1974. Survival of embryos, tadpoles, and adults of the frogs *Rana aurora aurora* and *Rana pretiosa pretiosa* sympatric in southwestern British Columbia. Canadian Journal of Zoology 52(5):613-627.

Nafis, G. 2020. California Herps – 'California red-legged frog - *Rana draytonii*'. Accessed December 29, 2020. http://www.californiaherps.com/frogs/pages/r.draytonii.html

May, D., Shidemantle, G., Melnick-Kelley, Q., Crane, K., Hua, J. 2019. The effect of intensified illuminance and artificial light at night on fitness and susceptibility to abiotic and biotic stressors. Environmental Pollution. 251: 600-608.

[MSRS] ManTech SRS Technologies, Inc. 2019a. Fairy_Shrimp_Pools_20190918 ArcMap 10.2.2 Feature Class.

[MSRS] ManTech SRS Technologies, Inc. 2019b. Vernal Pool Fairy Shrimp (Branchinecta lynchi) Surveys 2018-2019, Vandenberg Airy Force Base, California. Prepared for 30 CES/CEIEA. 22 October 2019. 30 pp.

[MSRS] ManTech SRS Technologies, Inc. 2020. Ground Based Strategic Deterrent Test Program biological survey report. Prepared for KFS, LLC. 46 pp.

Rathbun, G. B., and J. Schneider. 2001. Translocation of California red-legged frogs (*Rana aurora draytonii*). Wildlife Society Bulletin 29:1300-1303.

Rathbun, G. B., M. R. Jennings, T.G. Murphey, and N.R. Siepel. 1993. Status and ecology of sensitive aquatic vertebrates in lower San Simeon and Pico Creek, San Luis Obispo County, California. Final Report under Cooperative Agreement 14-16-0009-91-1909 between U.S. Fish and Wildlife Service and California Department of Parks and Recreation. Publication Number PB93-230779, National Technical Information Service, Springfield, Virginia.

Rees, M. and M. J. Long. 1992. Germination biology and the ecology of annual plants. Am. Nat. 139: 484-508.

Ryan M. J. (ed.). 2001. Anuran communication. Smithsonian Institution Press, USA. 252 p.

Sage Institute, Inc. 2019. Permit applications and supporting documentation for the U.S. Army Corps of Engineers and Regional Water Quality Control Board + Exhibits. Dated August 2018.

Satterthwaite, W. H., Holl, K. D., Hayes, G. F., and A. L. Barber. 2007. Seed banks in plant conservation: case study of Santa Cruz tarplant restoration. Biol. Conserv. 135: 57-66.

Schneider, H.E., and S.A. Carson. 2019. Lompoc yerba santa (*Eriodictyon capitatum*) germination study - Final Project Report 2019. Unpublished Report, Santa Barbara Botanic Garden, Santa Barbara, CA. 13 pp.

Scott, N. 2002. Annual report, California red-legged frog, *Rana aurora draytonii*, Permit TE-036501-4. Unpublished report submitted to the Ventura Fish and Wildlife Office.

[Service] U.S. Fish and Wildlife Service. 1996. Determination of threatened status for the California red-legged frog. Federal Register 61:25813-25833.

[Service] U.S. Fish and Wildlife Service. 2000. Endangered and threatened wildlife and plants; final rule for endangered status for four plants from south central coastal California. Federal Register 65: 14888-14898.

[Service] U.S. Fish and Wildlife Service. 2002a. Endangered and threatened wildlife and plants; Designation of critical habitat for *Eriodictyon capitatum* (Lompoc yerba santa) and *Deinandra increscens* ssp. *villosa* (Gaviota tarplant); Final rule. Federal Register 67: 67968 -68001.

[Service] U.S. Fish and Wildlife Service. 2002b. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

[Service] U.S. Fish and Wildlife Service. 2005. Recovery plan for vernal pool ecosystems of California and southern Oregon. Portland, Oregon. Xxvi + 606 pp.

[Service] U.S. Fish and Wildlife Service. 2007. Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office. Sacramento, California. September 2007. 75 pp.

[Service] U.S. Fish and Wildlife Service. 2009. *Deinandra conjugens* (Otay tarplant), 5-year review: summary and evaluation. 56 pp. Carlsbad Fish and Wildlife Office, Carlsbad, California. Dated June 30, 2009.

[Service] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; Revised designation of critical habitat for the California red-legged frog; final rule. Federal Register 75:12816-12959.

[Service] U.S. Fish and Wildlife Service. 2011. *Deinandra increscens* subsp. *villosa* (Gaviota tarplant) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura, California. 34 pp.

[Service] U.S. Fish and Wildlife Service. 2015. Programmatic Biological Opinion on Routine Mission Operations and Maintenance Activities, Vandenberg Air Force Base, Santa Barbara County, California (8-13-F-49R).

Shaffer, H. B., Fellers, G. M., Randall Voss, S., Oliver, C., and G.B. Pauly. 2004. Species boundaries, phylogeography and conservation genetics of the red-legged frog (*Rana aurora/draytonii*) complex. Molecular Ecology 13:2667-2677.

Storer, T. I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27:1-342.

Tanowitz, B. D. 1982. Taxonomy of *Hemizonia* sect. *Madiomeris* (Asteraceae: Madiinae). Syst. Bot. 7: 314-339.

Tanowitz, B. D., P. F. Salopek, and B. E. Mahall. 1987. Differential germination of ray and disc achenes in *Hemizonia increscens* (Asteraceae). American Journal of Botany 74: 303-312.

Tatarian, T, and Tatarian G. 2018. California red-legged frog workshop. PowerPoint presentation. California Polytechnic State University, San Luis Obispo. May 10, 2018.

Tennessen J.B., Parks S.E., Langkilde T. 2014 Traffic noise causes physiological stress and impairs breeding migration behaviour in frogs. Conserv Physiol 2: 1-8.

Troianowski, M., Mondy, N., Dumet, A., Arcanjo, C., and T. Lengagne. 2017 Effects of traffic noise on tree frog stress levels, immunity, and color signaling. Conservation Biology. 31, 1132–1140.

Wise, S. 2007. Studying the ecological impacts of light pollution on wildlife: Amphibians as models. In StarLight: A Common Heritage; Proceedings of the StarLight 2007 Conference; C. Marín and J. Jafari editors. La Palma, Canary Islands, Spain pp. 107–116.

Caorsi, V. Z., Both, C., Cechin, S., Antunes, R., and M. Borges-Martins. 2017. Effects of traffic noise on the calling behavior of two neotropical hylid frogs. PLoS One, 12(8): 1-14.

IN LITTERIS

Baldwin, B. 2001. Professor, University of California, Berkeley, Jepson Herbarium. Letter addressed to Jim Bartel, U.S. Fish and Wildlife Service, Carlsbad, California, regarding reproductive systems in Otay tarplant (*Deinandra conjugens*). Dated March 6, 2001.

Kephart, Beatrice. L. 2020. Chief, Installation Management Flight, Vandenberg Air Force Base, Santa Barbara County, California. Letter requesting consultation for the Ground Based Strategic Deterrent Test Program, addressed to Steve Henry, Field Supervisor, Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service, Ventura, California. Dated November 19, 2020.

Schneider, H. 2020. Rare Plant Biologist, Santa Barbara Botanic Garden. Email sent to Kristie Scarazzo, U.S. Fish and Wildlife Service, Ventura, California, regarding seed production and conservation collections of *Eriodictyon capitatum* and *E. altissimum.* Dated December 11, 2020.

Kaisersatt, S. 2021. Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Jennifer Strotman, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding responses to request for additional GBSD project information at Vandenberg Air Force Base. Dated January 5, 2021.

PERSONAL COMMUNICATIONS

Evans, R. 2021a. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated February 3, 2021.

Evans, R. 2021b. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated February 18, 2021.

Evans, R. 2021c. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated January 27, 2021.

Evans, R. 2021d. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated February 19, 2021.

Evans, R. 2021e. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated February 22, 2021.

Kaisersatt, S. 2020a. Biological Scientist, Environmental Section, Vandenberg Air Force Base, U.S. Air Force. Electronic mail to Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding additional clarifications and measures for listed species for the construction and operation of the GBSD Program at Vandenberg Air Force Base. Dated January 5, 2021.

Schneider, H. 2020. Rare Plant Biologist, Department of Conservation and Research, Santa Barbara Botanic Garden. Phone call with Sarah Termondt, Biologist, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, regarding *Eriodictyon capitatum* seed production. Dated December 18, 2020.

APPENDIX A

Project Area Detail

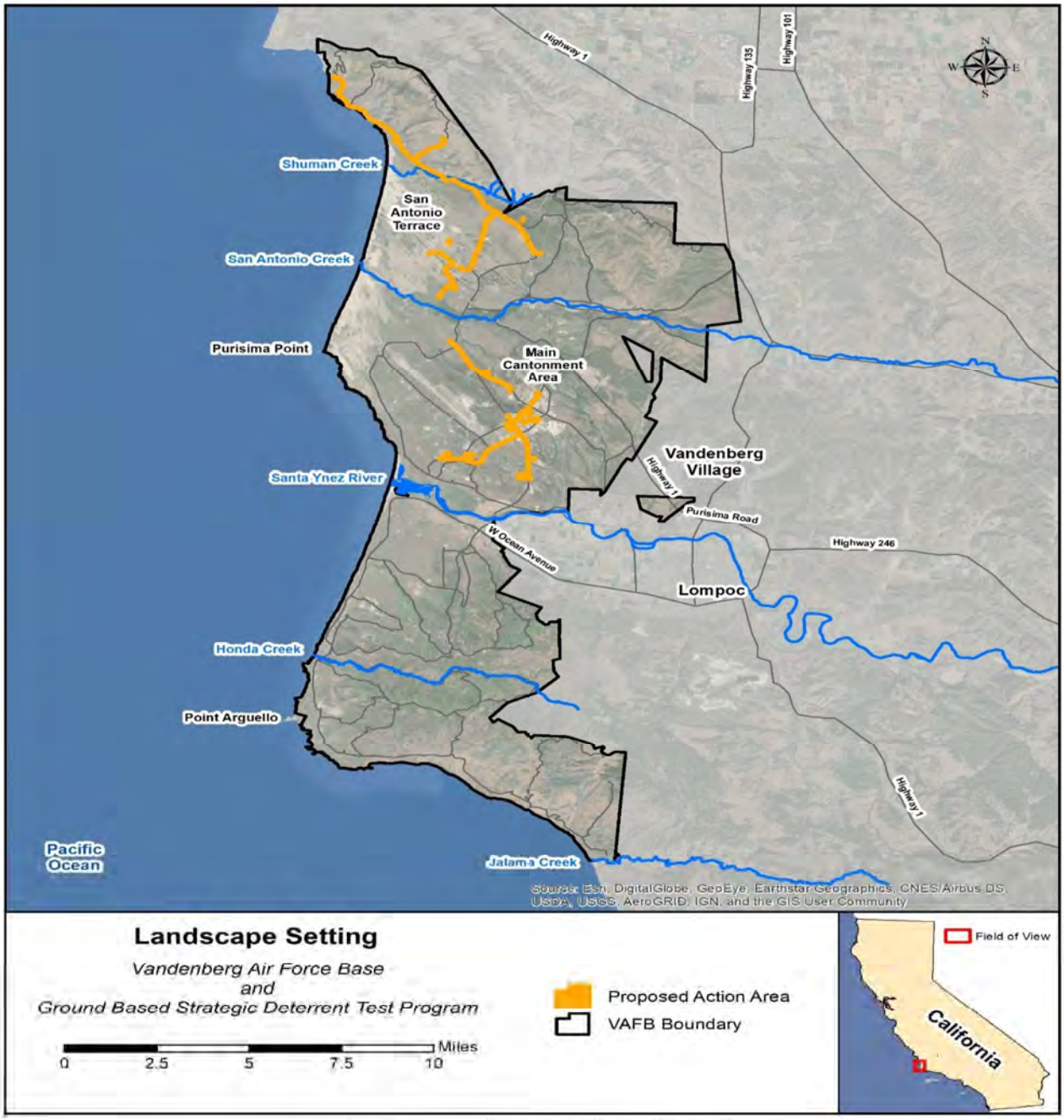

Figure 1. Landscape setting with action area

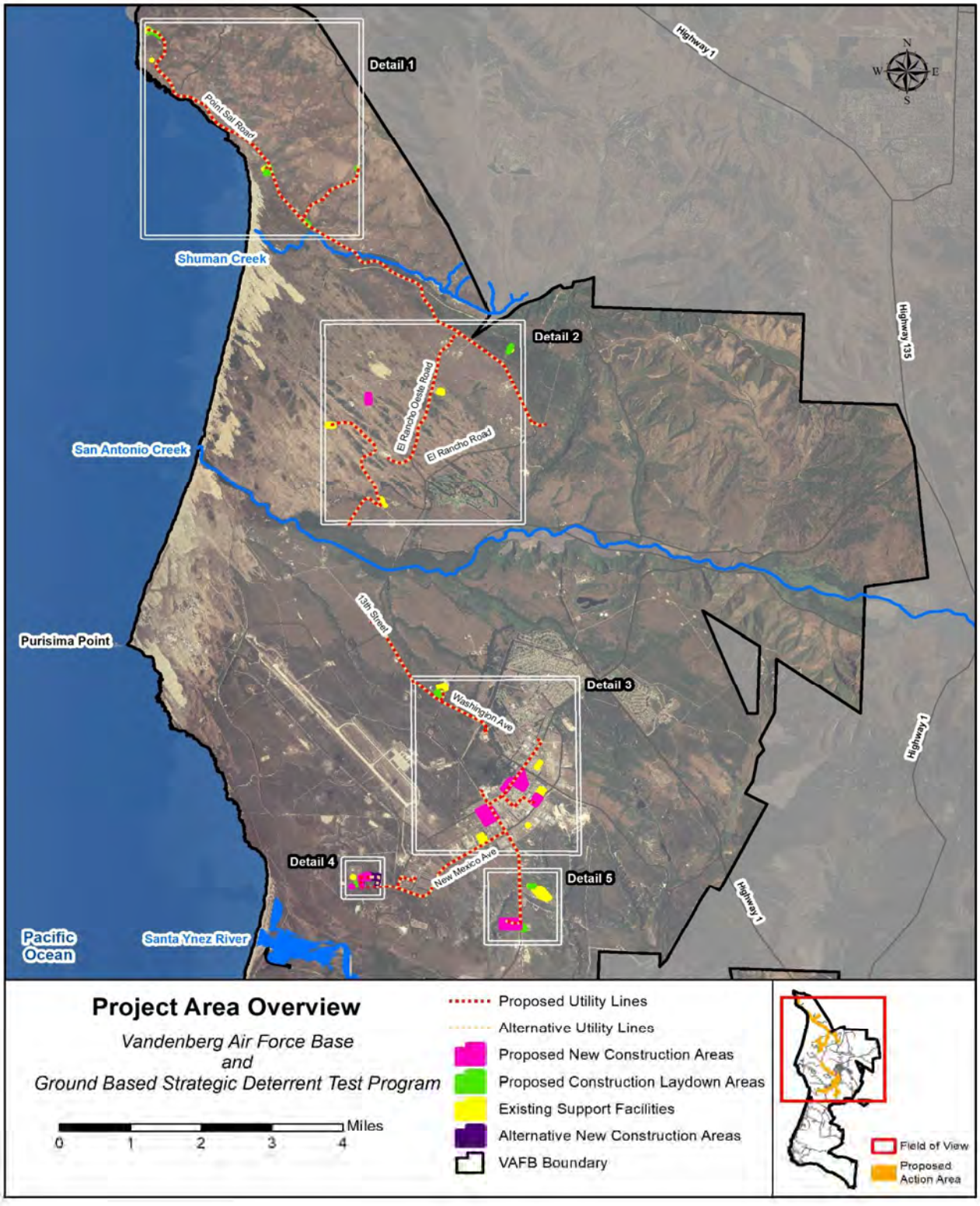

Figure 2-0. Project area overview.

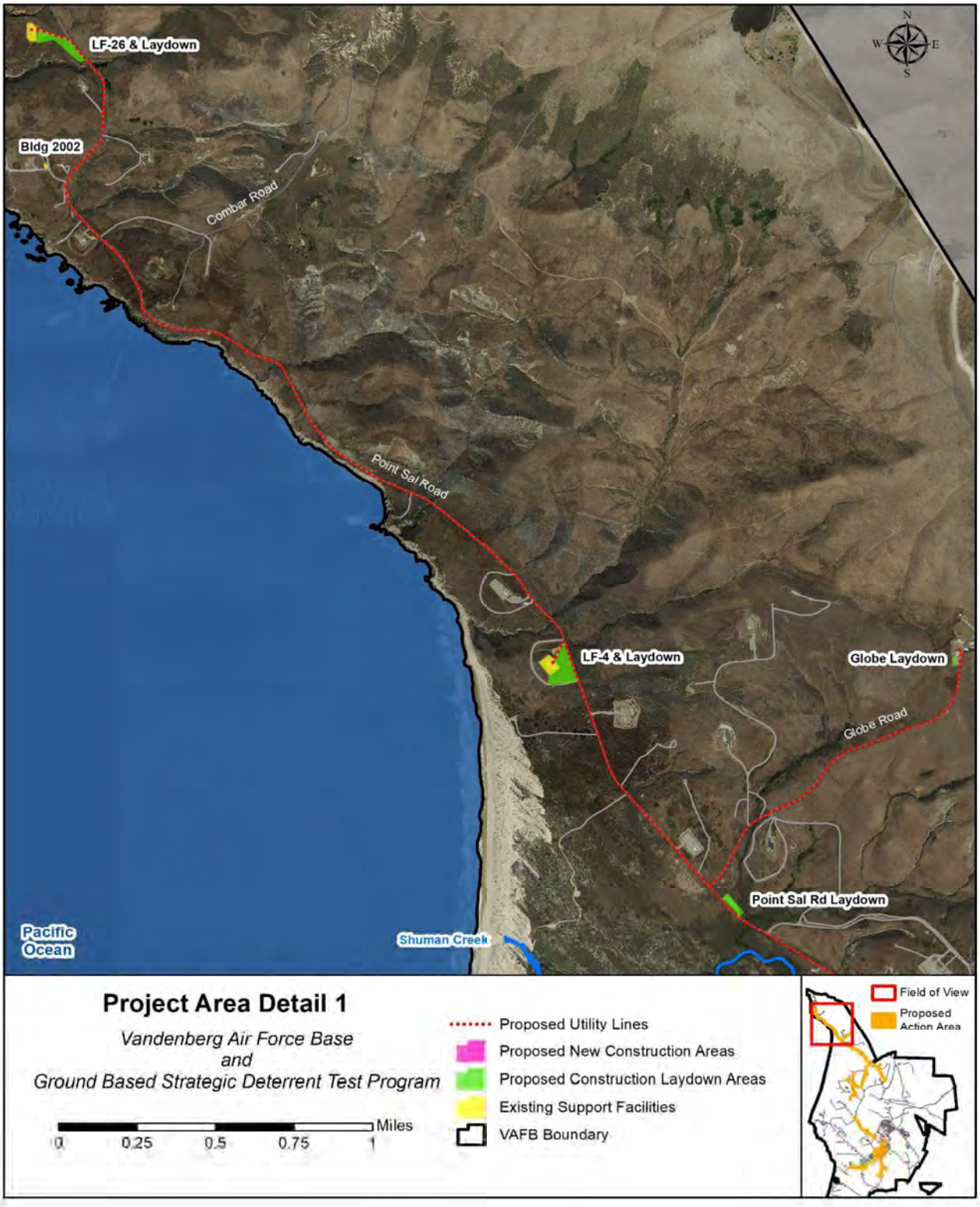

Figure 2-1. Project area detail 1.

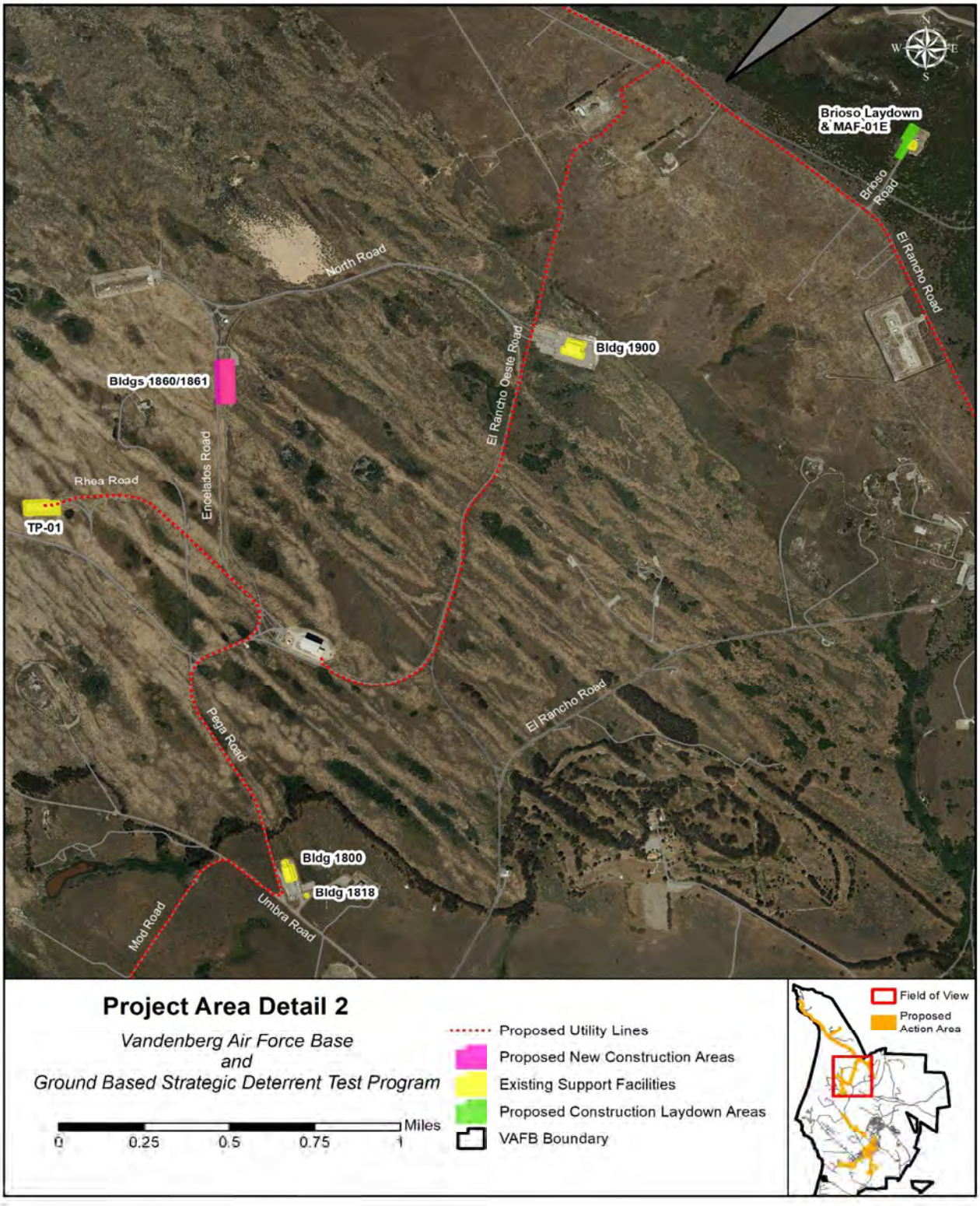

Figure 2-2. Project area detail 2.

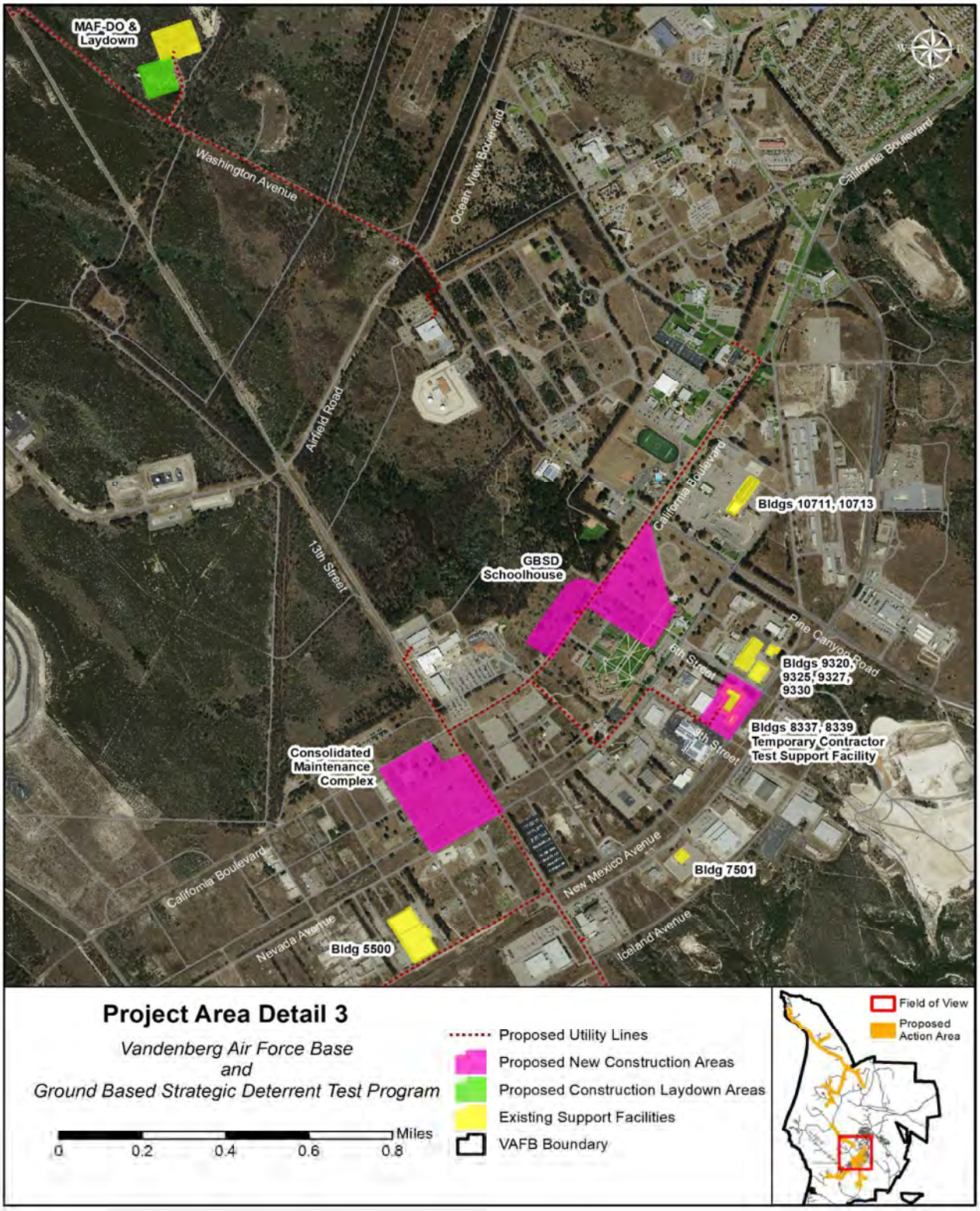

Figure 2-3. Project area detail 3.

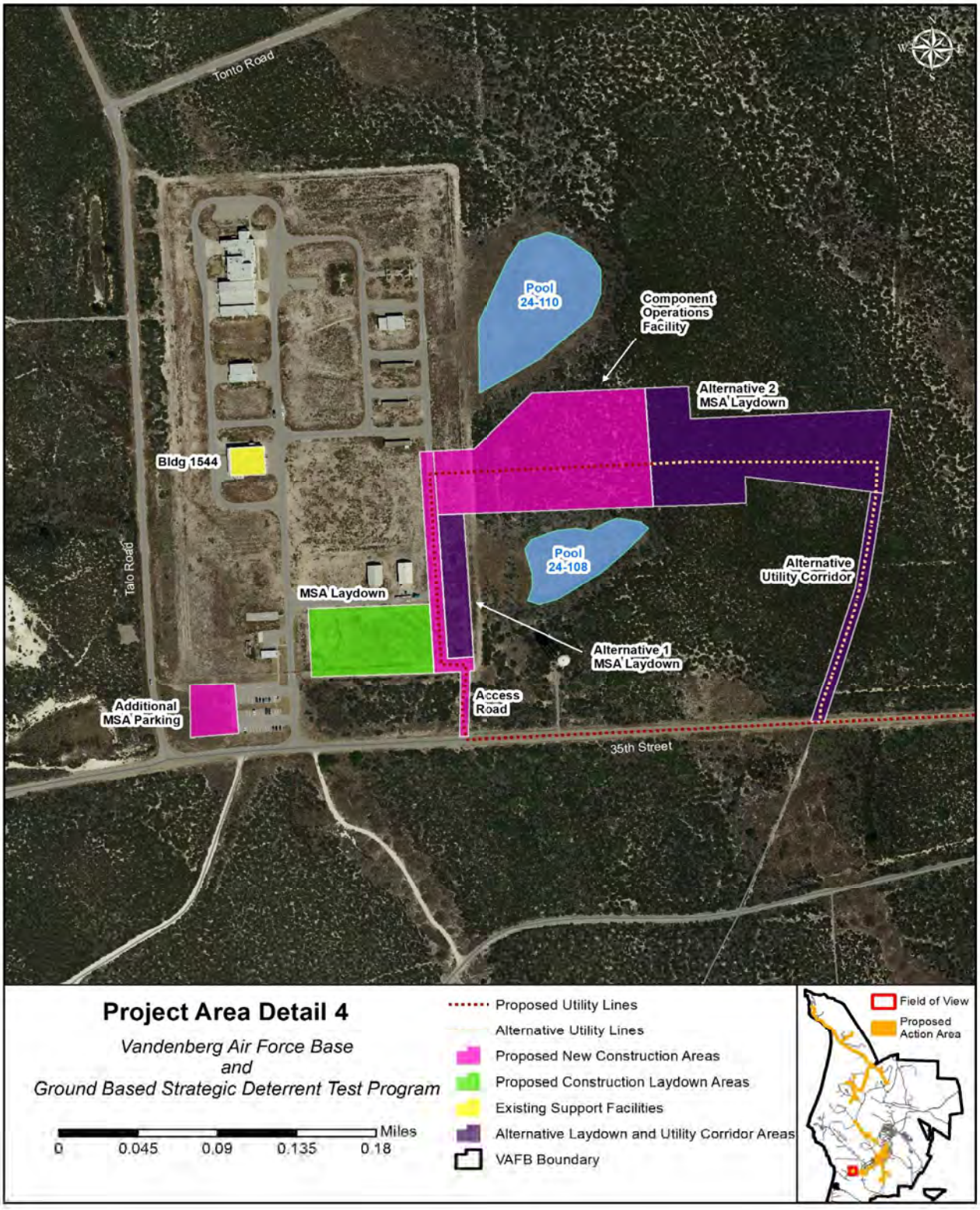

Figure 2-4. Project area detail 4.

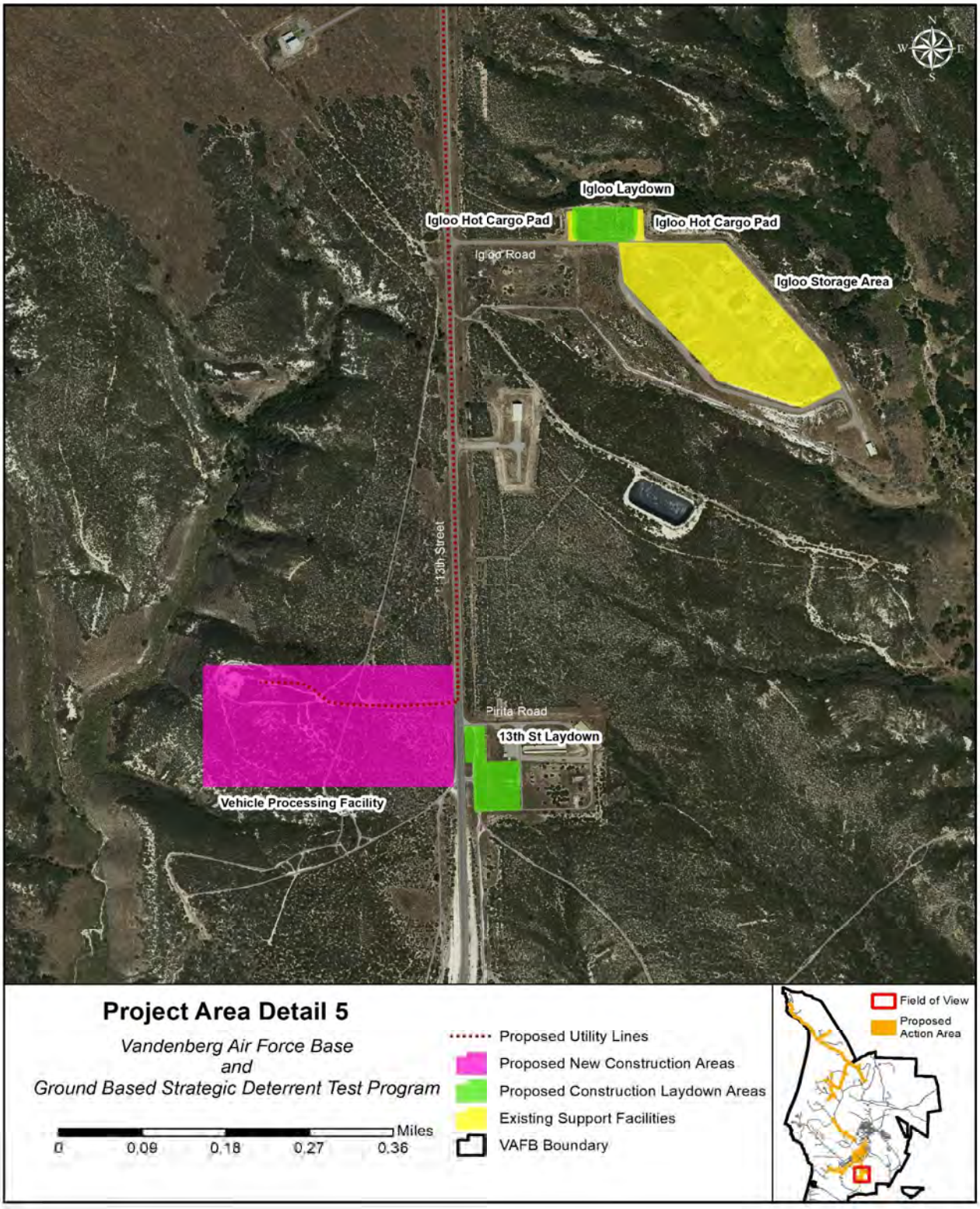

Figure 2-5. Project area detail 5.

REPUBLIC OF THE MARSHALL ISLANDS
ENVIRONMENTAL PROTECTION AUTHORITY
P.O. Box 1322
Majuro, Marshall Islands 96960
Phone: (692) 625-3035/5203 * Fax: (692) 625-5202 * Email: rmiepa@ntamar.net

22 April 2021

Mr. David C. Hasley
Chief, Environmental Division Deputy Chief of Staff, Engineer USASMDC/ARSTRAT
Huntsville, Alabama USA

Subject: Draft Environmental Assessment/Overseas Environmental Assessment, Ground Based Strategic Deterrent Test Program, February 2021

Mr. Halsey,

Please find enclosed comments on the above draft EA, provided by the Marshall Islands Environmental Protection Authority.

Regarding Section 1-6 on coordination with the RMI, while RMI EPA agrees that the UES applies, US NEPA also directly applies as though RMI were within the United States. UES is an operational agreement, not to be substituted for US NEPA's legal and regulatory requirements as outlined in the Compact. The minor modification to the DEP as proposed has been rejected by RMI EPA. Adequate and appropriate reference is needed to the relevant Compact provisions, as a US law, is needed regarding the application of NEPA to activities within the RMI.

Regarding Section 1.7 on Public notification and review, as recently conveyed, RMI EPA did not adequately receive and distribute hard copies on display, due both to the current unusual border closures and mail restrictions during the Covid emergency, as well as other shortcomings regarding mail distribution. No direct effort was undertaken to verify receipt and display with RMIEPA. These materials still have not been received. This should be noted in the EA and addressed going forward. Prior comments by RMI EPA regarding translation and accessibility apply, although the more concise nature of the EA is appreciated, though it should not come at the sacrifice of specific disclosure and analysis.

Regarding Section 2.1.5 Downrange test and support, RMI EPA notes the acknowledgement that no missile components are expected to impact territorial seas and areas outside of USAKA/USAG-KA. However, RMI EPA does occasionally receive reports, though not fully verified, within outer islands communities proximate to the BOA. RMI EPA recommends project support staff undertake additional communication through appropriate channels with the RMI

government, including possible involvement of local governments, regarding advance communication and verification prior to and following testing activities within the BOA.

Regarding Section 2.2 Proposed Action, the EA states that both testing programs would exist in parallel under the proposed activity, but also that their environmental character is largely the same. It is unclear to RMI EPA if there is increase in test flight numbers or cumulative payload at USAG-KA/USAKA. RMI EPA notes discussions on operations in section 4.2.1.4.2 on 4-9 refers to a substantial increase in support actions and personnel. It would be important to clarify the anticipated scale of the action, such as its frequency, and relate this to environmental impacts. It is unclear to RMIEPA as to the additional character of the undertaking. For example, of twice as many tests were undertaken, it is likely there would be a proportional reflection to a certain degree in anticipated impacts, which would be different than describing a general continuation. Section 2.2.5.1refers to up to 9 annual tests anticipated but it is unclear what is additional.

In section 2.5.5.1.2 RMI EPA suggests a more contemporary term other than "natives of the Marshall Islands". The term Marshallese is used elsewhere in the EA. RMI citizens can also be considered.

Regarding Table 2.5 Environmental Consequences in cultural resources, and other relevant discussions, it should be noted in the EA that Kwajalein is listed in the US National Register of Historic Places and as a US National Historic Landmark. The discussion of sea turtles on page 3-83 as a matter of traditional cultural importance for Marshallese deserves consideration as a traditional cultural property as reflected in NHPA and RMI laws and regulations, and consultation with legally mandated authorities.

In the relevant portion of Section 4.0 Environmental Consequences, and the related FONSI (Section A) RMI EPA considers the statements of no significant impact to be generally conclusory and arbitrary pronouncements, rather than informed assessments which specifically address findings and delineate or justify why effects are significant or not. A finding on no significant impact should be clearly supported in direct and descriptive detail and specific justification as to why there is a finding of no significant impact. The EA and FONSI should use or explain the context and intensity criteria that define significance, or clarification of established thresholds to determine significance or non-significance. Intensity would relate to an impact that may be both beneficial and adverse, the degree to which the proposed action affects public health or safety, unique characteristics of the area, degree of controversy of effect on the human environment, unique, uncertain or unknown risks, establishment of precedent for future actions with significant effects, cumulative effects, among others (forming a convincing statement of reasons as to why an EIS is not required). RMI EPA would suggest that further detail is needed beyond the brief and conclusory statement, and which should link to specific information and conclusions within the document, providing direct justification for the lack of necessity for an EIA (or, should opinions provide, for an EIA), including in relation to established and distinguishable thresholds for significance or non-significance, including cumulative impact. RMIEPA notes that portions of the 1993 SEIS for USAKA may contain threshold

distinctions for possible reference. In the Appendix List of mitigation measures, RMIEPA would suggest that some of these are existing operational commitments and not mitigate emissions measures such that avoid a EIS, for example regarding hazardous materials that any accidental accidental spills would be contained and cleaned up, or that trash would be picked up from the beach and dunes. These are not discretionary actions which address impacts, but rather more accurately part of the project description.

Regarding the assessment of biological resources and cumulative effects in Section 4, the EA refers to DEP procedures. The EA states that "testing activities at USAG-KA/RTS could have additive effects on biological resources including long-term addition of man-made objects to the ocean, cumulative amounts of hazardous materials in the habitats at Illeginni Islet, or increased frequency of disturbance events." No such DEP is presumed and is typically undertaken after, not before, the EA. The EA exists as a legal NEPA obligation to take a hard look at potential impacts as part of the decision process, and cannot be substituted, particularly by operational documents intended for a post-decision phase. The reference to the DEP refers to monitoring, which does not mitigate the cumulative impacts so listed. The EA only states there are "a number" of other measures but does not reference them or take them into any further account in in this section. RMIEPA finds this section inadequate in meeting NEPA's "hard look" standard. The nature, scale or character of such "additive effects" is not described. This is also true regarding the potential for hazardous materials and any interaction within the ecosystem, including biological resources.

RMIEPA is unclear regarding the nature or scale of any chemical or artificial contaminants, including data or assessments in the deep marine environment, and in particular their cumulative impact. In this regard, RMIEPA recalls the 2017 Flight Experiment 1 EA and its reference to marine exposure of missile payload materials, specifically regarding Tungsten alloy, and agreement to undertake a benchmark study. No such study is mentioned in the present EA. RMIEPA cannot judge the relevance as there is reference or mention of specific marine or human receptor exposure to hazardous materials, including Tungsten alloy, depleted uranium and/or beryllium, chromium and other hazardous materials. Monitoring for these materials as a mitigation measure without specific inclusion otherwise in the EA does not adequately indicate a hard look at, and evaluation of, effects prior to the FONSI.

Regarding cumulative impacts assessment in the relevant portion of Section 4.3, RMIEPA references recent comments on other, related EAs at USAG-KA and USAKA. Regarding the 2016 EA for MMIII and Fuze Modernization, RMIEPA stated that "RMI EPA would suggest an approach in the EA, such as a descriptive matrix or list, which outlines all of the planned, potential or reasonably foreseeable actions relating to missile testing, and other related security actions, within a common geography for the 2030 timeframe in question, as well as brief summaries of existing respective NEPA-level conclusions, and how such conclusions are addressed in this EA document, as well as plans for future NEPA work (including a statement of the overall impact that can be expected if the individual impacts are allowed to accumulate through the 2030 timeframe). Otherwise, *RMI EPA would presume that this will be the only NEPA-level document produced through the 2030 analytical timeframe for missile testing or*

other related security actions or projects, and that this EA would summarize the full extent of projected and cumulative impacts." (Emphasis added). This EA is another in a long and growing list of related EAs for test programs which appear to EPA to inappropriately acknowledge cumulative impacts, and which are not adequately tiered to the original 1989 EIS (and related SEIS), which itself is well-outdated and a generation old. Only a few years ago, RMIEPA presumed the existing EA would have been the final testing program. Yet another has been added with this EA without an adequate analysis of cumulative impacts, and can be seen as a piecemeal approach to effects analysis. While the variety of test programs may be logical to the project proponents, for RMIEPA the cumulative effect of ongoing and expanding testing is at best uncertain and inadequately analyzed.

Thank you for the opportunity to provide comments, and I look forward to future engagement.

Sincerely,

Ms. Moriana Phillips
General Manager, RMIEPA

cc: UES Project Team

B

Cultural Resource Consultation

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Jill Remington Love
Executive Director
Department of
Heritage & Arts

Utah Division of State History

Don Hartley
Director
State Historic Preservation Officer

October 21, 2019

Michelle Cottle
Chief, Environmental Quality Branch
75 CEG/CEIE
7290 Weiner St., Bldg. 383
Hill AFB, Utah 84056

RE: GBSD Complex

For future correspondence, please reference Case No. 19-2300

Dear Ms. Cottle:

The Utah State Historic Preservation Office received your submission and request for our comment on the above-referenced project on October 18, 2019. Based on the information provided to our office, we concur with your determinations of eligibility and with your finding of No Adverse Effect for the proposed undertaking. (If more substantial modifications are proposed for eligible buildings 11536 and 11537, we'll look forward to further consultation on those.)

This information is provided to assist with Section 106 responsibilities as per §36CFR800. If you have questions, please contact me at (801) 245-7239 or by email at clhansen@utah.gov.

Sincerely,

Christopher Hansen
Preservation Planner/Utah SHPO

DEPARTMENT OF THE AIR FORCE
75TH CIVIL ENGINEER GROUP (AFMC)
HILL AIR FORCE BASE UTAH

10 October 2019

Michelle Cottle
Chief, Environmental Quality Branch
75 CEG/CEIE
7290 Weiner St, Building 383
Hill AFB, UT 84056

Timothy Nuvangyaoma
Chairman
Hopi Tribal Council
PO Box 9000
Kykotsmovi AZ 86039

RE: Section 106 Review – Construction of the GBSD Campus

Dear Chairman Nuvangyaoma,

Hill Air Force Base (AFB) is proposing to add a campus to support the Ground Based Strategic Deterrent (GBSD) mission on Hill AFB property in Davis County, Utah (Attachment 1 – Location Map). These buildings are necessary to expand support for the GBSD program. The campus falls within the Ogden Air Materiel Area Historic District.

The undertaking proposes potential modifications to three structures, Bldg 1530 which is not historic, 11536 and 11537 which are eligible for the National Register. The extent of the modifications are currently unknown but primarily expected to be to interior equipment and interior repair. No major modifications have been proposed at this time. In addition, possible expansion or alteration to the surrounding parking areas may occur (all modified APE boundaries are noted in orange on the map). Should additional modifications be required that have the potential to impact the historic integrity of the structure and the District, further consultation will occur on those projects.

The majority of the work includes the construction of three new facilities and their associated parking areas. Each are depicted in blue on the attached map and will fall within that boundary, but will not necessarily encompass the entirety of the boundary. The first facility, the GBSD Mission Integration Facility (MIF) will be a multi-level facility approximately 140,000 square feet. An associated multi-level parking structure (~315,000 square feet) will be located to the south. The second location is a supporting software facility (SMAC) which will include a multi-story 152,000 square foot building with associated multi-level parking structure to the north. The

final location, noted as the TACC on the map, is still within the initial design phase and will be included in a multi-installation GBSD Testing EA currently being drafted. Consultation on the projects incorporated within this EA will continue consultation as the project progresses.

A large part of the current project, particularly the MIF, falls within the boundary of the National Register eligible historic railway. Impacts to this site have been mitigated through a MOA signed in 2014 and on file at the State Historic Preservation Office and the Advisory Council on Historic Preservation. In addition, the campus does fall within the boundary of the Ogden Air Materiel Area Historic District. The proposed work will support the continued Intercontinental Ballistic Missile mission for which the existing National Register eligible buildings have been included and will not adversely impact any significant viewsheds related to this district.

The location of these sites have been disturbed by previous building construction and infrastructure throughout the installation's history so have a minimal likelihood of subsurface archaeology. However, should anything be found during construction, the Hill AFB Unanticipated Discovery of Archaeological Resources Protocol will be followed. In consideration of the above mitigations and previous disturbance, Hill AFB has determined that the proposed work on the GBSD Campus will have No Adverse Effect to historic properties and recommends that the proposed project proceed. We request your concurrence in this determination as specified in 36 CFR 800.

Should you or your staff have any questions, please contact Ms. Anya Kitterman, Cultural Resource Manager, at (801) 586-2464 or at anya.kitterman@us.af.mil.

Concur
for
10-22-19

Sincerely

Michelle Cottle
Chief, Environmental Branch
75th Civil Engineer Group

Attachments:
1. Location Map

CC: Leigh Kuwanwisiwma, Director of Cultural Preservation, Hopi Tribe

DISTRIBUTION LIST
Blackfeet Indian Tribe
Confederated Tribes of the Goshute Indian Reservation
Crow Tribe of Montana
Duckwater Shoshone Tribe
Eastern Shoshone Tribe
Ely Shoshone Tribe
Shoshone-Bannock Tribes of the Fort Hall Reservation
Shoshone-Paiute Tribes of the Duck Valley Reservation
Skull Valley Band of Goshute Indians
Northwestern Band of Shoshone Nation
Paiute Indian Tribe of Utah
Pueblo of Zuni
San Juan Southern Paiute Tribe
Hopi Tribe
Navajo Nation
Northern Arapaho Tribe
Te-Moak Tribe of Western Shoshone
Ute Indian Tribe
Ute Mountain Ute Tribe
Wells Band of the Western Shoshone

DEPARTMENT OF THE AIR FORCE
75TH CIVIL ENGINEER GROUP (AFMC)
HILL AIR FORCE BASE UTAH

10 October 2019

Michelle Cottle
Chief, Environmental Quality Branch
75 CEG/CEIE
7290 Weiner St, Building 383
Hill AFB, UT 84056

Dr. Chris Merritt
Chris Hansen
State Historic Preservation Office
300 Rio Grande
Salt Lake City, Utah 84101

RE: Section 106 Review – Construction of the GBSD Campus

Dear Dr. Merritt and Mr. Hansen,

Hill Air Force Base (AFB) is proposing to add a campus to support the Ground Based Strategic Deterrent (GBSD) mission on Hill AFB property in Davis County, Utah (Attachment 1 – Location Map). These buildings are necessary to expand support for the GBSD program. The campus falls within the Ogden Air Materiel Area Historic District.

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Should you or your staff have any questions, please contact Ms. Anya Kitterman, Cultural Resource Manager, at (801) 586-2464 or at anya.kitterman@us.af.mil.

Sincerely,

Michelle Cottle
Chief, Environmental Branch
75th Civil Engineer Group

Attachments:
1. Location Map

DISTRIBUTION LIST
Blackfeet Indian Tribe
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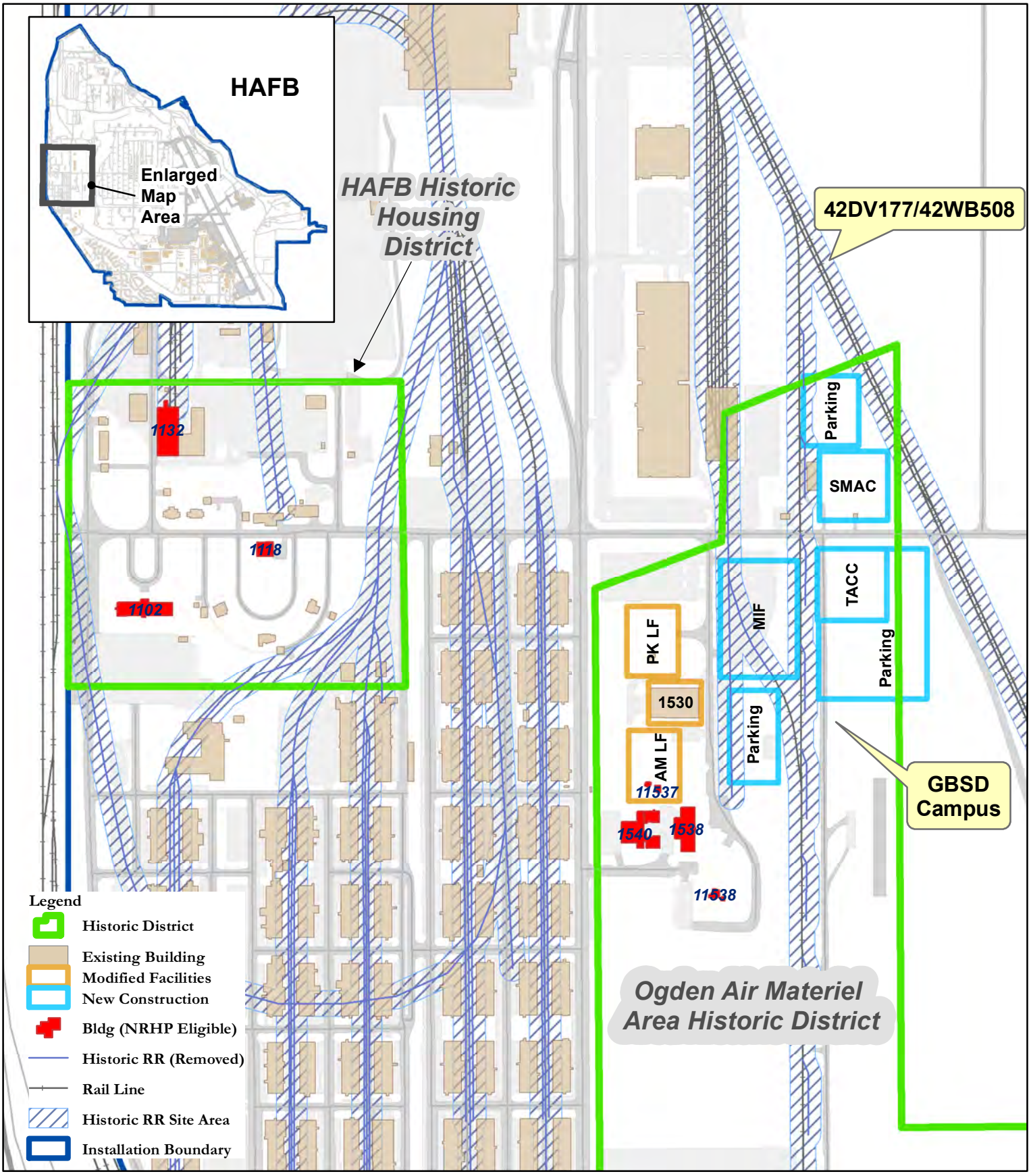
Wells Band of the Western Shoshone



GBSD Campus Plan
USGS 7.5' Quadrangle Roy, UT
Hill Air Force Base, UT

N

1:8,000

0 250 500 1,000 Feet

0 0.05 0.1 0.2 Miles

Hinono'einino'
Northern Arapaho Tribe
TRIBAL HISTORIC PRESERVATION OFFICE
P.O. Box 67 - St. Stephens, Wyoming 82524 -
PH: 307.856.1628 - cbearing.nathpo@gmail.com

12/3/2019

Anya Kitterman, Cultural Resource Manager
Department of the Air Force
75 CEG/CEIE
7290 Weiner St., Building 383
Hill AFB, UT 84056

Re: Section 106 Review - Construction of the GBSD Campus

Dear Ms. Kitterman:

After reviewing your request under the Section 106 process of the NHPA, and NEPA, our office would like to comment on the proposed Construction of the GBSD Campus located in Davis County, Utah. Due to the area being heavily disturbed with the existing buildings and infrastructure, the Northern Arapaho Tribal Historic Preservation Office makes the following determination:

No Adverse Effect on Historic Properties in the Direct and Visual APE

Our office has come to this determination by drawing conclusions from the survey and file search from maps depicting provenance of sites in regards to Direct and Visual APE. There are no cultural resources and one or more eligible historic properties within the APE. Currently, there are no properties of religious and cultural significance to the Northern Arapaho within the area of potential effect. However, if traditional cultural properties, rock features, or human remains are found during excavation with any new ground disturbance, we request to be contacted and a report provided.

Thank you for consulting with the Northern Arapaho THPO.

Sincerely,

Crystal C'Bearing
NATHPO Interim Director

THE PAIUTE INDIAN TRIBE OF UTAH

440 North Paiute Drive • Cedar City, Utah 84721 • (435) 586-1112 • Fax (435) 586-7388

October 31, 2019

Michelle Cottle
Chief, Environmental Quality Branch
75 CEG/CEIE
7290 Weiner St. Building 383
Hill Air Force Base, Utah 84056
City, Utah 84138

Dear Ms. Cottle,

Subject: Construction of the GBSD Campus

The Paiute Indian Tribe of Utah thanks you for your correspondence dated October 10, 2019 and have reviewed the material and do not have any objections pertaining to the above-named project. As you are aware the tribe supports the identification and avoidance of prehistoric archaeological sites and traditional cultural properties. The Paiute Tribe concurs with your determination of eligibility and effort for this undertaking.

The Paiute Tribe sincerely appreciates your accomplishments and consideration you and your staff have made to consult with the Tribes.

Sincerely,

Dorena Martineau/Cultural Resources
Paiute Indian Tribe of Utah
440 North Paiute Drive
Cedar city, Utah 84721
dmartineau@utahpaiutes.org
435-586-1112 ext. 107

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, DUGWAY PROVING GROUND
DUGWAY UT 84022-5000

January 11, 2021

Mr. Chris Merritt
Utah Deputy State Historic Preservation Officer – Archaeology
Utah Division of State History
300 Rio Grande
Salt Lake City, Utah 84101-1182

Dear Mr. Merritt:

In accordance with Section 106 of the National Historic Preservation Act (NHPA), this letter initiates consultation with the Utah State Historic Preservation Officer (SHPO) regarding proposed construction and associated activities relating to the Ground Based Strategic Deterrent (GBSD) Test Program at U.S. Army Dugway Proving Ground (DPG), Tooele County, Utah.

GBSD represents the modernization of the U.S. land-based nuclear arsenal, eventually replacing the aging Minuteman III intercontinental ballistic missile (ICBM) system. A portion of the proposed undertaking will occur on DPG. Other portions of the undertaking will occur at Hill Air Force Base (AFB) in Utah and Vandenberg AFB in California with missile launches over the Pacific Ocean and the Western Test Range (Figure 1). The two Air Force bases are conducting their own individual Section 106 consultation with their respective Tribal Governments and SHPO offices. In addition, Hill AFB is leading the consultation effort under the National Environmental Policy Act (NEPA).

The proposed undertaking at DPG includes the construction of one GBSD Physical Security System Test Facility (PSSTF) and the construction of associated utilities. The PSSTF would be a representative GBSD launch facility used for testing facility security features. The PSSTF would include above and below ground elements of a GBSD launch facility except the full-depth silo. Three locations at DPG are under consideration for the construction of this facility. All three proposed locations have been previously inventoried for historic properties.

The Area of Potential Effect (APE) on DPG is 139 acres (Figure 2). Three alternative parcels have been identified as the potential construction area of the PSSTF on DPG with Alternative 3 being the preferred location. Each alternative parcel measures approximately 10 acres in area but only a portion of the selected parcel, about 1.5 acres, would be fenced and used for the new facility. Electrical power and fiber optic cable would be extended to the site following established utility routes adjacent to

existing roads; it is undecided which side of the road the utility corridor will be established so the Area of Potential Effect for the utility corridor is 109 acres and includes a 30-meter-wide corridor on each side of the existing roads.

Construction of the PSSTF would require excavation and other ground disturbance within an approximate 25,000 square foot area to a maximum depth of approximately 45 feet. Any additional temporary laydown areas for equipment and materials would be located adjacent to the construction site within the 10-acre parcel. Refer to Figure 3 for a notational layout of the PSSTF.

The proposed activity to occur at the PSSTF is the testing of security systems. Activities would include testing of delay and denial structures and technologies, alarm systems, situational awareness systems, and communication systems. Live Fire Test and Evaluation activities are also planned to take place at the site which would involve the occasional use of munitions and explosives in accordance with all DPG Standard Operating Procedures. During test operations the number of support personnel on site would range between 15 and 100 depending on the type of activities occurring.

All areas of the undertaking have been previously inventoried for historic properties through several archaeological and architectural surveys. The list of previous survey projects is provided in the table below (Figure 4).

Antiquities Project	Project Name	Year	Type
U-99-DU-0138m	UTARNG Road-E CBR	1999	Archaeology Class III
U-00-DA-0514m	600 Series FP	2000	Archaeology Class III
U-03-DA-0157m	WDTC Cross Country MA - Stryker	2003	Archaeology Class III
U-03-DU-0580m	DTC Annex Leech Field	2003	Archaeology Class III
U-04-DA-0777m	Stryker OT Phase II - 2500 Additional Acres	2004	Archaeology Class III
U-06-DA-0224m	Small Arms Range Complex	2006	Archaeology Class III
U-07-DU-1443m	SWMU 204 Road	2007	Archaeology Class III
None	Rad Pad NRHP	2008	Building NRHP Eval
U-09-DU-0021m	Firing Point Placements	2009	Archaeology Class III
U-09-DU-0226m	Range Warning Signs and Gates	2009	Archaeology Class III
U-11-DU-0514m	Golden Eagle Traps	2011	Archaeology Class III
U-09-LI-0571m	Simpson DZ North	2011	Archaeology Class III
U-14-LI-1285m	South Davoren	2014	Archaeology Class III
U-15-DU-0240m	Rad Pad Firing Points	2015	Archaeology Class III

The list of identified archaeological and architectural resources within 200 meters of the APE is provided in the table below (Figure 5).

ID Number	NRHP	Antiquities Project	Resource Description
42TO0378	Determined Not Eligible - SHPO	U-84-MA-1063m	Undetermined Prehistoric Archaeological Site
42TO1188	Determined Not Eligible - SHPO	U-99-DU-0138m	Undetermined Prehistoric Archaeological Site
42TO1189	Determined Not Eligible - SHPO	U-99-DU-0138m	Undetermined Prehistoric Archaeological Site
42TO1474	Determined Not Eligible - SHPO	U-00-DA-0514m	Undetermined Prehistoric Archaeological Site
42TO1493	Determined Not Eligible - SHPO	U-00-DA-0514m	Early Archaic - Archaic Archaeological Site
42TO1636	Determined Not Eligible - SHPO	U-00-DA-0514m	Undetermined Prehistoric Archaeological Site
42TO2063	Determined Eligible - SHPO	U-03-DA-0157m	Undetermined Prehistoric Archaeological Site
42TO4163	Determined Eligible - SHPO	U-09-LI-0571m	Undetermined Prehistoric Archaeological Site
42TO4167	Determined Not Eligible - SHPO	U-09-LI-0571m	Undetermined Prehistoric Archaeological Site
42TO4168	Determined Not Eligible - SHPO	U-09-LI-0571m	Undetermined Prehistoric Archaeological Site
42TO4169	Determined Eligible - SHPO	U-09-LI-0571m	Undetermined Prehistoric Archaeological Site
42TO6087	Determined Not Eligible - SHPO	U-14-LI-1285m	Late Prehistoric Archaeological Site
42TO6251	Determined Not Eligible - SHPO	U-15-DU-0240m	Undetermined Prehistoric Archaeological Site
42TO6252	Determined Not Eligible - SHPO	U-15-DU-0240m	Undetermined Prehistoric Archaeological Site
Bldg 8220	Determined Eligible-Keeper	None	Historic Building Military - Rad Pad Historic District
Bldg 8221	Determined Eligible-Keeper	None	Historic Building Military - Rad Pad Historic District
Bldg 8221N	Determined Not Eligible-Keeper	None	Out of Period Building
Bldg 8223	Determined Eligible-Keeper	None	Historic Building Military - DTC
Bldg 8225	Determined Eligible-Keeper	None	Historic Building Military - Rad Pad Historic District

Three archaeological resources and one historic building are located within the APE and include archaeological sites 42TO1189, 42TO1493, and 42TO1638 (Figure 6) and DPG Facility #8223 (Figure 7). The three archaeological sites are not historic properties, and all have been previously consulted upon with the SHPO and Tribal Governments regarding their lack of eligibility to the National Register of Historic Places (NRHP). The one historic building, Facility #8223, is a historic property known as the Defense Test Chamber (DTC) and was determined eligible for the NRHP by the Keeper of the Register.

Five archaeological resources are located outside of the APE but within 200 meters of the APE and include 42TO2063, 42TO4163, 42TO4167, 42TO4168, and 42TO4169 (Figures 6 and 8). Three of these archaeological resources are historic properties (42TO2063, 42TO4163, and 42TO4169) while the other two are not historic properties. All of these resources have been previously consulted upon with the SHPO and Tribal Governments regarding their eligibility to the NRHP.

The historic DTC building is within the utility corridor APE but will be avoided by the undertaking. The three archaeological historic properties that are located near the APE will also be avoided by the undertaking. Due to the close proximity to the utility corridor, the archaeological historic property 42TO2063 will be monitored during utility construction activities to ensure it is avoided. The archaeological historic properties that are near the preferred location for the PSSTF will be periodically monitored during construction and use of the PSSTF and if necessary will be marked as "no-go areas" to ensure avoidance.

Therefore, as all historic properties will be avoided by the undertaking and a monitoring plan for nearby historic properties has been developed, in accordance with 36 CFR §800.4(d)(1), I propose a determination of **no historic properties affected** by actions associated with this undertaking.

As required by the provisions of 36 CFR §800.4(d), I am providing this letter for your comment. Please direct correspondence for this project to Ms. Rachel Quist, DPG Cultural Resource Manager, AMIM-DUP-E MS #1, 5330 Valdez Circle, Dugway, Utah 84022-5001, email rachel.quist.civ@mail.mil or telephone (801) 663-4037. Your attention on this matter is appreciated.

Sincerely,

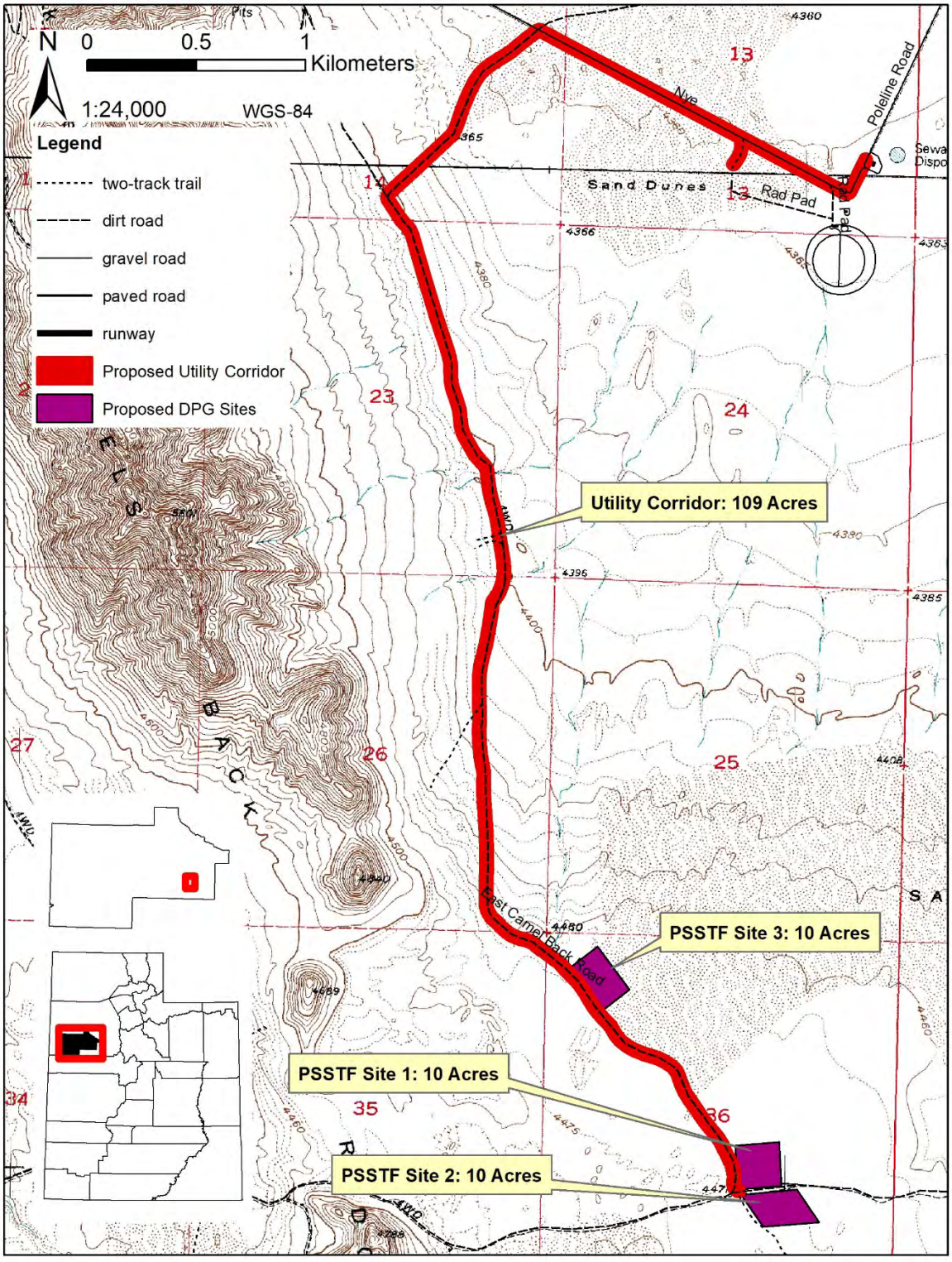
Digitally signed by GOODMAN.AARON.DOUGLAS.1186967778
Date: 2021.01.11 17:38:31 -07'00'

Aaron D. Goodman
Garrison Manager

Enclosure

Figures: Ground Based Strategic Deterrent (GBSD) Test Program at U.S. Army Dugway Proving Ground (DPG), Tooele County, Utah

Figure 1. Locations of the GBSD Test Program Proposed Activities



Basemaps: Camels Back Ridge NW & Camels Back Ridge SW 7.5' USGS Topo Map Map Created by R. Quist

GBSD Test Program at DPG: Areas of Potential Effect (APE)

Figure 2: DPG Area of Potential Effect (APE) Map, 139 acres.

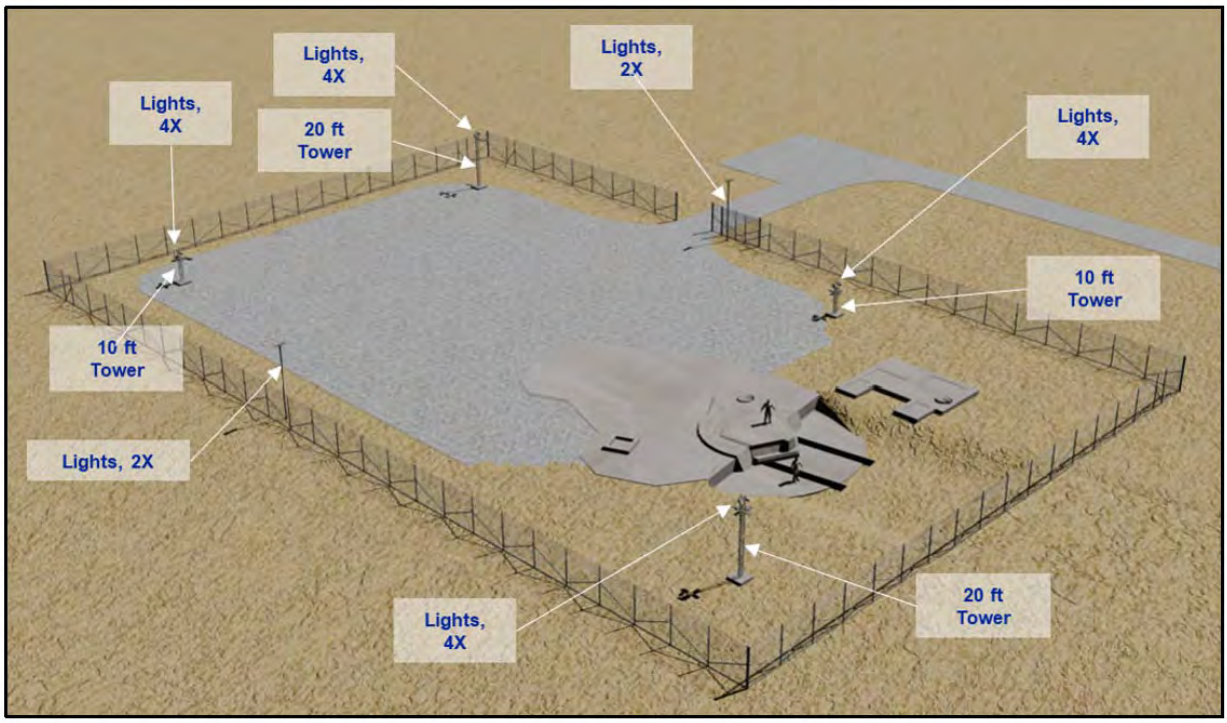
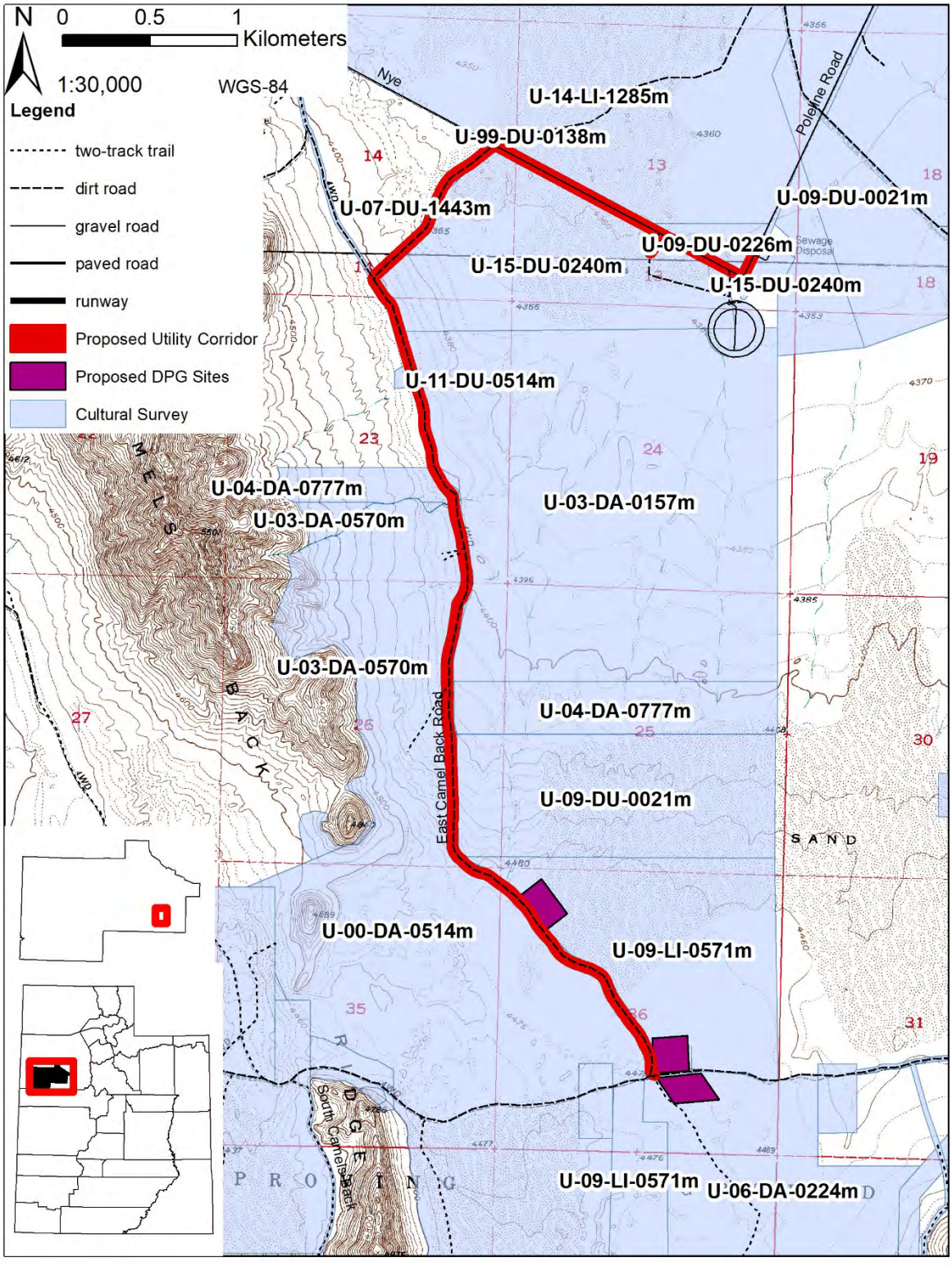


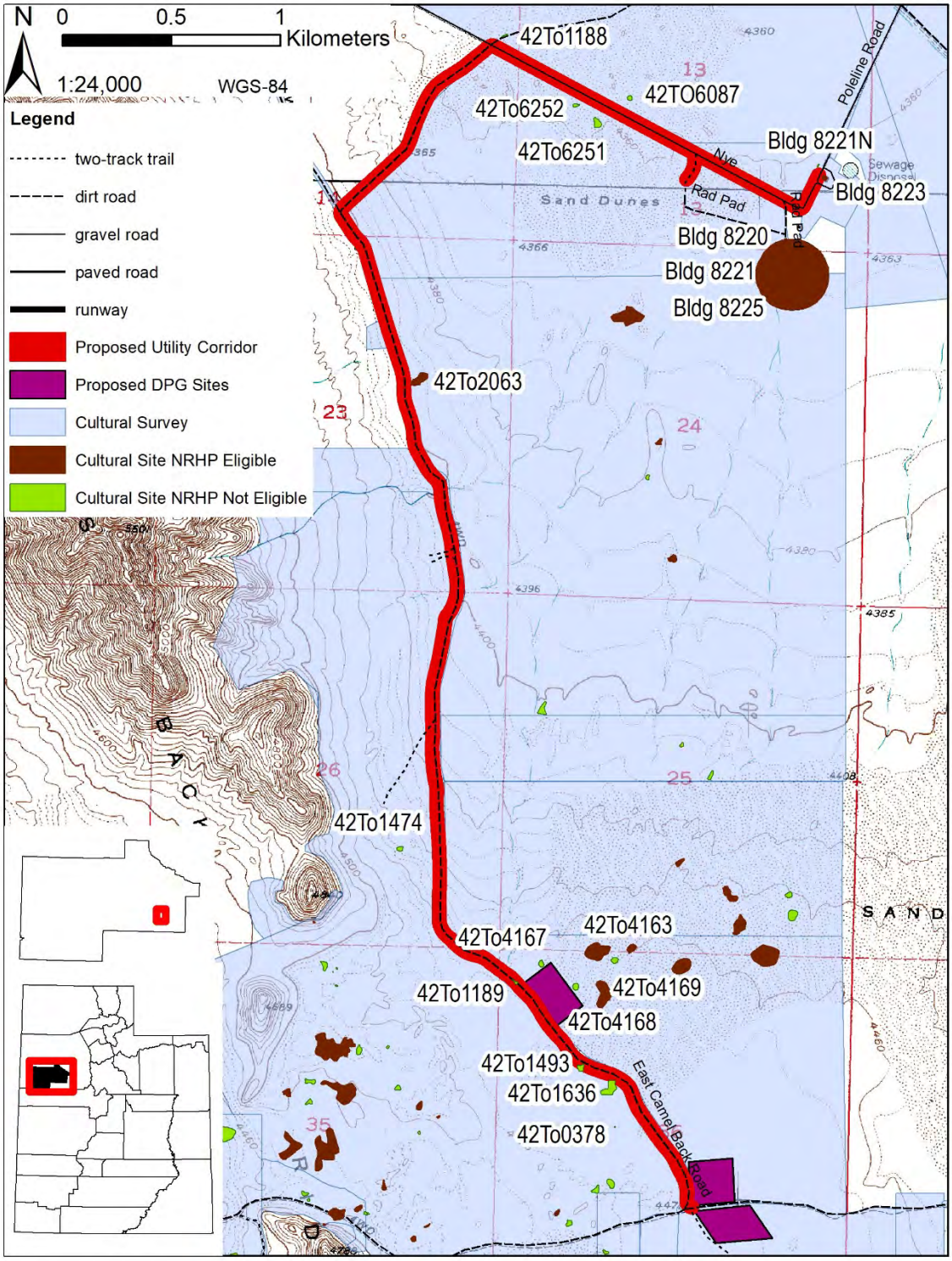
Figure 3: Notational layout of the PSSTF.



Basemaps: Camels Back Ridge NW & Camels Back Ridge SW 7.5' USGS Topo Map Map Created by R. Quist

GBSD Test Program at DPG: Previous Surveys Map

Figure 4: Previous cultural resource surveys within and around the APE.



Basemaps: Camels Back Ridge NW & Camels Back Ridge SW 7.5' USGS Topo Map Map Created by R. Quist

GBSD Test Program at DPG: Previous Surveys Map

Figure 5: Previously identified archaeological and architectural resources; labeled sites are within 200 meters of the APE.

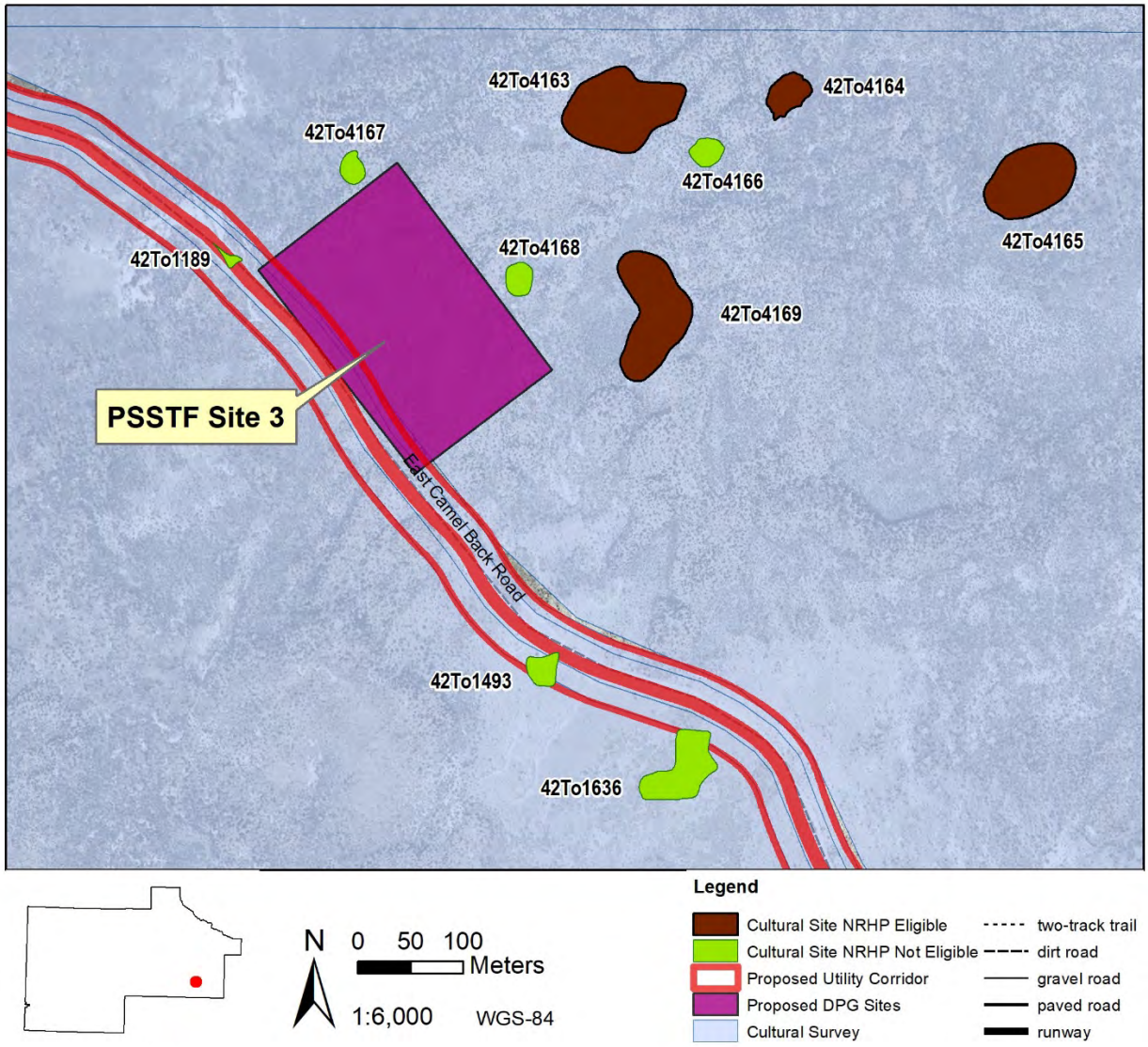
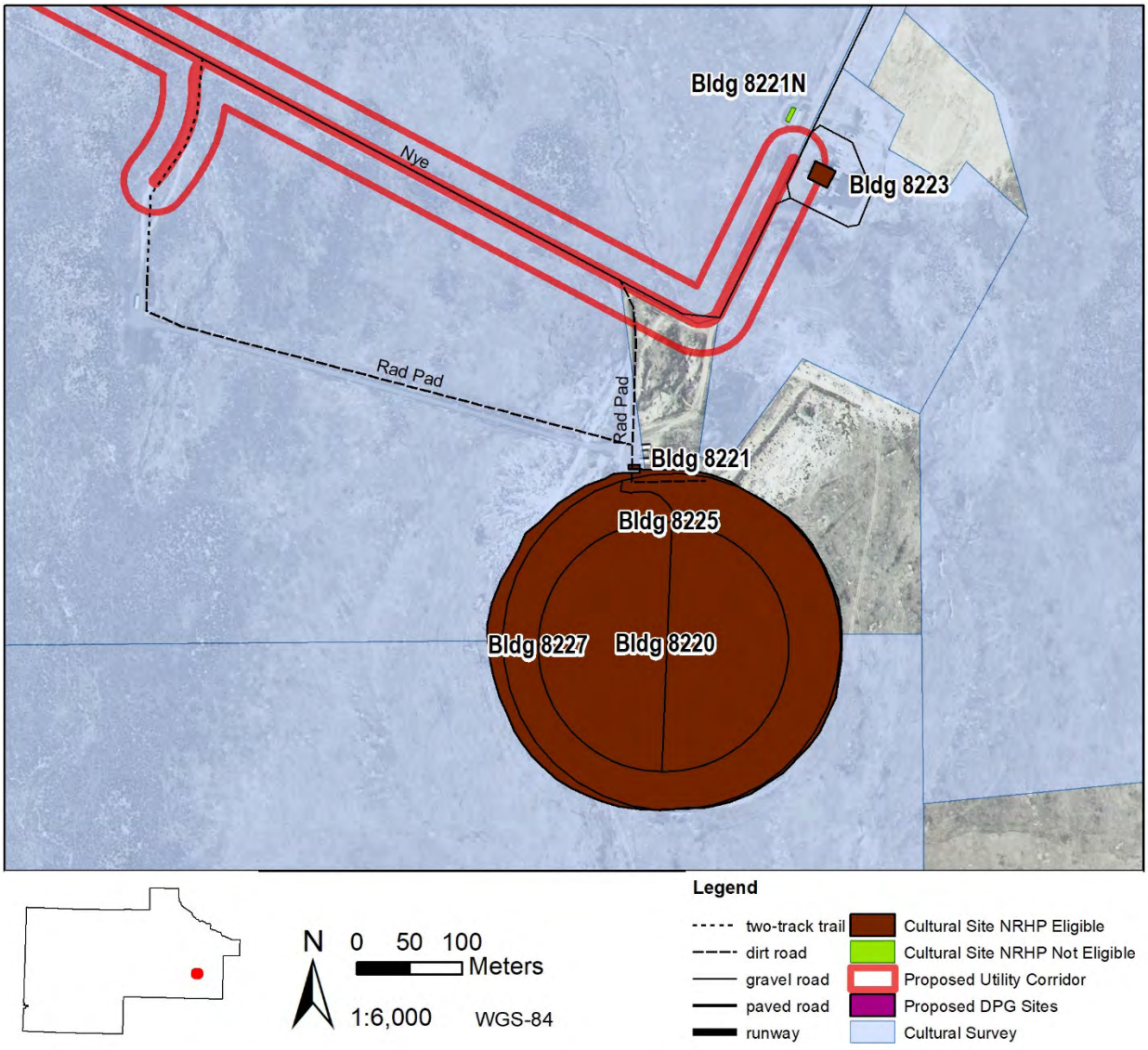


Figure 6: Detail map showing archaeological resources located within, and adjacent to, the APE. Sites 42TO4163 and 42TO4169 will be avoided during construction activities and periodically monitored during construction and use of the PSSTF and if necessary will be marked as “no-go areas” to ensure avoidance.



GBSD Test Program at DPG: Cultural Site Detail

Figure 7: Detail map showing architectural resources located within, and adjacent to, the APE. Buildings 8220, 8221, 8225, 8227 comprise the Rad Pad Historic District. Building 8223 will be avoided during construction activities.

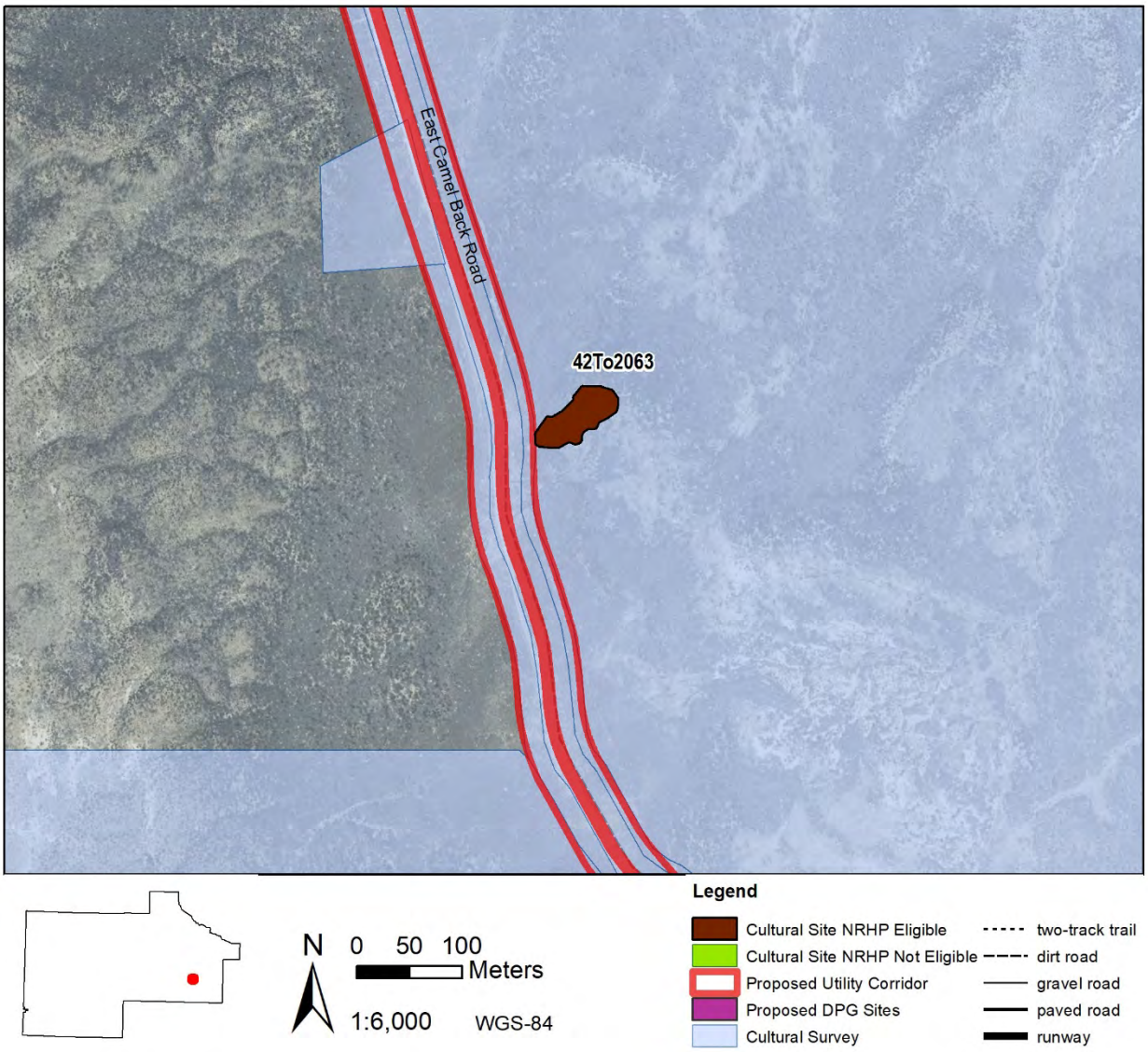


Figure 8: Detail map showing archaeological resources located adjacent to the APE. Site 42TO2063 will be avoided and monitored during utility construction activities.

Lieutenant Colonel Charles G. Hansen
Commander, 30th Civil Engineer Squadron
1172 Iceland Ave
Vandenberg AFB CA 93437-6011

January 12, 2021

Ms. Julianne Polanco
State Historic Preservation Officer
Department of Parks and Recreation
Office of Historic Preservation
P.O. Box 942896
Sacramento CA 94296-0001

Dear Ms. Polanco

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), California, in cooperation with the Air Force Nuclear Weapons Center, Kirtland AFB, New Mexico, proposes to develop and test a new intercontinental ballistic missile (ICBM) system by modifying existing ICBM infrastructure at Vandenberg AFB. The proposed Ground Based Strategic Deterrent (GBSD) Test Program would develop and test a new ICBM system to modernize the United States land-based nuclear arsenal for the purposes of replacing the nation's existing Minuteman III ICBM system.

30 SW determined that the proposed GBSD Test Program is an undertaking subject to compliance with Section 106 [codified at 54 USC 306108] of the National Historic Preservation Act of 1966, as amended [54 USC 300101 et seq.: Historic Preservation]. 30 SW will comply with Section 106 using the implementing regulations [Title 36 Code of Federal Regulations (CFR) Part 800] and is hereby initiating consultation with the California State Historic Preservation Officer (SHPO). Per 36 CFR §800.3(g), 30 SW is requesting expedited consultation to address multiple steps in §§800.3 through 800.6 with this submittal.

30 SW carried out a reasonable and good-faith cultural resources investigation that fulfills federal agency responsibilities pursuant to 36 CFR §800.4(a)-(d) and 36 CFR §800.5(a)-(d). Details of the investigation are provided in the attachment. 30 SW identified the Area of Physical Impacts and then identified the Area of Potential Effects (APE); 72 cultural resources are within the APE.

30 SW requests concurrence from the SHPO that the APE for the GBSD Project is adequately delineated. Additionally, 30 SW presents the following federal agency determinations of ineligibility for 14 archaeological resources and 5 built environment resources for concurrence from the SHPO:

a. CA-SBA-2127, which was previously incorrectly assigned the status of eligible for listing in the National Register of Historic Places (NRHP)(2S2, USAF970205B) when that status correctly belonged to CA-SBA-760/761/-1748 (the site complex immediately adjacent to and to the west of CA-SBA-2127), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP and, as such, its eligibility code should be revised from 2S2 to 6Y;

b. CA-SBA-1687, which was previously determined eligible for the NRHP as a contributing element to the San Antonio Terrace Archaeological District (SATAD)(2D2, USAF871231A), and was evaluated for individual eligibility for the NRHP during this investigation, does not meet any of the NRHP criteria of significance and thus is not individually eligible for listing in the NRHP, and also does not contribute to the significance of the SATAD and, as such, its eligibility code should be revised from 2D2 to 6Y;

c. CA-SBA-1777, CA-SBA-2159H, CA-SBA-2172, CA-SBA-2224, CA-SBA-2238, CA-SBA-2244, CA-SBA-2245, and CA-SBA-2307, which are inside the boundary of the SATAD, do not meet any of the NRHP criteria of significance and thus are not individually eligible for listing in the NRHP, and also do not contribute to the significance of the SATAD;

d. CA-SBA-1759, CA-SBA-2876, CA-SBA-3203, and CA-SBA-3562H, which are outside the boundary of the SATAD, do not meet any of the NRHP criteria of significance and thus are not eligible for listing in the NRHP;

e. P-42-041322, Facility 9320 (the 30th Range Squadron Maintenance Facility), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP;

f. P-42-041323, Facility 9325 (the 30th Space Command Squadron Receiving Warehouse), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP;

g. P-42-041324, Facility 9327 (the 576th Missile Maintenance Paint Shop), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP;

h. P-42-041336, Facility 7501 (the Missile Service Shop), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP; and

i. P-42-041380, Facilities 6809 and 6810 (Hot Cargo Pads), does not meet any of the NRHP criteria of significance and thus is not eligible for listing in the NRHP.

Additionally, 30 SW presents the following federal agency determination of eligibility for concurrence from the SHPO: CA-SBA-760/-761/-1748, which appeared to be previously unevaluated, yet whose boundary matches the boundary of CA-SBA-2127 within documents that determined that site to be eligible for the NRHP in 1997 (2S2, USAF970205B), should be ascribed the NRHP-eligible status that was ascribed to CA-SBA-2127 back in 1997 as eligible for the NRHP under Criterion d (2S2).

Additionally, pursuant to 36 CFR 800.5, 30 SW applied the criteria of adverse effect provided at 36 CFR 800.5(1)(a) to 25 historic properties within the APE and determined that 17 archaeological historic properties and 1 built environment historic property would not be adversely affected by the GBSD Test Program as described within the attachment. 30 SW requests concurrence from the SHPO on the assessment of no adverse effects to the historic properties listed in the table below:

Historic Properties with No Adverse Effects	
CA-SBA-228	CA-SBA-941
CA-SBA-513	CA-SBA-998
CA-SBA-594	CA-SBA-1853
CA-SBA-722	CA-SBA-1865/H
CA-SBA-730	CA-SBA-2128H
CA-SBA-739	CA-SBA-2471
CA-SBA-740	CA-SBA-2320
CA-SBA-743	CA-SBA-2352
CA-SBA-939	P-42-041258 (MAF-01E/01C)

Lastly, pursuant to 36 CFR 800.5, 30 SW applied the criteria of adverse effect provided at 36 CFR 800.5(1)(a) to 25 historic properties within the APE and determined that 4 archaeological historic properties and 3 built environment historic properties would be adversely affected by the GBSD Test Program. 30 SW requests concurrence from the SHPO on the following assessments of adverse effects:

a. CA-SBA-512, the historic Native American village of Lospe, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: grading for the creation of a laydown area, trenching for the construction of an underground utility corridor, excavation for the construction of multiple underground structures at LF-04, and grading and/or disking associated with maintenance of the fire break surrounding LF-04;

b. CA-SBA-990 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: trenching for the construction of an underground utility corridor;

c. CA-SBA-Z00021H, the San Antonio Terrace Archaeological District, would be adversely affected by the GBSD Test Program because CA-SBA-512 and CA-SBA-990 are

contributing elements of the SATAD and the adverse effects to CA-SBA-512 and CA-SBA-990 described above also constitute adverse effects to the district;

d. CA-SBA-760/-761/-1748 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: grading and/or disking associated with maintenance of the fire break surrounding LF-04;

e. P-42-041239, Missile Alert Facility-D0, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related activities: complete demolition;

f. P-42-041242, Launch Facility-04, would be adversely affected by the GBSD Test Program because the proposed project would result in the alteration of a property [36 CFR 800.5(a)(2)(ii)] resulting from the following project-related activities: modification from a Minuteman III launch facility to a Ground Based Strategic Deterrent test launch facility; and

g. P-42-041253, Launch Facility-26, would be adversely affected by the GBSD Test Program because the proposed project would result in the alteration of a property [36 CFR 800.5(a)(2)(ii)] resulting from the following project-related activities: modification from a Minuteman III launch facility to a Ground Based Strategic Deterrent test launch facility.

As such, pursuant to 36 CFR 800.5(d)(2), 30 SW determined that the proposed GBSD Test Program would result in adverse effects to historic properties and shall consult further to resolved the adverse effects pursuant to 36 CFR 800.6.

If you have any questions or require additional information, please contact Christopher Ryan, Cultural Resources Manager, 30 CES/CEIEA at (805) 605-0748 or via e-mail at christopher.ryan.7@spaceforce.mil. Thank you for your assistance with this undertaking.

Sincerely

CHARLES G. HANSEN, Lt Col, USAF
Commander

Attachment:
Identification of Historic Properties and Finding of Adverse Effect, Ground Based Strategic Deterrent Test Program, Vandenberg Air Force Base, California (Ryan 2021)

Christopher Ryan
30 CES/CEIEA
1028 Iceland Avenue
Vandenberg AFB, CA 93437-6010

January 12, 2021

Mr. Sam Cohen
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

Dear Sam

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), California, in cooperation with the Air Force Nuclear Weapons Center, Kirtland AFB, New Mexico, proposes to develop and test a new intercontinental ballistic missile (ICBM) system by modifying existing ICBM infrastructure at Vandenberg AFB. The proposed Ground Based Strategic Deterrent (GBSD) Test Program would develop and test a new ICBM system to modernize the United States land-based nuclear arsenal for the purposes of replacing the nation's existing Minuteman III ICBM system.

30 SW determined that the proposed GBSD Test Program is an undertaking subject to compliance with Section 106 [codified at 54 USC 306108] of the National Historic Preservation Act of 1966, as amended [54 USC 300101 et seq.: Historic Preservation]. 30 SW will comply with Section 106 using the implementing regulations [Title 36 Code of Federal Regulations (CFR) Part 800]. 30 SW is continuing consultation with the Santa Ynez Band of chumash Indians.

30 SW carried out a reasonable and good-faith cultural resources investigation that fulfills federal agency responsibilities pursuant to 36 CFR §800.4(a)-(d) and 36 CFR §800.5(a)-(d). Details of the investigation are provided in the attachment. 30 SW identified the Area of Physical Impacts and then identified the Area of Potential Effects (APE); 72 cultural resources are within the APE. Of these, 52 are archaeological resources, and 20 are architectural resources. Of the 52 archaeological resources, 21 are eligible for listing in the National Register of Historic Places. Pursuant to 36 CFR 800.5, 30 SW applied the criteria of adverse effect provided at 36 CFR 800.5(1)(a) and determined that 4 archaeological historic properties would be adversely affected by the GBSD Test Program as follows:

a. CA-SBA-512, the historic Native American village of Lospe, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the

significance of the site: grading for the creation of a laydown area, trenching for the construction of an underground utility corridor, excavation for the construction of multiple underground structures at LF-04, and grading and/or disking associated with maintenance of the fire break surrounding LF-04;

b. CA-SBA-990 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: trenching for the construction of an underground utility corridor;

c. CA-SBA-Z00021H, the San Antonio Terrace Archaeological District, would be adversely affected by the GBSD Test Program because CA-SBA-512 and CA-SBA-990 are contributing elements of the SATAD and the adverse effects to CA-SBA-512 and CA-SBA-990 described above also constitute adverse effects to the district; and

d. CA-SBA-760/-761/-1748 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: grading and/or disking associated with maintenance of the fire break surrounding LF-04.

In summary, 30 SW reached a Section 106 finding of *adverse effect to historic properties* for this undertaking, and 30 SW recognizes that the Tribe may have additional concerns. 30 SW is seeking comments or concerns you may have about cultural resources with regard to the proposed undertaking, and the resolution of adverse effects to the four resources described above. I would be very pleased to escort you and any other Tribal members to the project area in the near future. I can be reached at (805) 605-0748 or via email at Christopher.ryan.7@us.af.mil. Thank you for your assistance with this undertaking.

Sincerely

Christopher Ryan

CHRISTOPHER RYAN
30 SW Tribal Liaison Officer

Attachment:
Identification of Historic Properties and Finding of Adverse Effect, Ground Based Strategic Deterrent Test Program, Vandenberg Air Force Base, California (Ryan 2021)

Spencer J. Cox
Governor

Deidre M. Henderson
Lieutenant Governor

Jill Remington Love
Executive Director
Department of
Heritage & Arts

Utah Division of State History

Christopher Merritt
State Historic Preservation Officer

Kevin Fayles
Interim Director

January 15, 2021

Aaron Goodman
Garrison Manager
US Army Garrison Dugway Proving Ground
IMDU-PWE MS#1
5330 Valdex Circle
Dugway, Utah 84022-5001

RE: GBSD Test Program at DPG

For future correspondence, please reference Case No. 21-0048

Dear Mr. Goodman,

The Utah State Historic Preservation Office (SHPO) received your submission and request for our comment on the above-referenced undertaking on January 12, 2021.

From the information provided to our office, it appears that all known historic properties will be avoided the proposed undertaking. As such, we concur with your determination of "No Historic Properties Affected" for this undertaking. However, given that many of the archaeological surveys in the Area of Potential Effect are 10 years or older (considered out of date by SHPO), we ask that you adhere to the following discovery protocol if newly identified cultural resources are inadvertently discovered:

> Discovery Clause: If during ground disturbing activity, contractors encounter any subsurface archaeological deposits including, but not limited to, prehistoric artifacts or features (pithouses, charcoal staining from hearths, etc.), human remains, historic building foundations or walls, outhouse/privies, or dense trash deposits, work must be halted within 50' of the discovery and notification made to the responsible Agency. The Agency will continue to halt work until an assessment of the discovery is completed by the agency, or a State and/or Federally permitted archaeologist and discussions with the Utah State Historic Preservation Office (UTSHPO). If the discovery is considered a significant, or a National Register Eligible property, the agency will coordinate the mitigation of the discovery with the UTSHPO.

This letter serves as our comment on the determinations you have made within the consultation process specified in §36CFR800.4. If you have questions, please contact me at 801-245-7246 or by email at sagardy@utah.gov.

Sincerely,

Savanna Agardy
Compliance Archaeologist

February 11, 2021

Mr. John P. Roth
Acting Secretary of the Air Force
1670 Air Force Pentagon
Washington, DC 20330-1670

Ref: *Establishing the Ground Based Strategic Deterrent Test Program at Vandenberg Air Force Base Santa Barbara County, California*
ACHP Project Number: 016469

Dear Mr. Roth:

In response to the recent notification by the 30th Space Wing, the Advisory Council on Historic Preservation (ACHP) will participate in consultation to develop a Section 106 agreement document for the referenced undertaking. Our decision to participate in this consultation is based on the *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, contained within the regulations, "Protection of Historic Properties" (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act. The criteria are met for this proposed undertaking because of potential procedural questions arising within the context of the decommissioning of the Minuteman III Intercontinental Ballistic Missile with the Ground Base Strategic Deterrent weapon system.

Section 800.6(a)(1)(iii) of these regulations requires that we notify you as the head of the agency of our decision to participate in consultation. By copy of this letter, we are also notifying Lieutenant Colonel Charles G. Hansen, Commander, 30th Civil Engineer Squadron, of this decision.

Our participation in this consultation will be handled by Ms. Katharine R. Kerr, who can be reached at (202) 517-0216 or via email at kkerr@achp.gov. We look forward to working with your agency and other consulting parties to seek ways to avoid, minimize, or mitigate the undertaking's potential adverse effects on historic properties.

Sincerely,

John M. Fowler
Executive Director

December 21, 2020

JAMES D. HUNSICKER, GS-15, DAFC
AFGSC Site Activation Task Force Lead
HQAFGSC A5F
66 Kenney Avenue
Barksdale AFB LA 71110

The Honorable Kenneth Kahn, Tribal Chairman
Santa Ynez Band of Chumash Indians
100 Via Juana Lane
Santa Ynez CA 93460

Dear Chairman Kahn

The United States Air Force (USAF) proposes to modernize the nation's land-based Inter-Continental Ballistic Missile (ICBM) arsenal. The proposed *Ground-Based Strategic Deterrent (GBSD) Test Program* would design, develop, and carry out operational testing of a new missile defense system at Vandenberg Air Force Base (AFB), as well as at Hill AFB and Dugway Proving Ground in Utah (Figure 1). Ultimately, the system that gets developed would replace the nation's existing system, the Minuteman III ICBM system.

At Vandenberg AFB (Figure 2), test program-related actions would include refitting two Minuteman launch facilities, and constructing a new Missile Alert Facility, a Consolidated Maintenance Facility, a GBSD Stage Processing Facility, a GBSD Re-entry Vehicle Maintenance Facility, and a GBSD Schoolhouse (Figures 3 and 4). Numerous existing buildings and structures would be converted to support the GBSD Test Program, and approximately 25 miles of dedicated communications lines would be installed. Test vehicles would be launched over the Pacific Ocean in the Western Test Range.

USAF has determined the proposed GBSD Test Program is subject to compliance with the National Environmental Policy Act (NEPA) (42 United States Code [USC] § 4321 et seq.) and Section 106 (codified at 54 USC 306108) of the National Historic Preservation Act (NHPA) of 1966, as amended (54 USC 300101 et seq.: Historic Preservation).

With regard to the NEPA, this letter initiates the USAF's government-to-government consultation with the Santa Ynez Band of Chumash Indians regarding proposed activities associated with the Ground Based Strategic Deterrent (GBSD) Test Program at Vandenberg Air Force Base (AFB). The USAF is preparing an Environmental Assessment/Overseas Environmental Assessment (EA/OEA) under NEPA. The USAF intends to publish a public review Draft GBSD Test Program EA/OEA for a 30-day review period in early 2021. However, the Tribe will receive a copy of the Draft EA/OEA prior to the public review period to provide an additional opportunity to comment. All comments must be received by the end of the upcoming draft EA/OEA public review period to ensure they are considered and become part of the official record. Additional correspondence will be mailed to Santa Ynez Band of Chumash Indians when the draft EA/OEA public review period begins.

With regard to compliance with Section 106 of the NHPA, consultation with the Tribe was initiated on 5 November 2020 during a consultation meeting between Mr. Christopher Ryan, 30th Space Wing Tribal Liaison Officer and Vandenberg AFB Cultural Resources Manager, and three Tribal representatives – Mr. Sam Cohen, Ms. Nakia Zavalla, and Ms. Kathleen Marshall – at which time Mr. Ryan provided a general overview of the project and maps of the preliminary project footprint. Mr. Ryan is scheduled to continue consultation with the Tribe on 5 January 2021 during a meeting with Mr. Cohen and a presentation to the Tribal Elders' Council. USAF's federal agency determination for the proposed GBSD Test Program is adverse effects to historic properties. Mr. Ryan will review the adverse effects finding and seek input on measures to resolve adverse effects to acceptable levels at that time. Mr. Ryan also will be continuing consultation pursuant to the Native American Graves Protection and Repatriation Act.

If you have any questions pertaining to compliance with the NEPA, please contact Mr. Allen Holdaway (GBSD Test NEPA Program Manager) at 801-777-4752 or via e-mail at allen.holdaway@us.af.mil. If you have any questions pertaining to compliance with Section 106 of the NHPA, please contact Christopher Ryan (30th Space Wing Tribal Liaison Officer and Vandenberg AFB Cultural Resources Manager) at 805-605-0748 or via e-mail at christopher.ryan.7@spaceforce.mil.

Sincerely,

JAMES D. HUNSICKER, GS-15, DAFC
Air Force Global Strike Command
Site Activation Task Force Lead

Figure 1. Locations of GBSD Test Program Proposed Activities

Data Source: VAFB High-Resolution Imagery (2016); World Street Map

Figure 2. Proposed GBSD Test Program Location at Vandenberg AFB

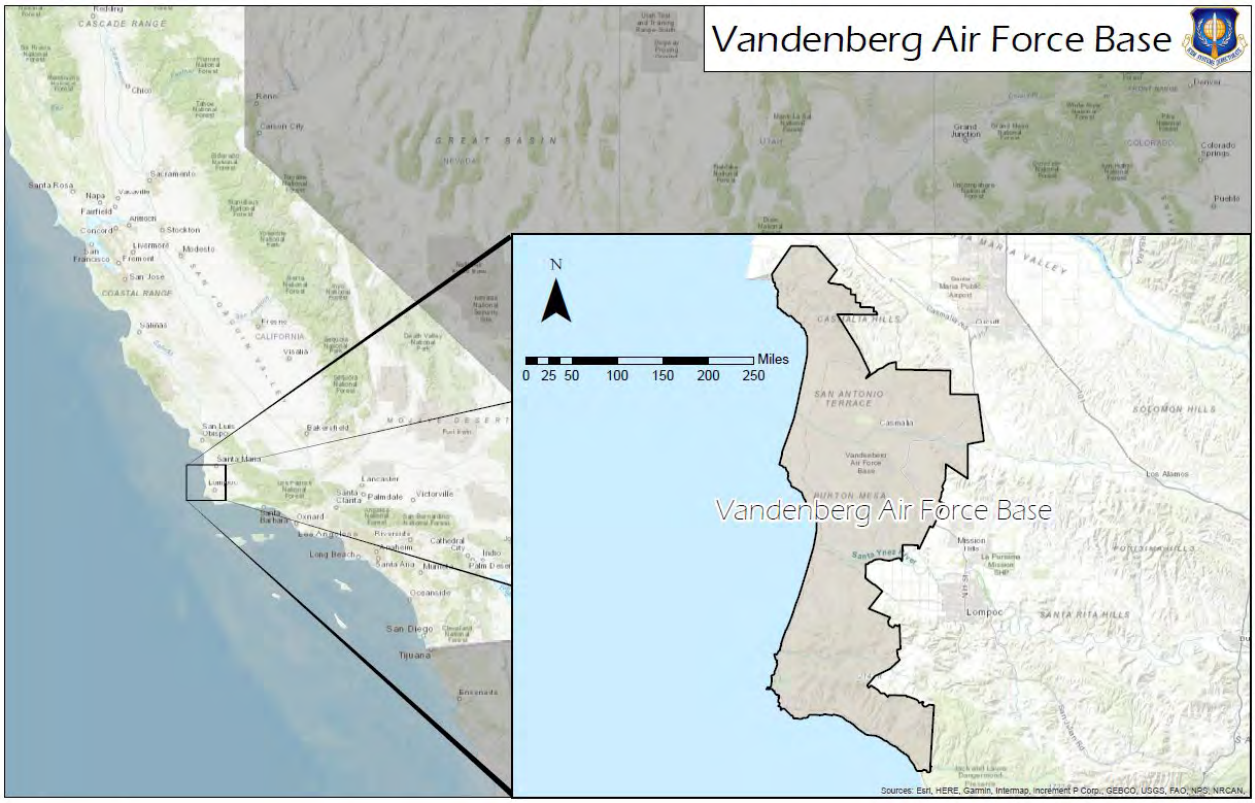


Figure 3. Proposed GBSD Test Program Locations at Vandenberg AFB

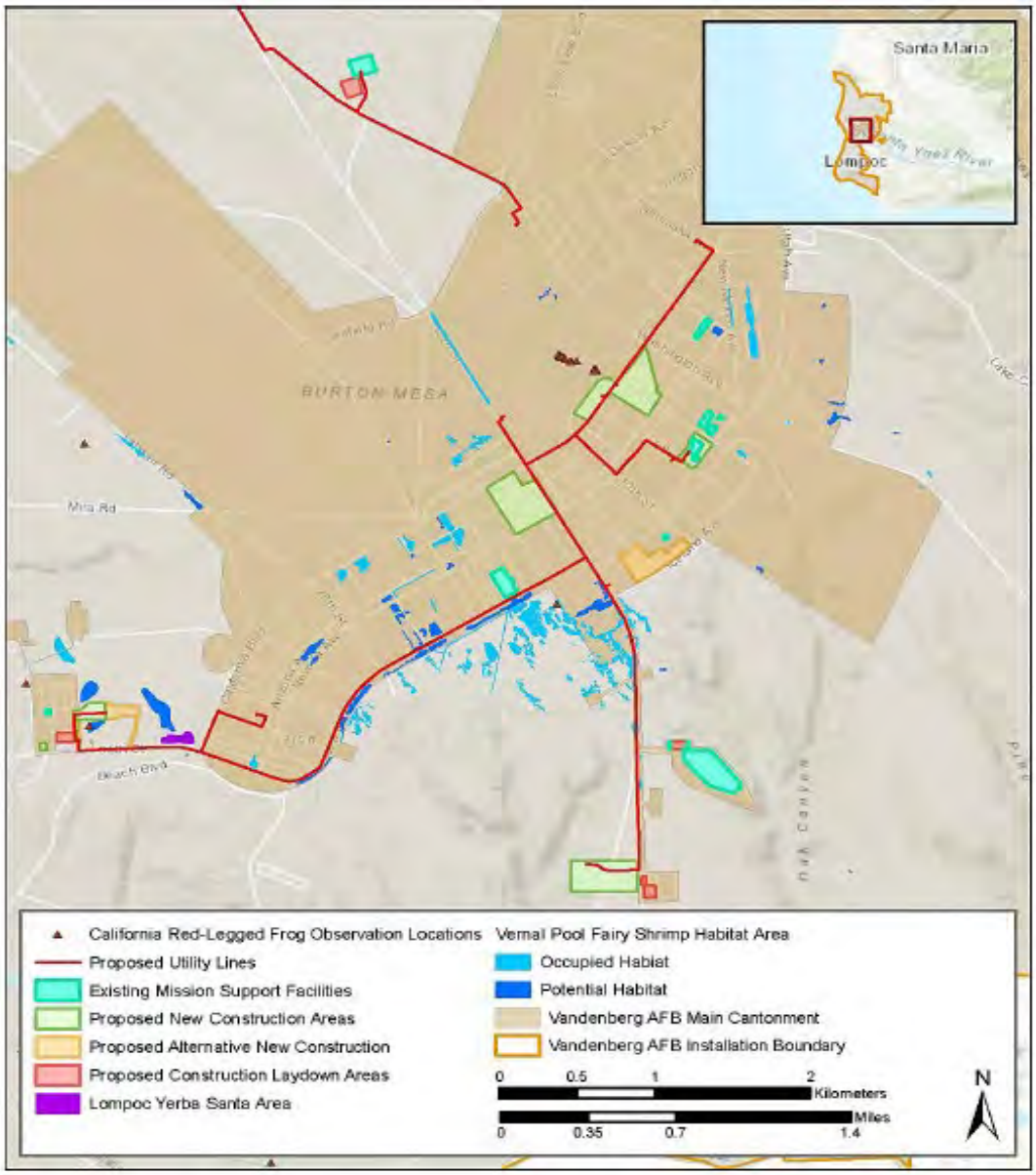


Figure 4. Proposed GBSD Test Program Launch Facility Modifications at Vandenberg AFB

Christopher Ryan
30 CES/CEIEA
1028 Iceland Avenue
Vandenberg AFB, CA 93437-6010

January 12, 2021

Mr. Sam Cohen
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

Dear Sam

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), California, in cooperation with the Air Force Nuclear Weapons Center, Kirtland AFB, New Mexico, proposes to develop and test a new intercontinental ballistic missile (ICBM) system by modifying existing ICBM infrastructure at Vandenberg AFB. The proposed Ground Based Strategic Deterrent (GBSD) Test Program would develop and test a new ICBM system to modernize the United States land-based nuclear arsenal for the purposes of replacing the nation's existing Minuteman III ICBM system.

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30 SW carried out a reasonable and good-faith cultural resources investigation that fulfills federal agency responsibilities pursuant to 36 CFR §800.4(a)-(d) and 36 CFR §800.5(a)-(d). Details of the investigation are provided in the attachment. 30 SW identified the Area of Physical Impacts and then identified the Area of Potential Effects (APE); 72 cultural resources are within the APE. Of these, 52 are archaeological resources, and 20 are architectural resources. Of the 52 archaeological resources, 21 are eligible for listing in the National Register of Historic Places. Pursuant to 36 CFR 800.5, 30 SW applied the criteria of adverse effect provided at 36 CFR 800.5(1)(a) and determined that 4 archaeological historic properties would be adversely affected by the GBSD Test Program as follows:

a. CA-SBA-512, the historic Native American village of Lospe, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the

significance of the site: grading for the creation of a laydown area, trenching for the construction of an underground utility corridor, excavation for the construction of multiple underground structures at LF-04, and grading and/or disking associated with maintenance of the fire break surrounding LF-04;

b. CA-SBA-990 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: trenching for the construction of an underground utility corridor;

c. CA-SBA-Z00021H, the San Antonio Terrace Archaeological District, would be adversely affected by the GBSD Test Program because CA-SBA-512 and CA-SBA-990 are contributing elements of the SATAD and the adverse effects to CA-SBA-512 and CA-SBA-990 described above also constitute adverse effects to the district; and

d. CA-SBA-760/-761/-1748 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: grading and/or disking associated with maintenance of the fire break surrounding LF-04.

In summary, 30 SW reached a Section 106 finding of *adverse effect to historic properties* for this undertaking, and 30 SW recognizes that the Tribe may have additional concerns. 30 SW is seeking comments or concerns you may have about cultural resources with regard to the proposed undertaking, and the resolution of adverse effects to the four resources described above. I would be very pleased to escort you and any other Tribal members to the project area in the near future. I can be reached at (805) 605-0748 or via email at Christopher.ryan.7@us.af.mil. Thank you for your assistance with this undertaking.

Sincerely

Christopher Ryan

CHRISTOPHER RYAN
30 SW Tribal Liaison Officer

Attachment:
Identification of Historic Properties and Finding of Adverse Effect, Ground Based Strategic Deterrent Test Program, Vandenberg Air Force Base, California (Ryan 2021)

RYAN, CHRISTOPHER D GS-12 USSF SPOC 30 CES/CEANC

From: RYAN, CHRISTOPHER D GS-12 USSF SPOC 30 CES/CEANC
Sent: Tuesday, March 02, 2021 8:52 AM
To: Sam Cohen; Nakia Zavalla
Cc: Kelsie Merrick; KEPHART, BEATRICE L CIV USSF SPOC 30 CES/CEI; YORK, DARRYL L GS-14 USSF SPOC 30 CES/CEIE; KAISERSATT, SAMANTHA O CIV USSF SPOC 30 CES/CEIEA
Subject: RE: Vandenberg Air Force Base (VAFB) - Notice of Availability - Ground Based Strategic Deterrent (GBSD) Test Program -Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA)
Attachments: USAF_2021_0122_001 GBSD Test Program Vandenberg AFB 2021-02-22.pdf

Greetings Sam and Nakia
Regarding the GBSD Test Program, I received comments from the SHPO (attached) following initial submittal of the Section 106 report. On page 3, the SHPO requests an updated summary of consultation with the Tribe. I submitted the Section 106 report to the Tribe in mid-January. Would you be able to provide me with any comments the Tribe has on the project and the Section 106 report today or by mid-day tomorrow? If that is not possible, would you please let me know that the Tribe's review is in progress and provide an estimated date for completion of your review of that document?

A couple things worth noting:

1. If you have some comments and are still working on the report, your comments to date would suffice for the purposes of communicating back to the SHPO.
2. If you are interested in a site visit, would you please communicate that to me, and propose a date for that site visit.
3. If you are interested in meeting to discuss the Draft EA/OEA, would you please state that and propose a date for that meeting?

Lastly, I have a draft of the NAGPRA Written Plan of Action and will be sending that to you shortly. Would you please let me know your availability to meet to discuss NAGPRA compliance. Of course, if you would like to have a single meeting to address all of these issues, that is fine with me. Thank you very much in advance.
Respectfully, Chris

Christopher Ryan
30 SW Tribal Laiason Officer
1028 Iceland Ave, Bldg 11146
VAFB, CA 93437-6010
805.605.0748

From: RYAN, CHRISTOPHER D GS-12 USSF SPOC 30 CES/CEANC
Sent: Friday, February 19, 2021 8:27 AM
To: 'Sam Cohen' <scohen@santaynezchumash.org>
Cc: Nakia Zavalla <NZavalla@santaynezchumash.org>; Kelsie Merrick <kmerrick@santaynezchumash.org>; KEPHART, BEATRICE L CIV USSF SPOC 30 CES/CEI <beatrice.kephart@spaceforce.mil>; YORK, DARRYL L GS-14 USSF SPOC 30 CES/CEIE <darryl.york@spaceforce.mil>
Subject: RE: Vandenberg Air Force Base (VAFB) - Notice of Availability - Ground Based Strategic Deterrent (GBSD) Test Program -Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA)

Hi Sam
Yes, and we've already initiated consultation with the Tribe on this. We discussed it during our in-person meeting on November 5th, and during our January 5th Zoom meeting. And the Tribe received a letter from Global Strike Command on this project. And I submitted our Section 106 documentation to both the SHPO and the Tribe, electronically.
I'm glad you asked about this project; the next step is to perform a field visit at the Tribe's earliest possible convenience (although not next week).
There will be an MOA on this, and there will be NAGPRA Written Plan of Action. And the ACHP has opted to participate in the resolution of adverse effects, so they also will be a signatory on the MOA.
Very best regards, Chris

From: Sam Cohen <scohen@santaynezchumash.org>
Sent: Friday, February 19, 2021 8:00 AM
To: RYAN, CHRISTOPHER D GS-12 USSF SPOC 30 CES/CEANC <christopher.ryan.7@spaceforce.mil>
Cc: Sam Cohen <scohen@santaynezchumash.org>; Nakia Zavalla <NZavalla@santaynezchumash.org>; Kelsie Merrick <kmerrick@santaynezchumash.org>
Subject: [Non-DoD Source] Fwd: Vandenberg Air Force Base (VAFB) - Notice of Availability - Ground Based Strategic Deterrent (GBSD) Test Program -Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA)

Is there going to be separate NHPA 106 consultation for this?

Sam Cohen
Santa Ynez Chumash
Cell 805-245-9083

Sent from my iPhone

Begin forwarded message:

> **From:** Karen Barnes <barnesk@kfs-llc.com>
> **Date:** February 19, 2021 at 6:39:47 AM PST
> **To:** SAMANTHA O CIV USSF SPOC 30 CES/CEIEA <samantha.kaisersatt@spaceforce.mil>, "HOLDAWAY, ALLEN R GS-13 USAF AFMC AFNWC/NXD" <allen.holdaway@us.af.mil>
> **Cc:** "Hasley, David C CIV USARMY SMDC (USA)" <david.c.hasley.civ@mail.mil>, susan.b.pearsall.ctr@mail.mil
> **Subject: Vandenberg Air Force Base (VAFB) - Notice of Availability - Ground Based Strategic Deterrent (GBSD) Test Program -Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA)**

Notice of Availability
Ground Based Strategic Deterrent (GBSD) Test Program
Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA)

The United States (U.S.) Air Force (USAF) has prepared a Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA) in accordance with the Council on Environmental Quality (CEQ) and USAF regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR Section 1502.14 and 32 CFR Section 989.8, respectively).

The Draft EA/OEA analyzes the implementation of the Ground Based Strategic Deterrent (GBSD) Test Program. GBSD represents the modernization of the U.S. land-based nuclear arsenal, eventually replacing the aging Minuteman III intercontinental ballistic missile system. Before USAF can make future decisions to transition the Minuteman III weapon system from active status to the GBSD weapon system, developmental and operational program testing of the new system must occur. Test program-related actions would occur primarily at Hill Air Force Base (HAFB) in Utah and at Vandenberg Air Force Base (VAFB) in California. Such tests would include conducting missile launches from VAFB with flights over the Pacific Ocean in the Western Test Range. Additional test support activities would occur at U.S. Army Dugway Proving Ground (DPG) in Utah.
Because the proposed GBSD Test Program would overlap several years of Minuteman III flight testing, the Proposed Action analyzed in the EA/OEA takes into consideration actions and resulting impacts that would occur from conducting both GBSD and Minuteman III test programs in parallel. It includes analysis of associated facility construction and modifications, and test operations, which would occur at HAFB, VAFB, and DPG. The EA/OEA also includes analysis of the proposed GBSD Formal Training Unit/Schoolhouse, including its anticipated parallel operations with the existing Minuteman III Schoolhouse at VAFB. All GBSD Test Program and Minuteman III demonstrations proposed to occur at U.S. Army Garrison–Kwajalein Atoll (USAG-KA) and within the Republic of the Marshall Islands territorial waters must comply with the U.S. Army Kwajalein Atoll Environmental Standards (UES). A Document of Environmental Protection (DEP) is under development to outline the activities proposed to occur at USAG-KA and within the Republic of the Marshall Islands.

The Draft GBSD Test Program EA/OEA and Draft Finding of No Significant Impact (FONSI) are available at http://gbsdtesteaoea.govsupport.us.

Public comments on the Draft Test Program EA/OEA and Draft FONSI will be accepted from **February 19, 2021 to March 22, 2021** and can be provided in either of the following ways: (1) E-mail comments by **March 22, 2021** to gbsdtesteaoea-comments@govsupport.us; (2) Mail comments, postmarked no later than **March 22, 2021**, to: USASMDC, ATTN: SMDC-EN (D. Hasley), P.O. Box 1500, Huntsville, AL 35807.

Contract Support

Dr. Karen L. Charley-Barnes

Senior Project Manager
KFS, LLC
303 Williams Avenue – Suite 116
Huntsville, AL 35801
Office: 256-713-1646
Fax: 256-713-1617

March 18, 2021

To: USASMDC
ATTN: SMDC-EN (D. Halsey)
P.O. Box 1500
Huntsville, AL 35807
gbsdtesteaoea-comments@govsupport.us

Vandenberg Air Force Base
ATTN: Christopher Ryan, 30th Space Wing Tribal Liaison Officer 30 CES/CEIEA
1027 Iceland Avenue Vandenberg AFB, CA 93437

RE: Vandenberg Air Force Base ("VAFB")
Ground Based Strategic Deterrent ("GBSD") Test Program Environmental Assessment ("EA") Comments
Section 106 of the National Historic Preservation Act ("NHPA") Consultation EA comment deadline: March 22, 2021

USASMDC and VAFB:

The Santa Ynez Band of Chumash Indians ("Chumash" or "Tribe") thanks USASMDC and VAFB for the opportunity to provide comments on the GBSD EA. Insofar as USASMDC and VAFB will meet their federal agency responsibilities to consider potential project effects to cultural resources pursuant to the National Environmental Policy Act ("NEPA") by compliance with Section 106 of the NHPA, the Tribe's views as expressed herein pertain to both the NEPA and documents submitted to the Tribe as part of Tribal consultation requirements under Section 106 of the NHPA.

Furthermore, VAFB is covered by Executive Order 13175 as reaffirmed by that Presidential Memorandum on Tribal Coordination that reaffirmed Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," and emphasized the importance of strengthening government-to-government relationships with Native American tribes.

In addition, the Department of Defense ("DOD") is an original signatory to the MOU REGARDING INTERAGENCY COORDINATION AND COLLABORATION FOR THE PROTECTION OF INDIAN SACRED SITES (2012) and the **Action Plan to** Implement the Memorandum of Understanding (MOU) Regarding Interagency

Coordination and Collaboration for the Protection of Indian Sacred Sites dated March 5, 2013. The Tribe believes the MOU and Action Plan should be applied to the GBSD Test Program.

The Tribe, therefore, makes the following comments:

(1) The EA Must Address Cultural Resources (from http://www.npi.org/NEPA/impact)

Cultural resources are referred to in different ways at different points in the CEQ regulations. The regulatory definition of the term "human environment" at 40 CFR 1508.14 –impacts on the quality of the human environment being the subjects of any EA - includes "the natural and physical environment and the relationship of people with that environment." The definition of "effects" at 40 CFR 1508.8 – as in "effects on the quality of the human environment" – includes changes in the human environment that are "aesthetic, historic, cultural, economic, (or) social."

The regulatory definition of the word "significantly" at 40 CFR 1508.27 – as in "major federal action significantly affecting the quality of the human environment" – includes as measures of impact intensity:

- Impacts on an area's unique characteristics, such as "historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, and ecologically critical areas" (40 CFR 1508.27(b)(3)).
- Impacts on "districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places" and on "significant scientific, cultural, or historical resources" (40 CFR 1508.27(b)(8)).

Clearly, impacts on cultural resources are to be addressed in an EA. **Note that it is not just impacts on historic properties that should be addressed. The regulations use "historic" and "cultural" in parallel, not as synonyms.**

(2) Deferral of Mitigation does not Comply with NEPA (from **http://www.npi.org/NEPA/impact**)

Deferral. With respect to historic properties, a very common problem is "deferral," in which the agency:

> Acknowledges that it does not know much about what effects there may be on historic properties (often because such properties have not yet been identified); but
> Says that whatever effects there may be, NHPA Section 106 review (of the National Historic Preservation Act), to be performed later, will take care of them; and
> Concludes that therefore, whatever alternative is decided on, impacts on historic properties will not be a problem.

Considering environmental impacts *after* a decision has been made defeats NEPA's purpose of considering impacts in *preparing* to make decisions. It also almost guarantees last-minute conflicts between project implementation and historic preservation.

Failure to consider things that are not historic properties. With respect to other kinds of cultural resources, a common problem is that they are not considered at all. Historic properties are sometimes the only things discussed in the "cultural resource" part of an EA. All archeological sites must be considered within an EA, not just archaeological sites that are eligible for listing on the National Register of Historic Places. Additionally, if social impacts are considered, they are often considered only terms of easily quantifiable socioeconomic variables like population, employment, and use of public services. The result is that impacts on many classes of cultural resource simply are not identified or considered in deciding whether significant impacts may occur.

(3) Traditional Cultural Properties and Cultural Landscapes must also be included in Section 106 consultations and the EA

Traditional cultural properties, because they are a property type that is eligible for listing on the NRHP, must be identified in the same manner in the Section 106 process as other types of cultural resources of significance to Indian tribes or Native Hawaiian organizations. The regulations at 36 CFR Section 800.4 outline several steps a federal agency must take to identify historic properties. In summary, to determine the scope of identification efforts, a federal agency, in consultation with the State Historic Preservation Officers (SHPO)/Tribal Historic Preservation Officer (THPO), must:

Determine and document the area of potential effect for its undertaking;
Review existing information; and
Seek information from consulting parties including Indian tribes or Native Hawaiian organizations.

Based on the information gathered through these efforts, the federal agency, in consultation with the SHPO and any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by the undertaking, develops and implements a strategy to identify historic properties within the area of potential effects. Identification efforts may include background research, oral history interviews, scientific analysis, and field investigations. **http://www.achp.gov/natl-qa.pdf**

There is no single defining feature or set of features that comprise a traditional cultural property or cultural landscape. Such places could be comprised of natural features such as mountains, caves, plateaus, and outcroppings; water courses and bodies such as rivers, streams, lakes, bays, and inlets; views and view sheds from them, including the overlook or similar locations ; vegetation that contributes to its significance; and, manmade features including archaeological sites; buildings and structures; circulation features such as trails; land use patterns; evidence of cultural traditions, such as petroglyphs and evidence of burial practices; and markers or monuments, such as cairns, sleeping circles, and geoglyphs. **http://www.achp.gov/natl-qa.pdf**

Based on such research, the ACHP TRADITIONAL CULTURAL LANDSCAPES ACTION PLAN advises as follows:

The ACHP, as the agency with responsibility for overseeing the Section 106 review process, and DOI, through the National Park Service (NPS), as the agency with responsibility for overseeing the National Register of Historic Places, should provide leadership in addressing Native American cultural landscapes in the national historic preservation program. Together, the ACHP and NPS should:

Promote the recognition and protection of Native American traditional cultural landscapes both within the federal government and the historic preservation community as well as at the state and local levels, and,
Address the challenges of the consideration of these historic properties in the Section 106 review process as well as in NEPA reviews. **http://www.achp.gov/pdfs/native-american-traditional-cultural-landscapes- action-plan-11-23-2011.pdf**

Thus, it is the Tribe's view that the EA and Section 106 analysis must identify and consider Traditional Cultural Properties and Cultural Landscapes.

(4) U.N. Declaration on the Rights of Indigenous Peoples must now be followed after December 2010

In December 2010, the United States announced support for the **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)**. In announcing this support, President Obama stated: "The aspirations it affirms—including the respect for the institutions and rich cultures of Native peoples—are one we must always seek to fulfill…[W]hat matters far more than any resolution or declaration – are actions to match those words." The UNDRIP addresses indigenous peoples' rights to maintain culture and traditions (Article 11); and religious traditions, customs, and ceremonies (Article 12); to participate in decision making in matters which would affect their rights (Article 18); and to maintain spiritual connections to traditionally owned lands (Article 25).

The ACHP will now incorporate UNDRIP in the Section 106 review process:

While the Advisory Council on Historic Preservation's (ACHP) work already largely supports the United Nations Declaration on the Rights of Indigenous Peoples, additional and deliberate actions will be taken to more overtly support the Declaration. The Section 106 review process provides Indian tribes and Native Hawaiian organizations (NHOs) with a very important opportunity to influence federal decision making when properties of religious and cultural significance may be threatened by proposed federal actions. While federal agencies are required to consult with Indian tribes and NHOs and to take their comments into account in making decisions in the Section 106 review process, adding the principles of the Declaration to that consideration may assist federal agencies in making decisions that result in the protection of historic properties of religious and cultural significance to Indian tribes and NHOs. **http://www.achp.gov/docs/UN%20Declaration%20Plan%203-21-13.pdf**

(5) Subsurface testing is required.

Pedestrian surveys are of limited utility and never alone are sufficient when there are known areas of habitation or ceremony. The Tribe understands that VAFB has completed a Phase I Pedestrian Survey of the project area, and Extended Phase I subsurface archaeological survey, and some Phase II subsurface archaeological testing for all areas scheduled for any excavation or other types of ground disturbance.

The project is in a region where there are many sites; there is reason to suspect that buried sites may be present that went undetected during the survey. Because the soil profile is depositional then there may be a need to conduct additional subsurface testing, particularly in areas where ground disturbance is planned at depths greater than one meter. Backhoes are sometimes used to test for deeply buried deposits and informal sampling procedures are often employed while screening the backdirt. The Tribe understands that no backhoe pits or trenches were excavated.

Sometimes the federal agency will argue that archaeological survey is not warranted for a particular project or there may be factors that justify additional investigation even though a Phase I study has been completed with negative results. Following is a list of environmental and cultural factors that should be considered when assessing the overall cultural sensitivity of a project area:

- Areas with high viewshed or visibility such as or ridgelines, peaks, ledges, outcrops, benches, or prominent hills; and

- Areas with a relatively high density of sites in the vicinity; and

- Areas where past ethnographic studies have revealed associated placenames; and

- Areas near known sites. Mapped boundaries of sites most frequently reflect only cultural residue that was visible on the surface when the site was recorded and do not necessarily reflect the actual extent of the site. In addition, loci such as cemeteries or other areas may be adjacent to or nearby but separate from the main habitation; and

- Areas near known rock art sites or rocky outcroppings of the type where rock shelters and art have traditionally been located; and

- Areas in or near known gathering areas; and
- Named, ethnohistorically documented village sites are of the highest priority and therefore warrant the greatest amount of protection possible.

The Tribe understands that some project work would occur within the ethnographically documented village of Lospe, and that excavation could occur to depths greater than one meter.

(6) Exhaustion of Non-Excavation Methods of mitigation and remediation.

To the extent feasible, VAFB should exhaust all non-excavation methods of mitigation and remediation before performing any excavation that could potentially impact cultural and historic sites.

(7) Soil Prior disturbance is NOT Dispositive:

The mantra that cultural sites have been disturbed and therefore automatically are not significant is oftentimes incorrect:

> Disturbed sites still may contain valuable information. The newer approach is to treat disturbed sites as having the potential to provide information even if they have been disturbed;
> Disturbed sites still have spiritual significance;
> Disturbance may only be on the surface, while much excavation may continue to depths greater than one meter.

(8) Need to Analyze Cumulative Impacts to Cultural Resources:

The EA must analyze other past and reasonably foreseeable projects in and near the project area that have impacted cultural resources, such as:

> The impact of constructing LF-04, Point Sal Road, two parking lots, and underground utilities on the ethnographically documented village of Lospe;
> The impact of constructing LF-26, Point Sal Road, one parking lot, and underground utilities on CA-SBA-760/761.;
> Other cultural resources within the project area impacted by road construction, underground utilities, and other construction projects.

(9) MONITORING: Native American monitoring during any ground disturbing activities.

More than one Native American monitor would be required when there are multiple work areas in progress or multiple pieces of equipment operating in a single work area. Native American monitors are required for all ground-disturbing work within 60 meters of all prehistoric archaeological sites.

(10) Need NEPA/Section 106 Mitigation Plan

http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa- mitigation-monitoring-draft-guidance.pdf

February 18, 2010

MEMORANDUM FOR HEADS OF FEDERAL DEPARTMENTS AND AGENCIES

FROM: NANCY H. SUTLEY, Chair, Council on Environmental Quality SUBJECT: DRAFT GUIDANCE FOR NEPA MITIGATION AND MONITORING

I. INTRODUCTION

To provide for the performance of mitigation, agencies should create internal processes to ensure that mitigation actions adopted in any NEPA process are documented and that monitoring and appropriate implementation plans are created to ensure that mitigation is carried out. See *Aligning NEPA Processes with Environmental Management Systems* (CEQ 2007) at 4 (discussing the use of environmental management systems to track implementation and monitoring of mitigation). http://ceq.hss.VAFB.gov/nepa/nepapubs/Aligning_NEPA_Processes_with_Environmenta l_Management_Systems_2007.pdf (**http://www.slideshare.net/whitehouse/aligning- nepa-processes**).

Agency NEPA implementing procedures should require clearly documenting the commitment to mitigate the measures necessary in the environmental documents prepared during the NEPA process (40 C.F.R. § 1508.10) and in the decision documents such as the Record of Decision. When an agency identifies mitigation in an EA and commits to implement that mitigation to achieve an environmentally preferable outcome, or commits in an EA to mitigation to support a FONSI and proceeds without preparing an EA, then the agency should ensure that the mitigation is adopted and implemented.

Methods to ensure implementation should include, as appropriate to the agency's underlying authority for decision-making, appropriate conditions in financial agreements, grants, permits or other approvals, and conditioning funding on implementing the mitigation. To inform performance expectations, mitigation goals should be stated clearly. These should be carefully specified in terms of measurable performance standards to the greatest extent possible. The agency should also identify the duration of the agency action and the mitigation measures in its decision document to ensure that the terms of the mitigation and how it will be implemented are clear.

If funding for implementation of mitigation is not available at the time the decision on the proposed action and mitigation measures is made, then the impact of a lack of funding and resultant environmental effects if the mitigation is not implemented warrant disclosure in the EA or EA. In cases where, after analyzing the proposed actions with or without the mitigation, the agency determines that mitigation is necessary to support the FONSI or committed to in the ROD, and the necessary funding is not available, the agency may still be able to move forward with the proposed action once the funding VAFBs become available. The agencies should ensure that the expertise and

professional judgment applied in determining the appropriate mitigation measure is reflected in the administrative record, and when and how those measures will be implemented are analyzed in the EA or EA.

Under NEPA, a federal agency has a continuing duty to gather and evaluate new information relevant to the environmental impact of its actions. See 42 U.S.C. § 4332(2)(A). For agency decisions based on an EA, the regulations require that, "a monitoring and enforcement program shall be adopted…where applicable for mitigation." 40 C.F.R. §1505.2(c). In addition, the regulations state that agencies may "provide for monitoring to assure that their decisions are carried out and should do so in important cases." 40 C.F.R. §1505.3. Monitoring plans and programs should be described or incorporated by reference in the agency decision documents.

The Tribe requests review of the plan to mitigate project impacts to cultural resources.

The Tribe requests inclusion as a signatory on any and all MOAs under NEPA and the NHPA pertaining to mitigating impacts to cultural resources for the GBSD Test Program.

(11) Native American Graves Protection and Repatriation Act ("NAGPRA")

The GBSD Test Program project area includes areas where ancestors are known to be buried. The burial areas are located within the ethnographically documented village of Lospe. Section 3 of NAGPRA is triggered in the event of intentional excavation or inadvertent discovery of Native American human remains and cultural items on Federal lands.

> Intentional Excavation: The planned archeological removal of human remains, funerary objects, sacred objects, or objects of cultural patrimony found under or on the surface of Federal or tribal lands pursuant to section 3 (c) of the Act. [43 CFR 10.2 (g)(3)].
> Inadvertent Discovery: The unanticipated encounter or detection of human remains, funerary objects, sacred objects, or objects of cultural patrimony found under or on the surface of Federal or tribal lands pursuant to section 3 (d) of NAGPRA. [43 CFR 10.2 (g)(4)].

The National Park Service provides a NAGPRA Section 3 Plan of Action Checklist, which states:

The written plan of action is an integral part of the consultation process mandated by 43 CFR 10.5 whenever there is activity affecting or likely to affect Native American cultural items on Federal or tribal lands. The plan of action must document compliance with ARPA, especially 43 CFR 7.7 – 7.9, regarding requirements for permits on Indian lands.

> Information on the kinds of objects that are considered to be –
> - Funerary objects
> - Sacred objects
> - Objects of cultural patrimony
>
> Specific information used to determine custody/ownership under 43 CFR 10.6
>
> Planned treatment, care, and handling of –
> - Human remains
> - Funerary objects
> - Sacred objects
> - Objects of cultural patrimony

The planned archeological recording of –

- Human remains
- Funerary objects
- Sacred objects
- Objects of cultural patrimony

The kinds of analysis planned for –

- Human remains
- Funerary objects
- Sacred objects
- Objects of cultural patrimony

Steps to be followed to contact Indian tribe officials at the time of excavation or inadvertent discovery of specific –

- Human remains
- Funerary objects
- Sacred objects
- Objects of cultural patrimony

The kind of traditional treatment, if any, to be used for –

- Human remains
- Funerary objects
- Sacred objects
- Objects of cultural patrimony

The nature of reports to be prepared

The planned disposition of human remains, funerary objects, sacred objects, and objects of cultural patrimony following 43 CFR 10.6 [NOTE: a Notice of Intended Disposition is still required prior to disposition.]

The plan of action complies with 43 CFR 10.3 (b)(1) and follows the requirements of ARPA.

The plan of action is signed by the Federal agency official.

A copy of the plan of action is provided to the consulting lineal descendants, Indian tribes, and Native Hawaiian organizations.

The Tribe requests review of the NAGPRA Plan of Action for the GBSD Test Program.

The Tribe requests inclusion as a signatory on the NAGPRA Plan of Action for the GBSD Test Program.

The Tribe requests concurrent development of the NAGPRA Plan of Action for the GBSD Test Program and the MOA to mitigate project impacts to cultural resources for the GBSD Test Program.

Sincerely,

Kenneth Kahn,
Tribal Chairman

CC: Ms. Julianne Polanco, California State Historic Preservation Officer (by e-mail)

Ms. Katharine Kerr, Advisory Council on Historic Preservation (by email)

VIA E-MAIL

Christopher Ryan
30 CES/CEIEA
1028 Iceland Avenue
Vandenberg AFB CA 93437

March 29, 2021

Mr. Sam Cohen
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

Ms. Nakia Zavalla
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

RE: Ground Based Strategic Deterrent Test Program (USAF_2021_0122_001)

Dear Sam, Dear Nakia

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), is continuing consultation with the Santa Ynez Band of Chumash Indians (Tribe) pursuant to Section 106 of the National Historic Preservation Act (NHPA) regarding the proposed Ground Based Strategic Deterrent (GBSD) Test Program.

On 23 March 2021 I sent the Tribe a letter responding to the comments offered by the Tribe in a letter dated 18 March 2021 pertaining to the Section 106 investigation report and the Draft Environmental Assessment (EA) for the proposed undertaking. In that letter I stated that I would very soon provide the Tribe with a report documenting traditional cultural properties (TCPs), cultural landscapes, and sacred sites within and near the project footprint and also a draft Native American Graves Protection and Repatriation Act (NAGPRA) Plan of Action for the proposed undertaking. I am pleased to provide the Tribe with that report and that draft NAGPRA Plan of Action herewith.

To reiterate, comment #1 offered by the Tribe was that the EA must address the fullest range of cultural resources, not just historic properties, and comment #3 was that TCPs and cultural landscapes must be considered under Section 106 and the National Environmental Policy Act (NEPA). 30 SW, working with archaeologists from HDR Inc., reviewed multiple reports addressing TCPs, gathering areas, and sacred sites at Vandenberg AFB and prepared *Places of Traditional Religious and Cultural Importance, Ground Based Strategic Deterrent Test Program* (Attachment 1). This documented is submitted to the Tribe for review and comment. 30 SW hopes

the Tribe will find this report to be a satisfactory supplement to the Section 106 investigation report and thus fully address the Tribe's concern regarding the requirement to consider the broadest range of cultural resources per the NEPA. The draft EA will be revised to include a summary of the broadest range of cultural resources. However, no details regarding the nature and location of places of traditional religious and cultural importance will appear in the final EA.

Once again, 30 SW recognizes the Tribe may possess unique knowledge and understanding of the project area. If the Tribe has additional information regarding sacred or otherwise sensitive areas within the area of potential effects that have not already been identified, 30 SW would be happy to work with the Tribe to protect those areas in the most appropriate manner.

Comment #11 offered by the Tribe was that a NAGPRA Plan of Action should be drafted to address intentional excavation and inadvertent discovery of human remains. 30 SW has prepared a Draft NAGPRA Plan of Action for your review and comment (Attachment 2)

30 SW respectfully requests prioritized and expedited review of the report *Places of Traditional Religious and Cultural Importance* such that the Tribe offers its views and comments—including any special or unique knowledge the Tribe may have regarding sensitive cultural resources not yet identified by 30 SW—by Friday, 2 April 2021. Should any Tribal members be interested in visiting the project area, I would be very pleased to plan that and serve as escort. I can be reached at (805) 605-0748 or via email at christopher.ryan.7@spaceforce.mil. Thank you very much for your continued assistance with this undertaking.

Sincerely
Christopher Ryan

CHRISTOPHER RYAN
Cultural Resources Manager, 30 CES/CEIEA

Attachments:
1. *Places of Traditional Religious and Cultural Importance, Ground Based Strategic Deterrent Test Program*
2. *Draft Plan of Action for the Treatment of Cultural Items in Accordance with the Native American Graves Protection and Repatriation Act and 43 CFR 10.5(e) for Archaeological Excavations and Inadvertent Discoveries Related to the Ground Based Strategic Deterrent Test Program*

CC: Mr. Ed Carroll, California Office of Historic Preservation
Ms. Katharine Kerr, Advisory Council on Historic Preservation
Lt. Col. Charles G. Hansen, Commander, 30th Civil Engineer Squadron, USAF
Mr. Michael Ackerman, Air Force Civil Engineer Center, NEPA Division
Mr. Allen Holdaway, Air Force Nuclear Weapons Center

State of California • Natural Resources Agency
Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION
OFFICE OF HISTORIC PRESERVATION
Armando Quintero, *Director*

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

February 22, 2021

Reply in Reference to: USAF_2021_0122_001

Lt. Col. Charles G. Hansen
Commander, 30th Civil Engineer Squadron
1172 Iceland Avenue
Vandenberg AFB, CA 93437-6011

VIA ELECTRONIC MAIL

Re: Section 106 Consultation for Ground Based Strategic Deterrent Test Program, Vandenberg AFB

Dear Lt. Col. Hansen:

The United States Air Force (USAF) is initiating consultation with the State Historic Preservation Officer (SHPO) regarding its effort to comply with Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. 306108), as amended, and its implementing regulation found at 36 CFR Part 800.

The USAF is proposing to modify Vandenberg Air Force Base's intercontinental ballistic missile system to allow for the development of a Ground Based Strategic Deterrent (GBSD) system. As described in the supporting documentation, the USAF intend to perform the following project activities:

- Transform Minuteman Launch Facilities 04 (a.k.a. Facility 1976) and 26 (a.k.a. Facility 1967) into GBSD launch facilities;
- Improvements to Test Pad 01;
- Establish and maintain launch facility fire breaks as required;
- Demolish and replace Minuteman Missile Alert Facility D0 with 15,000 square foot GBSD Minuteman Missile Alert Facility;
- Construct four facilities in the Cantonment Area;
- Repurposing and upgrading HVAC, utilities, mechanical and electrical systems and other features in 15 facilities and complexes;
- Establish approximately 35 acres of paved parking, sidewalks, and roads;
- Clear and grade eight temporary laydown areas;
- Install approximately 25 miles of subsurface communications conduit; and
- Pile driving for foundations.

Tribal consultation and historic property identification efforts identified 17 unevaluated resources and two resources requiring revisions to previous evaluation efforts within the project's approximately 246-acre area of potential effects (APE).

The USAF determined that the undertaking will adversely affect the following seven National Register of Historic Places (NRHP) eligible resources within the APE: CA-SBA-Z00021H (the San Antonio Terrace Archeological District/SATAD) and two district contributors CA-SBA-512 (Native American Village of Lospe) and CA-SBA-990, CA-SBA-760/761/1748, Launch Facilities 04 and 26 and Missile Alert Facility D0. The USAF are requesting concurrence with its delineation of the project's area of potential effects, NRHP eligibility determinations and finding of adverse effect to historic properties. Upon review of the information provided, the SHPO offers the following comments:

1) Pursuant to 36 CFR Part 800.4(a)(1), the SHPO does not object to the USAF's APE definition.

2) The SHPO concurs that 12 archaeological resources identified as CA-SBA-1777, 2159H, 2172, 2224, 2238, 2244, 2245, 2307, 1759, 2876, 3203 and 3562H do not meet NRHP eligibility requirements as individually eligible or as historic district contributors.

3) The SHPO concurs that five built environment resources identified as P-42-041322/Facility 9320 (30th Range Squadron Maintenance Facility constructed in 1958), P-42-041323/Facility 9325 (30th Space Command Squadron Receiving Warehouse constructed in 1958), P-42-041324/Facility 9327 (576th Missile Maintenance Paint Shop constructed in 1959), P-42-041336/Facility 7501 (Missile Service Shop constructed in 1962) and P-42-041380/Facilities 6809 and 6810 (Hot Cargo Pads comprising one resource constructed in 1961) do not meet NRHP eligibility requirements individually or as historic district contributors.

4) The SHPO concurs that CA-SBA-2127, previously incorrectly assigned the status of eligible for listing in the NRHP (2S2, USAF970205B) when that status correctly belonged to CA-SBA-760/761/-1748 (the site complex immediately adjacent to and to the west of CA-SBA-2127), does not meet NRHP eligibility requirements individually or as a historic district contributor.

5) The SHPO concurs that CA-SBA-1687, a resource previously determined eligible as a contributing element to the SATAD (2D2, USAF871231A), does not meet NRHP eligibility requirements individually eligible or as a historic district contributor.

6) The USAF's project description mentions that 15 facilities and complexes will be repurposed and reused for the GBSD program however no construction dates, NRHP eligibility summaries or facility identification numbers were provided.

7) The SHPO requests an updated summary of tribal consultation with the Santa Ynez Band of Chumash Indians.

8) The SHPO requests information on the USAF'S design alternatives and efforts to avoid and/or minimize the undertaking's effects on historic properties.

9) The SHPO is unable to comment on the USAF's finding of adverse effect at this time.

Notify Historian Ed Carroll at (916) 445-7006 or Ed.Carroll@parks.ca.gov if there are any questions or concerns.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

SANTA YNEZ BAND OF CHUMASH INDIANS

P.O. BOX 517 · SANTA YNEZ · CA · 93460

Tel: 805.688.7997 · Fax: 805.686.9578

www.santaynezchumash.org

March 18, 2021

To: USASMDC
ATTN: SMDC-EN (D. Halsey)
P.O. Box 1500
Huntsville, AL 35807
gbsdtesteaoea-comments@govsupport.us

Vandenberg Air Force Base
ATTN: Christopher Ryan, 30th Space Wing Tribal Liaison Officer 30 CES/CEIEA
1027 Iceland Avenue Vandenberg AFB, CA 93437

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Furthermore, VAFB is covered by Executive Order 13175 as reaffirmed by that Presidential Memorandum on Tribal Coordination that reaffirmed Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," and emphasized the importance of strengthening government-to-government relationships with Native American tribes.

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- Impacts on "districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places" and on "significant scientific, cultural, or historical resources" (40 CFR 1508.27(b)(8)).

Clearly, impacts on cultural resources are to be addressed in an EA. **Note that it is not just impacts on historic properties that should be addressed. The regulations use "historic" and "cultural" in parallel, not as synonyms.**

(2) Deferral of Mitigation does not Comply with NEPA (from **http://www.npi.org/NEPA/impact**)

Deferral. With respect to historic properties, a very common problem is "deferral," in which the agency:

- Acknowledges that it does not know much about what effects there may be on historic properties (often because such properties have not yet been identified); but
- Says that whatever effects there may be, NHPA Section 106 review (of the National Historic Preservation Act), to be performed later, will take care of them; and
- Concludes that therefore, whatever alternative is decided on, impacts on historic properties will not be a problem.

Considering environmental impacts *after* a decision has been made defeats NEPA's purpose of considering impacts in *preparing* to make decisions. It also almost guarantees last-minute conflicts between project implementation and historic preservation.

Failure to consider things that are not historic properties. With respect to other kinds of cultural resources, a common problem is that they are not considered at all. Historic properties are sometimes the only things discussed in the "cultural resource" part of an EA. All archeological sites must be considered within an EA, not just archaeological sites that are eligible for listing on the National Register of Historic Places. Additionally, if social impacts are considered, they are often considered only terms of easily quantifiable socioeconomic variables like population, employment, and use of public services. The result is that impacts on many classes of cultural resource simply are not identified or considered in deciding whether significant impacts may occur.

(3) Traditional Cultural Properties and Cultural Landscapes must also be included in Section 106 consultations and the EA

Traditional cultural properties, because they are a property type that is eligible for listing on the NRHP, must be identified in the same manner in the Section 106 process as other types of cultural resources of significance to Indian tribes or Native Hawaiian organizations. The regulations at 36 CFR Section 800.4 outline several steps a federal agency must take to identify historic properties. In summary, to determine the scope of identification efforts, a federal agency, in consultation with the State Historic Preservation Officers (SHPO)/Tribal Historic Preservation Officer (THPO), must:

- Determine and document the area of potential effect for its undertaking;
- Review existing information; and
- Seek information from consulting parties including Indian tribes or Native Hawaiian organizations.

Based on the information gathered through these efforts, the federal agency, in consultation with the SHPO and any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by the undertaking, develops and implements a strategy to identify historic properties within the area of potential effects. Identification efforts may include background research, oral history interviews, scientific analysis, and field investigations. **http://www.achp.gov/natl-qa.pdf**

There is no single defining feature or set of features that comprise a traditional cultural property or cultural landscape. Such places could be comprised of natural features such as mountains, caves, plateaus, and outcroppings; water courses and bodies such as rivers, streams, lakes, bays, and inlets; views and view sheds from them, including the overlook or similar locations ; vegetation that contributes to its significance; and, manmade features including archaeological sites; buildings and structures; circulation features such as trails; land use patterns; evidence of cultural traditions, such as petroglyphs and evidence of burial practices; and markers or monuments, such as cairns, sleeping circles, and geoglyphs. **http://www.achp.gov/natl-qa.pdf**

Based on such research, the ACHP TRADITIONAL CULTURAL LANDSCAPES ACTION PLAN advises as follows:

The ACHP, as the agency with responsibility for overseeing the Section 106 review process, and DOI, through the National Park Service (NPS), as the agency with responsibility for overseeing the National Register of Historic Places, should provide leadership in addressing Native American cultural landscapes in the national historic preservation program. Together, the ACHP and NPS should:

- Promote the recognition and protection of Native American traditional cultural landscapes both within the federal government and the historic preservation community as well as at the state and local levels, and,
- Address the challenges of the consideration of these historic properties in the Section 106 review process as well as in NEPA reviews. **http://www.achp.gov/pdfs/native-american-traditional-cultural-landscapes- action-plan-11-23-2011.pdf**

Thus, it is the Tribe's view that the EA and Section 106 analysis must identify and consider Traditional Cultural Properties and Cultural Landscapes.

(4) U.N. Declaration on the Rights of Indigenous Peoples must now be followed after December 2010

In December 2010, the United States announced support for the **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)**. In announcing this support, President Obama stated: "The aspirations it affirms—including the respect for the institutions and rich cultures of Native peoples—are one we must always seek to fulfill…[W]hat matters far more than any resolution or declaration – are actions to match those words." The UNDRIP addresses indigenous peoples' rights to maintain culture and traditions (Article 11); and religious traditions, customs, and ceremonies (Article 12); to participate in decision making in matters which would affect their rights (Article 18); and to maintain spiritual connections to traditionally owned lands (Article 25).

The ACHP will now incorporate UNDRIP in the Section 106 review process:

While the Advisory Council on Historic Preservation's (ACHP) work already largely supports the United Nations Declaration on the Rights of Indigenous Peoples, additional and deliberate actions will be taken to more overtly support the Declaration. The Section 106 review process provides Indian tribes and Native Hawaiian organizations (NHOs) with a very important opportunity to influence federal decision making when properties of religious and cultural significance may be threatened by proposed federal actions. While federal agencies are required to consult with Indian tribes and NHOs and to take their comments into account in making decisions in the Section 106 review process, adding the principles of the Declaration to that consideration may assist federal agencies in making decisions that result in the protection of historic properties of religious and cultural significance to Indian tribes and NHOs. **http://www.achp.gov/docs/UN%20Declaration%20Plan%203-21-13.pdf**

(5) Subsurface testing is required.

Pedestrian surveys are of limited utility and never alone are sufficient when there are known areas of habitation or ceremony. The Tribe understands that VAFB has completed a Phase I Pedestrian Survey of the project area, and Extended Phase I subsurface archaeological survey, and some Phase II subsurface archaeological testing for all areas scheduled for any excavation or other types of ground disturbance.

The project is in a region where there are many sites; there is reason to suspect that buried sites may be present that went undetected during the survey. Because the soil profile is depositional then there may be a need to conduct additional subsurface testing, particularly in areas where ground disturbance is planned at depths greater than one meter. Backhoes are sometimes used to test for deeply buried deposits and informal sampling procedures are often employed while screening the backdirt. The Tribe understands that no backhoe pits or trenches were excavated.

Sometimes the federal agency will argue that archaeological survey is not warranted for a particular project or there may be factors that justify additional investigation even though a Phase I study has been completed with negative results. Following is a list of environmental and cultural factors that should be considered when assessing the overall cultural sensitivity of a project area:

- Areas with high viewshed or visibility such as or ridgelines, peaks, ledges, outcrops, benches, or prominent hills; and

- Areas with a relatively high density of sites in the vicinity; and

- Areas where past ethnographic studies have revealed associated placenames; and
- Areas near known sites. Mapped boundaries of sites most frequently reflect only cultural residue that was visible on the surface when the site was recorded and do not necessarily reflect the actual extent of the site. In addition, loci such as cemeteries or other areas may be adjacent to or nearby but separate from the main habitation; and
- Areas near known rock art sites or rocky outcroppings of the type where rock shelters and art have traditionally been located; and
- Areas in or near known gathering areas; and
- Named, ethnohistorically documented village sites are of the highest priority and therefore warrant the greatest amount of protection possible.

The Tribe understands that some project work would occur within the ethnographically documented village of Lospe, and that excavation could occur to depths greater than one meter.

(6) Exhaustion of Non-Excavation Methods of mitigation and remediation.

To the extent feasible, VAFB should exhaust all non-excavation methods of mitigation and remediation before performing any excavation that could potentially impact cultural and historic sites.

(7) Soil Prior disturbance is NOT Dispositive:

The mantra that cultural sites have been disturbed and therefore automatically are not significant is oftentimes incorrect:

- Disturbed sites still may contain valuable information. The newer approach is to treat disturbed sites as having the potential to provide information even if they have been disturbed;
- Disturbed sites still have spiritual significance;
- Disturbance may only be on the surface, while much excavation may continue to depths greater than one meter.

(8) Need to Analyze Cumulative Impacts to Cultural Resources:

The EA must analyze other past and reasonably foreseeable projects in and near the project area that have impacted cultural resources, such as:

- The impact of constructing LF-04, Point Sal Road, two parking lots, and underground utilities on the ethnographically documented village of Lospe;
- The impact of constructing LF-26, Point Sal Road, one parking lot, and underground utilities on CA-SBA-760/761.;
- Other cultural resources within the project area impacted by road construction, underground utilities, and other construction projects.

(9) MONITORING: Native American monitoring during any ground disturbing activities.

More than one Native American monitor would be required when there are multiple work areas in progress or multiple pieces of equipment operating in a single work area. Native American monitors are required for all ground-disturbing work within 60 meters of all prehistoric archaeological sites.

(10) Need NEPA/Section 106 Mitigation Plan

http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa- mitigation-monitoring-draft-guidance.pdf

February 18, 2010

MEMORANDUM FOR HEADS OF FEDERAL DEPARTMENTS AND AGENCIES

FROM: NANCY H. SUTLEY, Chair, Council on Environmental Quality SUBJECT: DRAFT GUIDANCE FOR NEPA MITIGATION AND MONITORING

I. INTRODUCTION

To provide for the performance of mitigation, agencies should create internal processes to ensure that mitigation actions adopted in any NEPA process are documented and that monitoring and appropriate implementation plans are created to ensure that mitigation is carried out. See *Aligning NEPA Processes with Environmental Management Systems* (CEQ 2007) at 4 (discussing the use of environmental management systems to track implementation and monitoring of mitigation). http://ceq.hss.VAFB.gov/nepa/nepapubs/Aligning_NEPA_Processes_with_Environmenta l_Management_Systems_2007.pdf (**http://www.slideshare.net/whitehouse/aligning- nepa-processes**).

Agency NEPA implementing procedures should require clearly documenting the commitment to mitigate the measures necessary in the environmental documents prepared during the NEPA process (40 C.F.R. § 1508.10) and in the decision documents such as the Record of Decision. When an agency identifies mitigation in an EA and commits to implement that mitigation to achieve an environmentally preferable outcome, or commits in an EA to mitigation to support a FONSI and proceeds without preparing an EA, then the agency should ensure that the mitigation is adopted and implemented.

Methods to ensure implementation should include, as appropriate to the agency's underlying authority for decision-making, appropriate conditions in financial agreements, grants, permits or other approvals, and conditioning funding on implementing the mitigation. To inform performance expectations, mitigation goals should be stated clearly. These should be carefully specified in terms of measurable performance standards to the greatest extent possible. The agency should also identify the duration of the agency action and the mitigation measures in its decision document to ensure that the terms of the mitigation and how it will be implemented are clear.

If funding for implementation of mitigation is not available at the time the decision on the proposed action and mitigation measures is made, then the impact of a lack of funding and resultant environmental effects if the mitigation is not implemented warrant disclosure in the EA or EA. In cases where, after analyzing the proposed actions with or without the mitigation, the agency determines that mitigation is necessary to support the FONSI or committed to in the ROD, and the necessary funding is not available, the agency may still be able to move forward with the proposed action once the funding VAFBs become available. The agencies should ensure that the expertise and

professional judgment applied in determining the appropriate mitigation measure is reflected in the administrative record, and when and how those measures will be implemented are analyzed in the EA or EA.

Under NEPA, a federal agency has a continuing duty to gather and evaluate new information relevant to the environmental impact of its actions. See 42 U.S.C. § 4332(2)(A). For agency decisions based on an EA, the regulations require that, "a monitoring and enforcement program shall be adopted…where applicable for mitigation." 40 C.F.R. §1505.2(c). In addition, the regulations state that agencies may "provide for monitoring to assure that their decisions are carried out and should do so in important cases." 40 C.F.R. §1505.3. Monitoring plans and programs should be described or incorporated by reference in the agency decision documents.

The Tribe requests review of the plan to mitigate project impacts to cultural resources.

The Tribe requests inclusion as a signatory on any and all MOAs under NEPA and the NHPA pertaining to mitigating impacts to cultural resources for the GBSD Test Program.

(11) Native American Graves Protection and Repatriation Act ("NAGPRA")

The GBSD Test Program project area includes areas where ancestors are known to be buried. The burial areas are located within the ethnographically documented village of Lospe. Section 3 of NAGPRA is triggered in the event of intentional excavation or inadvertent discovery of Native American human remains and cultural items on Federal lands.

- Intentional Excavation: The planned archeological removal of human remains, funerary objects, sacred objects, or objects of cultural patrimony found under or on the surface of Federal or tribal lands pursuant to section 3 (c) of the Act. [43 CFR 10.2 (g)(3)].
- Inadvertent Discovery: The unanticipated encounter or detection of human remains, funerary objects, sacred objects, or objects of cultural patrimony found under or on the surface of Federal or tribal lands pursuant to section 3 (d) of NAGPRA. [43 CFR 10.2 (g)(4)].

The National Park Service provides a NAGPRA Section 3 Plan of Action Checklist, which states:

The written plan of action is an integral part of the consultation process mandated by 43 CFR 10.5 whenever there is activity affecting or likely to affect Native American cultural items on Federal or tribal lands. The plan of action must document compliance with ARPA, especially 43 CFR 7.7 – 7.9, regarding requirements for permits on Indian lands.

- Information on the kinds of objects that are considered to be –
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony
- Specific information used to determine custody/ownership under 43 CFR 10.6
- Planned treatment, care, and handling of –
  - Human remains
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony

- ☐ The planned archeological recording of –
  - Human remains
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony
- ☐ The kinds of analysis planned for –
  - Human remains
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony
- ☐ Steps to be followed to contact Indian tribe officials at the time of excavation or inadvertent discovery of specific –
  - Human remains
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony
- ☐ The kind of traditional treatment, if any, to be used for –
  - Human remains
  - Funerary objects
  - Sacred objects
  - Objects of cultural patrimony
- ☐ The nature of reports to be prepared
- ☐ The planned disposition of human remains, funerary objects, sacred objects, and objects of cultural patrimony following 43 CFR 10.6 [NOTE: a Notice of Intended Disposition is still required prior to disposition.]
- ☐ The plan of action complies with 43 CFR 10.3 (b)(1) and follows the requirements of ARPA.
- ☐ The plan of action is signed by the Federal agency official.
- ☐ A copy of the plan of action is provided to the consulting lineal descendants, Indian tribes, and Native Hawaiian organizations.

The Tribe requests review of the NAGPRA Plan of Action for the GBSD Test Program.

The Tribe requests inclusion as a signatory on the NAGPRA Plan of Action for the GBSD Test Program.

The Tribe requests concurrent development of the NAGPRA Plan of Action for the GBSD Test Program and the MOA to mitigate project impacts to cultural resources for the GBSD Test Program.

Sincerely,

Kenneth Kahn,
Tribal Chairman

CC: Ms. Julianne Polanco, California State Historic Preservation Officer (by e-mail)

Ms. Katharine Kerr, Advisory Council on Historic Preservation (by email)

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
30TH SPACE WING

VIA E-MAIL

Christopher Ryan
30 CES/CEIEA
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March 23, 2021

Mr. Sam Cohen
Santa Ynez Band of Chumash Indians
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Ms. Nakia Zavalla
Santa Ynez Band of Chumash Indians
P.O. Box 517
Santa Ynez, CA 93460

RE: Ground Based Strategic Deterrent Test Program (USAF_2021_0122_001)

Dear Sam, Dear Nakia

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), is continuing consultation with the Santa Ynez Band of Chumash Indians (Tribe) pursuant to Section 106 of the National Historic Preservation Act (NHPA) regarding the proposed Ground Based Strategic Deterrent (GBSD) Test Program. Thank you for providing the Tribe's comments following review of the Section 106 investigation report and the Draft Environmental Assessment (EA) for the proposed undertaking.

Since your receipt of the Section 106 investigation report in January, refinements in the project design have greatly reduced the extent of ground disturbance planned at Launch Facility 04 (LF-04) and within the historic Native American village of Lospe (CA-SBA-512) and at LF-26 and within prehistoric archaeological site CA-SBA-760/-761/-1748. Additionally, trenching for the proposed underground communications line through CA-SBA-990 has been re-routed to avoid disturbance to that site. Despite these refinements, the proposed undertaking still would result in adverse effects to CA-SBA-512 due to security fencing improvements and trenching associated with underground communications lines.

With regard to the Tribe's comments on the proposed undertaking's compliance with Section 106 of the NHPA and the National Environmental Policy Act (NEPA), 30 SW and GBSD Test Program project personnel respectfully offer the following responses to the concerns expressed within the correspondence dated March 18, 2021. For ease of reference, responses provided below correspond with the same order and numbering as the comments offered by the Tribe.

1) The EA must address Cultural Resources

In response to the Tribe's comment that the cultural resources analysis in the GBSD Test Program Draft Environmental Assessment/Overseas Environmental Assessment (EA/OEA) must include the fullest range of cultural resources—not just historic properties—USAF will:

- Revise the Draft EA/OEA to include analysis of the full range of cultural resources within the Final EA/OEA;
- Review three inventory reports addressing Traditional Cultural Properties, gathering areas, and sacred sites at Vandenberg AFB; one of those documents is authored by John Johnson and David Earle, another by Vine Deloria and Richard Stoffle with contributions by Larry Spanne, and the third by Chester King; and
- Provide a report that inventories the proposed project area for Traditional Cultural Properties and Landscapes, sacred sites, and gathering areas to the Tribe for review and comment. 30 SW intends to provide the Tribe with that report next Monday, 29 March 2021, or the following day at the latest.

2) Deferral of Mitigation does not comply with NEPA

In response to the Tribe's comment that deferral of mitigation does not comply with the NEPA, the Air Force is complying with the NEPA and the NHPA in parallel yet separate regulatory compliances. Per Air Force policy, the NEPA decision-making process will not conclude before completion of the Section 106 compliance process. Once consulting parties reach agreement on appropriate measures to resolve adverse effects to all historic properties and sign a Memorandum of Agreement, then USAF will complete compliance with the NEPA. Mitigation measures developed under Section 106 will be incorporated into the EA/OEA and FONSI per 40 CFR §1501.6. 30 SW hopes this reassurance satisfactorily allays the Tribes concerns on this matter.

3) Traditional Cultural Properties and Cultural Landscapes must also be included in Section 106 consultations and the EA

In response to the Tribe's comment that Traditional Cultural Properties and Cultural Landscapes must be considered under Section 106 and the NEPA, as mentioned above in #1, 30 SW is reviewing multiple documents addressing Traditional Cultural Properties, sacred sites, and traditional gathering areas on Vandenberg AFB and will present the results of that survey under separate submission to the Tribe very soon. Preliminary results of that review identified the following sites and areas:

- The waterfall and pools at the mouth of Dairy Basin Canyon;
- Residential or village sites with known cemeteries, including CA-SBA-512, CA-SBA-513, and CA-SBA-941—all three associated with the historically documented village of Lospe;
- A rock art site in the Casmalia Hills north of Shuman Canyon;
- An asphaltum seep near Minuteman Beach, along Point Sal Road north of Shuman Canyon;
- Gathering areas in the Casmalia Hills and near Minuteman Beach;
- Wetland areas on the San Antonio Terrace, especially adjacent to Turtle Pond, in the central part of the Intermediate Dunes; and
- Wetland areas along San Antonio Creek.

Of these cultural resources, 30 SW acknowledges the three archaeological sites associated with the village of Lospe (CA-SBA-512, CA-SBA-513, and CA-SBA-941) are within the area of potential effects. 30 SW is not aware of any additional Traditional Cultural Properties or Cultural Landscapes or sacred sites within or adjacent to the area of potential effects. However, 30 SW recognizes the Tribe may possess unique knowledge and understanding of the project area. If the Tribe has additional information regarding sacred or otherwise sensitive areas within the area of potential effects that have not already been identified, 30 SW would be happy to work with the Tribe to protect those areas in the most appropriate manner.

4) United Nations Declaration on the Rights of Indigenous Peoples

The USAF's consultation with the Tribe for the GBSD Test Program Draft EA is being conducted to request tribal comments on "historic properties of religious and cultural significance," as well as to identify cultural resources (in the broader sense) of significance to the Tribe so that those resources and comments are adequately considered. 30 SW hopes this reassurance satisfactorily allays the Tribes concerns on this matter.

5) Subsurface testing is required

To supplement existing and newly acquired surface survey data, archaeologists at HDR Inc. reviewed data from more than 2000 previously excavated shovel test pits, one-meter by one-meter test excavation units, and backhoe trenches to pin-point the location of where subsurface archaeological deposits do exist, and where they do not exist. Wherever archaeologists from HDR Inc. found gaps in existing subsurface data, they excavated additional shovel test pits to acquire any and all subsurface data needed. In total, an additional 158 shovel test pits were excavated to provide the most comprehensive subsurface data set possible.

30 SW acknowledges that archaeological excavations typically extend to one meter of depth or less. Occasionally test excavation units extend to 1.5 meters. The project description, as presented in the Section 106 investigation report, included ground disturbance to depths far greater than one meter. As mentioned, refinements in project design have greatly reduced both the amount of ground disturbance and the depth of ground disturbance. 30 SW and GBSD Test Program project personnel will continue to consult with the Tribe to pin-point locations where ground disturbance would exceed depths of one meter, and develop archaeological and Native American monitoring protocols that would identify deeply buried archaeological deposits during project implementation. Please rest assured, in accordance with the Section 106 implementing regulations, any newly identified archaeological deposits discovered during project implementation would constitute a discovery during construction and would cause the Section 106 review process to be re-opened. 30 SW hopes this reassurance satisfactorily allays the Tribes concerns on this matter.

6) Exhaustion of Non-Excavation Methods of Mitigation and Remediation

In response to the Tribe's comment that non-destructive mitigation measures should be full considered prior to resorting archaeological data recovery, GBSD Test Program project personnel have dramatically reduced the volume of project-related ground disturbance and are seeking additional opportunities to further reduce the extent of ground disturbance. 30 SW will fully consider alternative forms of mitigation and will consult further with the Tribe on the resolution of adverse effects, to include non-invasive, alternative mitigation measures. 30 SW welcomes the Tribe's suggestions and input on this matter.

7) Soil prior disturbance is not dispositive

In response to the Tribe's comment that prior disturbance to a site is not dispositive, in no instance was a site assumed to lack significance based on previous disturbance. Where evidence of prior disturbance was encountered, information from archaeological excavations was used to assess the degree to which the site's potential to provide significant information had been impaired by that prior disturbance. Some sites were determined ineligible for listing in the National Register due to prior disturbance; however, these were all resources that had been severely impacted or destroyed by previous construction projects and had already been subjected to archaeological data recovery operations as a result of those impacts. In the case of sites along the utility corridor, the documented extent of previous disturbance for road construction and the installation of previous utilities exceeds the depth of impacts anticipated during the GBSD Test Program. 30 SW hopes this reassurance satisfactorily allays the Tribes concerns on this matter.

8) Need to analyze cumulative impacts to cultural resources

In response to the Tribe's comment that cumulative impacts to cultural resources must be analyzed in the GBSD Test Program EA/OEA, USAF will include additional discussion of the original construction of LF-04, LF-26, and ancillary construction for roads, parking lots, and utility corridors. Project refinements require 30 SW to re-address the adverse effect findings as presented in the original Section 106 submittal to the Tribe and the SHPO. Following SHPO's acceptance of 30 SW's finding of adverse effect, 30 SW will develop a revised assessment of where adverse effects would and would not occur. As part of that reassessment, USAF will include an analysis of cumulative impacts to historic properties.

9) Native American monitoring

The Air Force recognizes that Tribes have unique knowledge about cultural resources that have traditional Tribal importance and this information is important for ensuring accurate assessments of the effects of the Project on cultural resources and determining appropriate mitigation if warranted. The Air Force foresees a role for the Tribes in assisting with identifying, recording, and evaluating cultural resources and assessing effects to cultural resources that would occur because of the Project.

The Tribe provided assistance and expertise during archaeological testing in August and December 2020 and its involvement is summarized in the archaeological report enclosed with 30 SW's correspondence dated January 12, 2021. The Air Force will continue to collaborate with the Tribe on future phases of the project, to identify, characterize and protect resources of significance to the Tribe, the details of which will be developed during the Section 106 consultation on the Memorandum of Agreement to resolve potential adverse effects on historic properties from the undertaking.

10) Need NEPA/Section 106 Mitigation Plan

In response to the Tribe's comment that the proposed undertaking will require a plan to resolve adverse effects to historic properties, 30 SW is completing the process of identifying a broad range of cultural resources that may be affected by the proposed undertaking with the Tribe and with the SHPO. Once the Tribe is satisfied with 30 SW's inventory, the SHPO will accept 30 SW's determination that the proposed undertaking would result in adverse effects to historic

properties and, as stated above in #8, 30 SW will develop a revised assessment of where adverse effects would and would not occur—including an analysis of cumulative impacts to historic properties—along with the draft mitigation plan and draft MOA. Presently, USAF is continuing efforts to avoid and/or minimize potential project effects, and to refine mitigation measures where avoidance is not possible.

11) Native American Graves Protection and Repatriation Act (NAGPRA) Plan of Action

In response to the Tribe's comment that a NAGPRA Plan of Action should be drafted to address intentional excavation and inadvertent discovery of human remains, 30 SW is preparing a Draft NAGPRA Written Plan of Action for your review and comment. As noted in your comment, the plan will include relevant items in the National Park Services NAGPRA Section 3 Plan of Action Checklist.

In closing, next Monday, 30 SW will provide the Tribe with (1) a report identifying Traditional Cultural Properties and Landscapes, sacred sites, and gathering areas, and (2) a draft NAGPRA Written Plan of Action. Fully recognizing the Tribe is very busy, 30 SW respectfully requests prioritized and expedited review of the report identifying Traditional Cultural Properties and sacred sites such that the Tribe offers its views and comments—including any special or unique knowledge the Tribe may have regarding sensitive cultural resources not yet identified by 30 SW—by Friday, 2 April 2021.

Should any Tribal members be interested in visiting the project area, I would be very pleased to plan that and serve as escort. I can be reached at (805) 605-0748 or via email at christopher.ryan.7@spaceforce.mil. Thank you very much for your continued assistance with this undertaking.

Sincerely

Christopher Ryan

RYAN.CHRISTOPHER.D.1296630701 Digitally signed by RYAN.CHRISTOPHER.D.1296630701
Date: 2021.03.23 15:04:12 -07'00'

CHRISTOPHER RYAN
Cultural Resources Manager, 30 CES/CEIEA

CC: Mr. Ed Carroll, California Office of Historic Preservation
Ms. Katharine Kerr, Advisory Council on Historic Preservation
Lt. Col. Charles G. Hansen, Commander, 30th Civil Engineer Squadron, USAF
Mr. Michael Ackerman, Air Force Civil Engineer Center, NEPA Division
Mr. Allen Holdaway, Air Force Nuclear Weapons Center

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
30TH SPACE WING

DELIVERED IN PERSON

Christopher Ryan
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April 2, 2021

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RE: Ground Based Strategic Deterrent Test Program (USAF_2021_0122_001)

Dear Sam, Dear Nakia

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), is continuing consultation with the Santa Ynez Band of Chumash Indians (Tribe) pursuant to Section 106 of the National Historic Preservation Act (NHPA) regarding the proposed Ground Based Strategic Deterrent (GBSD) Test Program.

In a letter dated 18 March 2021, the Tribe provided comments pertaining to the Section 106 investigation report and the Draft Environmental Assessment (EA) for the proposed undertaking. Several of the comments offered by the Tribe pointed to the fact that 30 SW's original Section 106 investigation report failed to include an inventory of the broadest range of cultural resources within the Area of Potential Effects (APE). In response, 30 SW expanded the inventory effort to include traditional cultural properties and cultural landscapes and sacred sites and, in coordination with archaeologists at HDR Inc., completed a report entitled *Places of Traditional and Cultural Important, Ground Based Strategic Deterrent Test Program*. 30 SW provided that report to the Tribe with a cover letter dated 29 March 2021. 30 SW genuinely appreciates the Tribe's willingness to prioritize and expedite review of that document and meet for in-person consultation on 2 April 2021.

To review, four comments directly pointed to the aforementioned gap in 30 SW's inventory of cultural resources in the APE:

1. Under comment #1, the Tribe commented the EA must address impacts on "historic or cultural resources…" [40 CFR 1508.27(b)(3)] and on "districts, sites, highways, structures, or objects

listed in or eligible for listing in the National Register of Historic Places" and on "significant scientific, cultural, or historical resources" (40 CFR 1508.27(b)(8)).

2. Under comment #2, the Tribe commented "With respect to other kinds of cultural resources, a common problem is that they are not considered at all. Historic properties are sometimes the only things discussed in the "cultural resource" part of an EA. All archeological sites must be considered within an EA, not just archaeological sites that are eligible for listing on the National Register of Historic Places. Additionally, if social impacts are considered, they are often considered only terms of easily quantifiable socioeconomic variables like population, employment, and use of public services. The result is that impacts on many classes of cultural resource simply are not identified or considered in deciding whether significant impacts may occur."

3. Under comment #3, the Tribe commented "Traditional Cultural Properties and Cultural Landscapes must also be included in Section 106 consultations and the EA. Traditional cultural properties, because they are a property type that is eligible for listing on the NRHP, must be identified in the same manner in the Section 106 process as other types of cultural resources of significance to Indian tribes or Native Hawaiian organizations." Furthermore, the Tribe offered that the federal agency must "Seek information from consulting parties including Indian tribes...."

4. Under comment #5, the Tribe commented "Subsurface testing is required.... The project is in a region where there are many sites; there is reason to suspect that buried sites may be present that went undetected during the survey. Because the soil profile is depositional then there may be a need to conduct additional subsurface testing, particularly in areas where ground disturbance is planned at depths greater than one meter."

   In response to this comment, 30 SW offered the following reply in a letter to the Tribe dated 22 March 2021:

   > To supplement existing surface survey data and newly acquired surface survey data, archaeologists at HDR Inc. reviewed data from more than 2000 previously excavated shovel test pits, one-meter by one-meter test excavation units, and backhoe trenches to pin-point the location of where subsurface archaeological deposits do exist, and where they do not exist. Wherever archaeologists from HDR Inc. found gaps in the existing subsurface survey and testing data, they excavated additional shovel test pits to acquire any and all subsurface data needed. In total, an additional 158 shovel test pits were excavated to provide the most comprehensive subsurface data set possible.
   >
   > 30 SW acknowledges that archaeological excavations typically frequently extend only to one meter of depth or less. Occasionally test excavation units extend to 1.5 meters in depth. Admittedly, the project description, as presented in the Section 106 investigation report, included ground disturbance to depths far greater than one meter. As mentioned above, refinements in the project design have not only greatly reduced the amount of ground disturbance, but also the depth of ground disturbance. 30 SW and GBSD Test Program project personnel will continue to consult with the Tribe to pin-point locations where ground disturbance would exceed depths of one meter, and develop archaeological and Native American monitoring protocols that would identify deeply buried archaeological deposits during project implementation. Please rest assured, in accordance with the Section

106 implementing regulations, any newly identified archaeological deposits discovered during project implementation would constitute a discovery during construction and would cause the Section 106 review process to be re-opened.

Once again, 30 SW recognizes the Tribe may possess unique knowledge and understanding of the project area. If the Tribe has additional information regarding sacred or otherwise sensitive areas within the area of potential effects that have not already been identified, 30 SW would be happy to work with the Tribe to protect those areas in the most appropriate manner.

30 SW hopes that the response to the Tribe's concern regarding the need for subsurface testing and 30 SW's supplemental inventory effort to identify traditional cultural properties and cultural landscapes and sacred sites within the APE represent, in the Tribe's view, a full and complete consideration of the broadest range of cultural resources within the APE.

To conclude, 30 SW respectfully requests the Tribe indicate its view of the completeness of the effort to identify all cultural resources within the APE below. Thank you very much for your continued assistance with this undertaking.

Sincerely

Christopher Ryan

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CHRISTOPHER RYAN
Cultural Resources Manager, 30 CES/CEIEA

At this time, the Tribe:

☐ Does not concur that the effort to identify the broadest range of cultural resources is complete.

☒ Concurs that the effort to identify the broadest range of cultural resources is complete.

Signature	4/7/21 Date	Signature	4/14/21 Date

CC: Mr. Ed Carroll, California Office of Historic Preservation
Ms. Katharine Kerr, Advisory Council on Historic Preservation
Lt. Col. Charles G. Hansen, Commander, 30th Civil Engineer Squadron, USAF
Mr. Michael Ackerman, Air Force Civil Engineer Center, NEPA Division
Mr. Allen Holdaway, Air Force Nuclear Weapons Center

DEPARTMENT OF THE AIR FORCE
UNITED STATES SPACE FORCE
30TH SPACE WING

VIA EMAIL

Christopher Ryan
30th Civil Engineer Squadron
1028 Iceland Ave
Vandenberg AFB CA 93437

16 April 2021

Ms. Julianne Polanco, State Historic Preservation Officer
Office of Historic Preservation
Department of Parks and Recreation
Office of Historic Preservation
P.O. Box 942896
Sacramento CA 94296-0001
ATTN: Mr. Ed Carroll

Ms. Katharine Kerr
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington DC 20001

RE: USAF_2021_0122_001, Ground Based Strategic Deterrent Test Program

Dear Ms. Polanco, Dear Ms. Kerr

The 30th Space Wing (30 SW) of the United States Space Force (USSF), Vandenberg Air Force Base (AFB), California, in cooperation with the Air Force Nuclear Weapons Center (AFNWC), Kirtland AFB, New Mexico, is continuing consultation with the California State Historic Preservation Officer (SHPO) regarding the proposed Ground Based Strategic Deterrent (GBSD) Test Program (OHP reference # USAF_2021_0122_001). Because the Advisory Council on Historic Preservation (ACHP) elected to participate in the resolution of adverse effects to historic properties pursuant to 36 CFR §800.6, 30 SW also is continuing consultation with the ACHP. 30 SW also is continuing consultation with the federally-recognized Santa Ynez Band of Chumash Indians (Tribe).

In the letter provided by the SHPO to Lt. Col. Hansen dated 25 March 2021, the SHPO stated that in order to comment or concur on the finding of adverse effect the SHPO required additional information for review as follows:

1) In its March 4, 2021 response letter, the USAF note that the "actual design of GBSD Test Program launch test facilities at Vandenberg AFB is still underway" and that the undertaking will no longer adversely affect CA-SBA-990. As all potential effects are to be analyzed as part of the consultation, please submit the final undertaking design accompanied by an accurate inventory of affected historic properties rather than what is noted in the USAF's letter as "the case of greatest effects."

2) Please provide an assessment of the cumulative effects the undertaking may have on the San Antonio Terrace Archeological District and NRHP eligible launch facilities/complexes at Vandenberg AFB.

3) Once the USAF has received comments from the Santa Ynez Band of Chumash Indians and has had the opportunity to understand how these comments will be considered in the project planning, please provide this information to all consulting parties. Please note that the SHPO does not consider the USAF's historic property identification efforts to be complete until an analysis of tribal comments has been provided.

4) As the undertaking's design is not yet complete, it is recommended that the USAF take the opportunity to avoid and/or minimize the undertaking's effects on historic properties to the extent possible.

In fulfillment of the request for additional information, USAF prepared a report "Revised Design of the Undertaking and Finding of Effect, Ground Based Strategic Deterrent Test Program" (Blackwell and Volta 2021), which is included herewith as Attachment 1. Also, in response to comments offered by the Tribe regarding the need to consider cultural resources more broadly to include traditional cultural properties and landscapes and sacred sites, USAF prepared a report entitled "Places of Traditional Religious and Cultural Importance, Ground Based Strategic Deterrent Test Program" (Volta 2021), which was submitted to the Tribe for review with courtesy copy to the SHPO and the ACHP and is included again herewith as Attachment 2.

In response to the first request—submittal of the final undertaking design accompanied by an accurate inventory of affected historic properties—that information is included in Attachment 1, Chapter 2, "Revised Design of the Undertaking" and Chapter 4, "Revised Finding of Effect."

In response to the second request—submittal of an assessment of the cumulative effects the undertaking may have on the San Antonio Terrace Archeological District and NRHP eligible launch facilities/complexes at Vandenberg AFB—that information is included in Attachment 1, Chapter 3, "Cumulative Effects to Cultural Resources."

In response to the fourth request—taking the opportunity to avoid and/or minimize the undertaking's effects on historic properties to the extent possible—that information is included in Attachment 1, Chapter 5, "Measures Proposed to Avoid or Minimize Adverse Effects to Historic Properties."

In response to the third request—submittal of the ways in which USAF has considered comments provided by the Tribe in terms of project planning—USAF offers the following comprehensive summary of tribal consultation to date:

1) November 5, 2020. Initiation of consultation per 36 CFR §800.3. An in-person meeting was held in Santa Ynez including Mr. Sam Cohen, Tribal Legal Advisor; Ms. Nakia Zavalla, Tribal Cultural Director; Ms. Kathleen Marshall, Samala Language Teacher; and Mr. Christopher Ryan, 30th Space Wing Tribal Liaison Officer and Vandenberg AFB Cultural Resources Manager. Mr. Ryan provided a general overview of the project and maps of the preliminary project footprint. At that time Mr. Ryan also pointed out that Launch Facility-04 is within the boundary of the historic Native American village of Lospe where burials are known to exist and, as such, USAF also would be developing a Plan of Action pursuant to the Native American Graves Protection and Repatriation Act (NAGPRA) to address inadvertent discovery of human remains and associated grave items during project implementation. Lastly, Mr. Ryan offered to provide a site

visit to any Tribal members interested in seeing the project area. The purpose of this consultation event was to provide the Tribe with general information and to notify them that additional information would be forthcoming in the form of a Section 106 investigation report. No comments were solicited from the Tribe at the time.

2) August to December 2020. Native American monitoring of archaeological field investigations, as needed. All field investigations performed by archaeologists with HDR Inc. involving archaeological excavations were monitored by a representative of the Tribe.

3) December 21, 2020. Initiation of consultation per the National Environmental Policy Act (NEPA). Consultation correspondence sent from Mr. Hunsicker, Headquarters Global Strike Command, to Chairman Kahn, Santa Ynez Band of Chumash Indians. The letter described the proposed undertaking, compliance requirements pursuant to the NEPA and Section 106 of the National Historic Preservation Act (NHPA), and notified the Chairman that the Tribe would be provided a Draft Environmental Assessment for review in early 2021. The letter also provided a summary of the 5 November meeting initiating Section 106 consultation with the Tribe. A copy of the letter is included within Attachment 3.

4) January 5, 2021. Continuing consultation per 36 CFR §800. Mr. Ryan participated in the Elders' Council Meeting, held via Zoom video-conference. Mr. Cohen from the Tribe also participated. Multiple forthcoming projects on Vandenberg AFB were discussed including special attention to the GBSD Test Program. Mr. Ryan offered to provide a site visit to any Tribal members interested in seeing the project area. Again, the purpose of this consultation event was to provide the Elders with general information and to notify them that the Section 106 investigation report would be submitted to the Tribe for review and comment within approximately two weeks' time. No comments were solicited from the Elders at the time.

5) January 22, 2021. Submittal of the Section 106 investigation report. Mr. Ryan submitted the Section 106 investigation report to the Tribe with a request for review and comment. A copy of the transmittal letter is included within Attachment 3.

6) February 19, 2021. Notice of Availability for the GBSD Test Program Environmental Assessment (EA). The Tribe receives notification that the Draft EA was available for review and comment and was available via a link to a website. Having received the Notice of Availability, Mr. Cohen and Mr. Ryan exchange emails wherein the SHPO's letter of 22 February is provided to the Tribe accompanied by a request for Tribal comments to date. The email exchange also reiterated the offer to provide a site visit to interested Tribal members, and suggested a meeting to discuss the Draft EA as well as NAGPRA compliance. A copy of the email exchange is included within Attachment 3.

7) March 18, 2021. Receipt of consolidated Tribal comments addressing both the Section 106 investigation report and the Draft EA. The letter is submitted to Mr. Halsey, Space and Missile Defense Command, and Mr. Ryan, Vandenberg AFB, and includes 11 numbered comments. The Tribe's 18 March letter is included in Attachment 3. USAF review of the tribe's letter resulted in categorizing the comments into those relating to 36 CFR §800.4, Identification of historic properties; those relating to 36 CFR §800.5, Assessment of adverse effects; those relating to 36 CFR §800.6, Resolution of adverse effects; and those relating to other regulatory issues, e.g., NAGPRA compliance. With the understanding that the Section 106 review process proceeds from one step to the next, USAF set about addressing the Tribe's comments relating to 36 CFR §800.4, which included:

a) Under comment #1, the Tribe commented the EA must address impacts on "historic or cultural resources…" [40 CFR 1508.27(b)(3)] and on "districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places" and on "significant scientific, cultural, or historical resources" (40 CFR 1508.27(b)(8)).

b) Under comment #2, the Tribe commented "With respect to other kinds of cultural resources, a common problem is that they are not considered at all. Historic properties are sometimes the only things discussed in the "cultural resource" part of an EA. All archeological sites must be considered within an EA, not just archaeological sites that are eligible for listing on the National Register of Historic Places. Additionally, if social impacts are considered, they are often considered only terms of easily quantifiable socioeconomic variables like population, employment, and use of public services. The result is that impacts on many classes of cultural resource simply are not identified or considered in deciding whether significant impacts may occur."

c) Under comment #3, the Tribe commented "Traditional Cultural Properties and Cultural Landscapes must also be included in Section 106 consultations and the EA. Traditional cultural properties, because they are a property type that is eligible for listing on the NRHP, must be identified in the same manner in the Section 106 process as other types of cultural resources of significance to Indian tribes or Native Hawaiian organizations." Furthermore, the Tribe offered that the federal agency must "Seek information from consulting parties including Indian tribes…."

d) Under comment #5, the Tribe commented "Subsurface testing is required…. The project is in a region where there are many sites; there is reason to suspect that buried sites may be present that went undetected during the survey. Because the soil profile is depositional then there may be a need to conduct additional subsurface testing, particularly in areas where ground disturbance is planned at depths greater than one meter."

8) 29 March 2021. 30 SW submitted transmittal letter, the report "Places of Traditional Religious and Cultural Importance, Ground Based Strategic Deterrent Test Program" (Volta 2021)(Attachment 2), and the Draft NAGPRA Plan of Action to the Tribe. The transmittal letter is included in Attachment 3. The report was prepared to address the Tribe's concerns as expressed in a-c, above. Within the body of the transmittal letter, USAF addressed the Tribe's concerns as expressed in d, above, as follows:

> To supplement existing surface survey data and newly acquired surface survey data, archaeologists at HDR Inc. reviewed data from more than 2000 previously excavated shovel test pits, one-meter by one-meter test excavation units, and backhoe trenches to pin-point the location of where subsurface archaeological deposits do exist, and where they do not exist. Wherever archaeologists from HDR Inc. found gaps in the existing subsurface survey and testing data, they excavated additional shovel test pits to acquire any and all subsurface data needed. In total, an additional 158 shovel test pits were excavated to provide the most comprehensive subsurface data set possible.
>
> 30 SW acknowledges that archaeological excavations typically frequently extend only to one meter of depth or less. Occasionally test excavation units extend to 1.5 meters in depth. Admittedly, the project description, as presented in the Section 106 investigation report, included ground disturbance to depths far greater than one meter. As mentioned above, refinements in the project design have not only greatly reduced the amount of ground disturbance, but also the depth of ground disturbance. 30 SW and GBSD Test Program project personnel will continue to consult with the Tribe to pin-point locations where ground disturbance would exceed depths of one meter, and develop archaeological and Native American monitoring protocols that would identify deeply buried archaeological deposits during project implementation. Please rest assured, in accordance with the Section 106 implementing regulations, any newly identified archaeological deposits discovered during project implementation would constitute a discovery during construction and would cause the Section 106 review process to be re-opened.

9) 2 April 2021. In-person meeting in Santa Ynez including Mr. Cohen and Mr. Ryan. The purpose of the meeting was to discuss the report "Places of Traditional and Cultural Importance" and whether that report adequately addressed the Tribe's concerns as expressed in 7a-7c, above. Mr. Cohen stated that he was pleased by the responsiveness of the USAF to the concerns expressed by the Tribe and that the report appeared to be a reasonable and good faith effort to identify traditional cultural properties and landscapes and sacred sites within the APE. Furthermore, Mr. Cohen stated he would confer with the Elders during their Tuesday Council meeting and reply back to the USAF with their views on the sufficiency of USAF's efforts to identify the broadest range of cultural resources within the APE as required under the NEPA.

10) 7 April 2021. Receipt of letter indicating the Tribe considered USAF efforts to identify the broadest range of cultural resources within the APE as complete. A copy of the letter is included in Attachment 3. With this letter, USAF understands their federal agency responsibilities to identify historic properties and all cultural resources within the APE pursuant to 36 CFR §800.4 is complete in the opinion of the Tribe. This concludes the USAF's summary of consultation with the Tribe to date.

On Saturday, 17 April 2021, Mr. Cohen and Mr. Ryan will continue consultation by meeting in-person in Santa Ynez. The purpose of the meeting is to review the Tribe's comments relating to the next step of the Section 106 review process, 36 CFR §800.5, Assessment of adverse effects. Mr. Ryan will submit the report "Revised Design of the Undertaking and Finding of Effect, Ground Based Strategic Deterrent Test Program" (Blackwell and Volta 2021) to the Tribe and point out the ways in which USAF has responded to the Tribe's comments by revising the project design to avoid and minimize effects to cultural resources of concern to the Tribe, and to present the USAF's analysis of cumulative effects to cultural resources of concern to the Tribe. Tribal comments and views deriving from this meeting and the Tribe's review of that report will be forwarded to the SHPO and the ACHP once they are received by the USAF.

Thus, 30 SW requests concurrence from the SHPO that USAF has completed a reasonable and good-faith cultural resources investigation that considers the broadest range of cultural resources within the APE to include traditional cultural properties and landscapes and sacred sites in fulfillment of federal agency responsibilities pursuant to 36 CFR §800.4(a)-(d).

Furthermore, following SHPO review of "Revised Design of the Undertaking and Finding of Effect, Ground Based Strategic Deterrent Test Program", pursuant to 36 CFR 800.5, 30 SW requests concurrence from the SHPO that:

a. CA-SBA-512, the historic Native American village of Lospe, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: surface preparations for the creation of a laydown area, trenching for the construction of an underground utility corridor, excavation for the repair and/or replacement of security fencing;

b. CA-SBA-Z00021H, the San Antonio Terrace Archaeological District (SATAD), would be adversely affected by the GBSD Test Program because CA-SBA-512 is a contributing element of the SATAD and the adverse effects to CA-SBA-512 described above also constitute adverse effects to the district;

c. CA-SBA-760/-761/-1748 would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related ground-disturbance within archaeological deposits that contribute to the significance of the site: grading and/or disking associated with maintenance of the fire break surrounding LF-04;

d. P-42-041239, Missile Alert Facility-D0, would be adversely affected by the GBSD Test Program because the proposed project would result in the physical destruction of or damage to all or part of the property [36 CFR 800.5(a)(2)(i)] resulting from the following project-related activities: demolition;

e. P-42-041242, Launch Facility-04, would be adversely affected by the GBSD Test Program because the proposed project would result in the alteration of a property [36 CFR 800.5(a)(2)(ii)] resulting from the following project-related activities: modification from a Minuteman III launch facility to a Ground Based Strategic Deterrent test launch facility; and

f. P-42-041253, Launch Facility-26, would be adversely affected by the GBSD Test Program because the proposed project would result in the alteration of a property [36 CFR 800.5(a)(2)(ii)] resulting from the following project-related activities: modification from a Minuteman III launch facility to a Ground Based Strategic Deterrent test launch facility.

As such, pursuant to 36 CFR 800.5(d)(2), 30 SW determined that the proposed GBSD Test Program would result in adverse effects to historic properties and shall consult further to resolved the adverse effects pursuant to 36 CFR 800.6.

If you have any questions or require additional information, please contact me at (805) 605-0748 or via e-mail at christopher.ryan.7@spaceforce.mil. Thank you for your assistance with this undertaking.

Sincerely

Christopher Ryan

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CHRISTOPHER RYAN
Cultural Resources Manager, 30 CES/CEIEA

Attachments:
1. *Revised Design of the Undertaking and Finding of Effect, GBSD Test Program*
2. *Places of Traditional Religious and cultural Importance, GBSD Test Program*
3. *Correspondence with the Santa Ynez Band of Chumash Indians*

CC: Mr. Sam Cohen, Santa Ynez Band of Chumash Indians
Ms. Nakia Zavalla, Santa Ynez Band of Chumash Indians
Lt. Col. Charles G. Hansen, Commander, 30th Civil Engineer Squadron, USAF
Mr. Michael Ackerman, Air Force Civil Engineer Center, NEPA Division
Mr. Allen Holdaway, Air Force Nuclear Weapons Center

PROGRAMMATIC AGREEMENT
AMONG
SPACE LAUNCH DELTA 30 OF THE UNITED STATES SPACE FORCE,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
THE SANTA YNEZ BAND OF CHUMASH INDIANS,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING NEW CONSTRUCTION AND MODIFICATION OF EXISTING MINUTEMAN TEST LAUNCH FACILITIES FOR THE GROUND BASED STRATEGIC DETERRENT TEST PROGRAM AT
VANDENBERG SPACE FORCE BASE,
SANTA BARBARA COUNTY, CALIFORNIA

WHEREAS, the United States Air Force Global Strike Command (AFGSC) intends to decommission the Minuteman III Intercontinental Ballistic Missile program and replace it with a yet-to-be-determined replacement program; and

WHEREAS, the replacement program, presently named the Ground Based Strategic Deterrent (GBSD) program, will be developed and tested as the GBSD Test Program (Undertaking) at Vandenberg Space Force Base (VSFB), Hill Air Force Base, Dugway Proving Ground, and the United States Army Garrison-Kwajalein Atoll and, under a separate undertaking, deployed operationally at sites within the continental United States; and

WHEREAS, the test program for the intended replacement program consists of the construction of new facilities in and near the main cantonment area and the modification of existing facilities currently supporting Minuteman test activities or mothballed facilities at VSFB, as described in *Identification of Historic Properties and Finding of Adverse Effect, Ground Based Strategic Deterrent Test Program, Vandenberg Air Force Base, Santa Barbara County, California*; and

WHEREAS, Space Launch Delta 30 (SLD 30) of the United States Space Force, in cooperation with AFGSC, plans to carry out GBSD Test Program activities at VSFB; and

WHEREAS, the Undertaking is being conducted to fulfill national security priorities under a constrained and accelerated schedule with design occurring concurrently with compliance for various environmental laws and regulations; and

WHEREAS, SLD 30 has consulted and continues to consult with the California State Historic Preservation Officer (SHPO) pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (54 USC § 306108); and

WHEREAS, SLD 30, in consultation with the SHPO, provides a final definition of the Undertaking's area of potential effects (APE) described in Attachment 1; and

WHEREAS, SLD 30 carried out cultural resource investigations to identify and evaluate historic properties for the Undertaking pursuant to 36 CFR § 800.4(a)-(d), and the SHPO has concurred with SLD 30's determinations of eligibility to date; and

WHEREAS, SLD 30 determined that the Undertaking will adversely affect Launch Facility (LF)-04, LF-26, Missile Alert Facility (MAF)-D0, archaeological sites CA-SBA-512 and CA-SBA-760/-761/-1748, and the San Antonio Terrace Archaeological District (SATAD; CA-SBA-Z00021H), all of which are eligible for listing in the National Register of Historic Places (NRHP) as described in *Identification of Historic Properties and Finding of Adverse Effect, Ground Based Strategic Deterrent Test Program, Vandenberg Air Force Base, Santa Barbara County, California*; and

WHEREAS, the SHPO concurred with SLD 30's finding that the proposed Undertaking will adversely affect historic properties; and

WHEREAS, the SHPO advised SLD 30 that the development of a Programmatic Agreement (PA) that creates a process to resolve adverse effects to historic properties subsequent to the PA's execution, rather than a memorandum of agreement that provides resolution of adverse effects to historic properties, might better assist SLD 30 with meeting the Undertaking's constrained and accelerated schedule for compliance with the National Environmental Policy Act; and

WHEREAS, SLD 30, in consultation with the SHPO, has implemented multiple design revisions to the Undertaking since SLD 30 initiated consultation on 12 January 2021 to better avoid and minimize adverse effects to historic properties, in accordance with 36 CFR § 800.6, and the consideration of subsequent design revisions may have diminished the relevance of the consulting parties' prior comment on prior iterations of the Undertaking's design and precluded the opportunity to reconsider prior comment, this PA provides a review process to verify SLD 30's compliance with 36 CFR §§ 800.4 and 800.5 for the final iteration of the Undertaking; and

WHEREAS, SLD 30 consulted with the Santa Ynez Band of Chumash Indians (SYBCI) regarding identification of and effects of the undertaking on properties of traditional cultural significance to the Tribe, and specifically the site of the historic village of Lospe (CA-SBA-512); and

WHEREAS, in accordance with 36 CFR § 800.6(a)(1), SLD 30 notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination with specified documentation, and the ACHP chose to participate in the consultation pursuant to 36 CFR § 800.6(a)(1)(iii); and

WHEREAS, SLD 30 invited the SYBCI to sign this PA as an invited signatory and the SYBCI accepted that invitation, and collectively SLD 30, the SHPO, the ACHP, and the SYBCI shall be referred to as "signatories";

NOW, THEREFORE, SLD 30, the SHPO, the SYBCI, and the ACHP agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

SLD 30 shall ensure the following measures are implemented:

I. PHASING OF THE UNDERTAKING

Phasing of the Undertaking is critical to upholding the historic preservation intent of the Section 106 process under the scheduling constraints of the Undertaking. SLD 30 has identified four phases based on the construction priorities of the Undertaking and the historic properties that are present and that would be potentially affected. The phases are depicted within Attachment 2. Each phase will undergo verification that the compliance efforts for the basic steps in the Section 106 process have been completed within that portion of the APE and, where no issues are found, construction would be permitted to commence in those phase areas.

A. Phase areas are identified as follows:

1. Phase I of the Undertaking includes renovation of 14 existing support facilities and construction of 4 new support facilities in the main cantonment area and on the San Antonio Terrace, and improvements to 26 miles of communications systems within existing roadway corridors, as depicted within Attachment 2. Phase I and Phase II are the highest priority in the construction schedule of the Undertaking. One built environment historic property is present in Phase I: MAF-O1E/O1C (P-42-041258; OHP # USAF_2020_0309_001). The 19 archaeological historic properties present in Phase I are listed below.

Trinomial	NRHP Eligibility	OHP #
CA-SBA-Z00021H	2S2 Eligible District (SATAD)	USAF871231A
CA-SBA-228	2S2 Individually Eligible	USAF_2017_0831_001
CA-SBA-513	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-594	2D2 Contributing Element of SATAD 3S Recommended Individually Eligible	USAF871231A –
CA-SBA-722	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-730	2D2 Contributing Element of SATAD	USAF871231A
CA-SBA-739	2D2 Contributing Element of SATAD	USAF871231A
CA-SBA-740	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-743	7R Unevaluated, assumed eligible	–
CA-SBA-939	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-941	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-990	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-998	2B Individually Eligible Contributing Element of SATAD	USAF_2020_0901_004 USAF871231A

Trinomial	NRHP Eligibility	OHP #
CA-SBA-1853	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A
CA-SBA-1865/H	2S2 Individually Eligible	USAF_2017_0831_001
CA-SBA-2128H	2S2 Individually Eligible	USAF_2017_0831_001
CA-SBA-2320	7R Unevaluated, assumed eligible	–
CA-SBA-2352	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001
CA-SBA-2471	2S2 Individually Eligible	USAF_2017_0831_001

2. Phase II of the Undertaking includes modifications to two existing Minuteman test launch silos and one launch control facility, and consists of all areas within the fence lines surrounding MAF D-0, LF-04, and LF-26. Undertaking activities at LF-04 and LF-26 include abatement of hazardous materials and refurbishment of interior launch facility systems. No new subterranean structures will be constructed and no ground disturbance will be required. Undertaking activities at MAF D-0 include demolition of the existing facility and construction of a new above-ground launch control facility within the existing fence line. Phase I and Phase II are the highest priority in the construction schedule of the Undertaking. The three built environment historic properties present in Phase II are listed below.

Primary #	Facility Name	NRHP Eligibility	OHP #
P-42-041239	Missile Alert Facility-D0	2S2 Individually Eligible	USAF_2020_0309_001
P-42-041242	Launch Facility-04	2S2 Individually Eligible	USAF_2020_0309_001
P-42-041253	Launch Facility-26	2S2 Individually Eligible	USAF_2020_0309_001

3. Phase III of the Undertaking consists of the establishment of a laydown area and fire break and improvements to utilities outside the fence line surrounding LF-26. Phase III actions are designed to support construction activities occurring subsequent to initial abatement activities in Phase II and are a lower priority than Phases I and II. One archaeological historic property is present in Phase III: CA-SBA-760/-761/-1748 (individually eligible; OHP # USAF_2021_0122_001).

4. Phase IV of the Undertaking consists of the establishment of a laydown area and fire break and improvements to utilities outside the fence line surrounding LF-04. Phase IV actions are designed to support construction activities occurring subsequent to initial abatement activities in Phase II and are a lower priority than Phases I, II, and III. The two archaeological historic properties present in Phase IV are listed below.

Trinomial	NRHP Eligibility	OHP #
CA-SBA-Z00021H	2S2 Eligible District (SATAD)	USAF871231A
CA-SBA-512	2B Individually Eligible Contributing Element of SATAD	USAF_2017_0831_001 USAF871231A

B. Phase Review

Following execution of the PA, SLD 30 shall make one of the following determinations to ensure that compliance with Section 106 is verified independently for each phase, using the schedule as shown in Attachment 3:

1. No Historic Properties Affected

    a. If SLD 30 makes a finding of no historic properties affected, it shall submit a document to the SHPO and the SYBCI with the following information using the documentation standards at 36 CFR § 800.11(d):

        i. A description of all actions that are included in the phase;

        ii. A description and a map of the APE for the phase;

        iii. A narrative and an inventory coverage map of the efforts to identify cultural resources in the APE for the phase and a rationale for the adequacy of those efforts;

        iv. A complete list of cultural resources within the APE for the phase and the NRHP eligibility status of each resource;

        v. A finding of no historic properties affected.

    b. Within seven calendar days of receiving the document in accordance with Stipulation I.B.1.a, the SHPO and the SYBCI will either:

        i. Provide concurrence with the finding of no historic properties affected and that Section 106 review for the phase is complete; or

        ii. Provide comments for SLD 30 to address. SLD 30 shall work with the SHPO and the SYBCI to resolve comments and reach concurrence with the finding of no historic properties affected and that Section 106 review is complete, within seven calendar days of receiving comments.

        iii. If SLD 30, the SHPO, and SYBCI cannot concur on no historic properties affected, then the dispute resolution procedures outlined in Stipulation VIII will be followed.

2. No Adverse Effect

    a. If SLD 30 makes a finding of no adverse effect to historic properties, it shall submit a document to the SHPO and the SYBCI with the following information using the documentation standards at 36 CFR § 800.11(e):

i. A description of all actions that are included in the phase;

ii. A description and a map of the APE for the phase;

iii. A narrative and an inventory coverage map of the efforts to identify cultural resources in the APE for the phase and a rationale for the adequacy of those efforts;

iv. A complete list of cultural resources within the APE for the phase and the NRHP eligibility status of each resource;

v. A description of historic properties that would be affected;

vi. A description of how the criteria of adverse effect [in accordance with 36 CFR § 800.5(a)] were applied and whether the application of the criteria of adverse effect included the use of any measures to avoid or minimize effects to historic properties; and

vii. A finding of no adverse effect.

b. Within seven calendar days of receiving the document in accordance with Stipulation I.B.2.a, the SHPO and the SYBCI will either:

i. Provide concurrence with the finding no adverse effect and that Section 106 review for the phase is complete; or

ii. Provide comments for SLD 30 to address. SLD 30 shall work with the SHPO and SYBCI to resolve comments and reach concurrence with the finding no adverse effect and that Section 106 review is complete, within seven calendar days of receiving comments.

iii. If SLD 30, the SHPO, and the SYBCI cannot concur with a finding of no adverse effect, then the dispute resolution procedures outlined in Stipulation VIII will be followed.

3. Adverse Effect

a. If SLD 30 makes a finding of adverse effect to historic properties, it shall submit a document to the SHPO and the SYBCI with the following information using the documentation standards at 36 CFR § 800.11(e):

i. A description of all actions that are included in the phase;

ii. A description and a map of the APE for the phase;

iii. A narrative and an inventory coverage map of the efforts to identify cultural resources in the APE for the phase and a rationale for the adequacy of those efforts;

iv. A complete list of cultural resources within the APE for the phase and the NRHP eligibility status of each resource;

v. A description of historic properties that would be affected;

vi. A description of how the criteria of adverse effect [in accordance with 36 CFR § 800.5(a)] were applied;

vii. A finding of adverse effect;

viii. Proposed measures that would resolve adverse effects to acceptable levels.

ix. If heritage documentation is proposed, the document will include the views of the National Park Service on the appropriate level of documentation. SLD 30 will contact the regional Historic American Building Survey/Historic American Engineering Record/Historic American Landscape Survey (HABS/HAER/HALS) coordinator at the National Park Service Interior Regions 8, 9, 10, and 12 Regional Office (NPS) to request that NPS stipulate the level of and procedures for completing the heritage documentation.

x. A schedule for the deliverables.

b. Within seven calendar days of receiving the document in accordance with Stipulation I.B.3.a, the SHPO and the SYBCI will either:

i. Provide concurrence on the adverse effect finding and proposed measures for resolution and that Section 106 review for the phase is complete; or

ii. Provide comments for SLD 30 to address. SLD 30 shall work with the SHPO and the SYBCI to resolve comments and reach concurrence with the finding of adverse effect and measures for resolution and that Section 106 review is complete, within 14 calendar days of receiving comments.

iii. If SLD 30, the SHPO, and the SYBCI cannot concur with a finding of no adverse effect, then the dispute resolution procedures outlined in Stipulation VIII will be followed.

C. The target schedule for completing Section 106 review for the Undertaking's phases is included with this PA as Attachment 3.

II. AREA OF POTENTIAL EFFECTS

SLD 30, in consultation with the SHPO, delineated the Undertaking's final APE, included as Attachment 1. The APE for the Undertaking as a whole shall be partitioned into phase APEs to correlate with the phases of the Undertaking set out in Stipulation I.A. If during implementation of the PA SLD 30 determines that there must be changes to the Undertaking, upon determining the Undertaking must be changed, SLD 30 will notify the SHPO and the SYBCI of the required APE changes with a request for comment within 7 calendar days. SLD 30 will prepare a letter report documenting the required changes, whether those changes require revisions to the APE, and which of the Undertaking's phases in Stipulation I.A would require APE revisions as a consequence of the proposed changes to the Undertaking. If so, the APE will be re-delineated in accordance with 36 CFR § 800.4(a)(1), and the process described in Stipulation I.B will be followed with respect to the individual phases in Stipulation I.A.

III. AVOIDANCE AND MINIMIZATION MEASURES

Any measures to avoid historic properties or to minimize effects to historic properties that are the result of consultation under Stipulation I.B will be included in the monitoring and discovery plan, which upon completion will be added to this PA as Attachment 4.

A. The initial plan will contain the monitoring and discovery protocols that apply to the Undertaking as a whole, including roles and responsibilities, safety considerations, procedures to delimit and protect culturally sensitive areas during construction, archaeological monitoring field methods, procedures for reporting, evaluating, and treating unexpected discoveries, protocols for the unanticipated discovery of human remains and other items protected under the Native American Graves Protection and Repatriation Act (43 CFR Part 10), and standards for documentation and reporting. These procedures will be consistent with the VSFB Integrated Cultural Resources Management Plan, Volume 5 (*Management of Prehistoric Archaeological Resources*), Chapter 7 (*Cultural Resources Monitoring and Treatment of Archaeological Discoveries*) and Chapter 8 (*Treatment of Human Remains*).

B. As Section 106 review is completed for each phase of the Undertaking, any resource avoidance or minimization measures developed during the phase review will be described in an addendum to the initial monitoring and discovery plan.

IV. MITIGATION

Any measures to mitigate adverse effect on historic properties that are the result of consultation under Stipulation I.B will be included in a Built Environment Treatment Plan (BETP) and an Archaeological Resource Treatment Plan (ARTP), which upon completion will be added to this PA as Attachments 5 and 6, respectively.

A. Built Environment Treatment Plan

1. The initial BETP will contain the mitigation protocols for built environment resources that apply to the Undertaking as a whole, including a review of applicable regulations, required qualifications, a context for research, and information about the history and significance of each historic property in the APE for Undertaking as a whole. These protocols will be consistent with the VSFB Integrated Cultural Resources Management Plan, Volume 8 (*Management of Cold War Resources*), Chapter 4 (*Historic Preservation Plan for the Management and Treatment of Cold War Properties*).

2. As Section 106 review is completed for each phase of the Undertaking, any proposed mitigation activities developed for built environment historic properties, if applicable to that phase, will be described in an addendum to the initial BETP. The addendum will include review responsibilities and timelines, format and quantity of printed materials, and distribution and accessibility information.

B. Archaeological Resource Treatment Plan

1. The initial ARTP will contain the mitigation protocols for archaeological resources that apply to the Undertaking as a whole, including a review of applicable regulations, required qualifications, environmental and cultural setting, a context for research, information about the history and significance of each historic property in the APE for Undertaking as a whole, and overall field, analysis, and curation methods. These protocols will be consistent with the VSFB Integrated Cultural Resources Management Plan, Volume 5 (*Management of Prehistoric Archaeological Resources*), Chapter 6 (*Standards and Procedures for Treating Archaeological Resources*).

2. As Section 106 review is completed for each phase of the Undertaking, any proposed mitigation activities developed for archaeological historic properties, if applicable to that phase, will be described in an addendum to the initial ARTP. The addendum will include review responsibilities and timelines, format and quantity of printed materials, and distribution and accessibility information.

C. If during implementation of the PA, SLD 30 determines that there must be changes to the undertaking, and those changes result in additional adverse effects to historic properties, additional mitigations to resolve adverse effects would be determined in consultation with the SHPO and the SYBCI following the procedures in Stipulation I.B. Upon agreement of appropriate mitigation measures, those measures would be appended to the appropriate treatment plan.

V. DURATION

A. This PA will expire if its terms are not carried out within five (5) years from the date of its execution. Prior to such time, SLD 30 may consult with the other signatories to reconsider the terms and duration of the PA and amend it in accordance with Stipulation IX below.

B. If SLD 30 determines the terms of the PA have been fulfilled, it shall notify other signatories in writing. Upon written concurrence from signatories that the terms of the PA have been fulfilled, this PA will be considered expired.

C. All mitigation measures shall be completed prior to the expiration of this PA.

VI. STANDARDS AND QUALIFICATIONS

A. Pursuant to Section 112(a)(1)(A) of the NHPA [54 USC § 306131(a)(1)(A)] and 36 CFR § 800.2(a)(1), SLD 30 will ensure that all work carried out in accordance with this agreement will be done by or under the direct supervision of appropriate historic preservation professionals who meet the *Secretary of the Interior's Professional Qualifications Standards*.

B. SLD 30 will ensure that contractors retained for services also meet these professional qualifications standards.

VII. ANNUAL REPORTING

A. By January 30 of each year, following the execution of this PA, until it expires or is terminated, SLD 30 shall provide all parties to this PA, except for the ACHP, an annual summary report detailing work undertaken pursuant to its terms. Such report shall be delivered electronically and include any scheduling changes proposed, any problems encountered, and any disputes and objections received in SLD 30's efforts to carry out the terms of this PA.

B. SLD 30 shall coordinate a meeting of the signatories and consulting parties to be scheduled within ninety (90) days of distribution of the annual report to discuss activities carried out pursuant to this PA during the preceding year and activities scheduled for the upcoming year. This meeting, should it be deemed unnecessary, may be cancelled by mutual consent of the signatory parties.

VIII. DISPUTE RESOLUTION

A. Should any signatory to this PA object at any time to any actions proposed or the manner in which the terms of this PA are implemented, SLD 30 shall consult with such party to resolve the objection. If SLD 30 determines that such objection cannot be resolved, SLD 30 shall:

1. Forward all documentation relevant to the dispute, including SLD 30's proposed resolution, to the ACHP. The ACHP shall provide the other signatories with its advice on the resolution of the objection within 30 days of receiving adequate documentation. Prior to reaching a final decision on the dispute, SLD 30 shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the signatories and provide them with a copy of this written response. SLD 30 will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the 30-day time period, SLD 30 may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, SLD 30 shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and provide the signatories with a copy of such written response.

B. SLD 30's responsibility to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

C. Should any member of the public raise a timely and substantive objection pertaining to the manner in which the terms of the PA are carried out, at any time during its implementation, SLD 30 shall take the objection into account by consulting with the objector to resolve this objection. When SLD 30 responds to an objection, it shall notify the consulting parties of the objection and in the manner in which it was resolved. SLD 30 may request the assistance of a consulting party to resolve an objection.

IX. AMENDMENTS

This PA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

X. TERMINATION

A. If any signatory to this PA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other signatories to attempt to develop an amendment per Stipulation IX, above. If within 30 days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the PA upon written notification to the other signatories.

B. Once the PA is terminated, and prior to work continuing on the undertaking, SLD 30 must either (a) execute a Memorandum of Agreement pursuant to 36 CFR § 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. SLD 30 shall notify the signatories as to the course of action it will pursue.

EXECUTION of this PA by SLD 30, the SHPO, the SYBCI, and the ACHP, and implementation of its terms evidence that SLD 30 has taken into account the effect of the undertaking on historic properties and afforded the ACHP an opportunity to comment.

PROGRAMMATIC AGREEMENT
AMONG
SPACE LAUNCH DELTA 30 OF THE UNITED STATES SPACE FORCE,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
THE SANTA YNEZ BAND OF CHUMASH INDIANS,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING NEW CONSTRUCTION AND MODIFICATION OF EXISTING
MINUTEMAN TEST LAUNCH FACILITIES FOR THE GROUND BASED
STRATEGIC DETERRENT TEST PROGRAM AT
VANDENBERG SPACE FORCE BASE,
SANTA BARBARA COUNTY, CALIFORNIA

SIGNATORY:

Space Launch Delta 30 of the United States Space Force, Vandenberg Space Force Base

By: _____ Date: JUN 1 1 2021

CHARLES G HANSEN, LT COL, USAF
Commander, 30th Civil Engineer Squadron

PROGRAMMATIC AGREEMENT
AMONG
SPACE LAUNCH DELTA 30 OF THE UNITED STATES SPACE FORCE,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
THE SANTA YNEZ BAND OF CHUMASH INDIANS,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING NEW CONSTRUCTION AND MODIFICATION OF EXISTING
MINUTEMAN TEST LAUNCH FACILITIES FOR THE GROUND BASED
STRATEGIC DETERRENT TEST PROGRAM AT
VANDENBERG SPACE FORCE BASE,
SANTA BARBARA COUNTY, CALIFORNIA

SIGNATORY:

California State Historic Preservation Officer

By: _____ Date 6/11/21

JULIANNE POLANCO
State Historic Preservation Officer

PROGRAMMATIC AGREEMENT
AMONG
SPACE LAUNCH DELTA 30 OF THE UNITED STATES SPACE FORCE,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
THE SANTA YNEZ BAND OF CHUMASH INDIANS,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING NEW CONSTRUCTION AND MODIFICATION OF EXISTING
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STRATEGIC DETERRENT TEST PROGRAM AT
VANDENBERG SPACE FORCE BASE,
SANTA BARBARA COUNTY, CALIFORNIA

SIGNATORY:

Advisory Council on Historic Preservation

By: _____ Date ____6/11/2021_____
REID NELSON
Executive Director, Acting

PROGRAMMATIC AGREEMENT
AMONG
SPACE LAUNCH DELTA 30 OF THE UNITED STATES SPACE FORCE,
THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
THE SANTA YNEZ BAND OF CHUMASH INDIANS,
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REGARDING NEW CONSTRUCTION AND MODIFICATION OF EXISTING
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STRATEGIC DETERRENT TEST PROGRAM AT
VANDENBERG SPACE FORCE BASE,
SANTA BARBARA COUNTY, CALIFORNIA

INVITED SIGNATORY:

Santa Ynez Band of Chumash Indians

By: _____ Date 06/11/2021

KENNETH KAHN
Chairman

All PA attachments contain sensitive information and are not included.

C

Stakeholders Distribution List

Appendix C: Stakeholders Distribution List

Vandenberg Space Force Base

Federal

NOAA – Channel Islands National Marine Sanctuary – Santa Barbara, CA

NOAA – National Marine Fisheries Service – Southwest Regional Office – Long Beach, CA

National Park Service – Channel Islands National Park – Ventura, CA

U.S. Army Corps of Engineers – Vandenberg AFB, CA

U.S. Coast Guard – Santa Barbara, CA

U.S. Department of Transportation – Federal Aviation Administration (FAA) – Washington, DC

U.S. Environmental Protection Agency, Region 9 – Environmental Review Office – San Francisco, CA

U.S. Fish and Wildlife Service – Ventura Fish and Wildlife Office – Ventura, CA

State

California Coastal Commission – Energy, Ocean Resources and Federal Consistency Division – San Francisco, CA

Central Coast Regional Water Quality Control Board – San Luis Obispo, CA

Central Coast Regional Water Quality Control Board – Central Coast Ambient Monitoring – Program (CCAMP) – San Luis Obispo, CA

California Department of Fish & Wildlife South Coast Region

California Environmental Protection Agency – Sacramento, CA

California Office of Historic Preservation – State Historic Preservation Officer – Sacramento, CA

Office of the Governor – Office of Planning and Research – Sacramento, CA

Santa Barbara County Air Pollution Control District – Santa Barbara, CA

Tribes

Santa Ynez Band of Chumash Indians – Elders Council – Santa Ynez, CA

Local

Santa Barbara County Board of Supervisors – Santa Barbara County Planning & Development – Santa Barbara, CA

Santa Barbara County Planning & Development – Santa Barbara CA

City of Lompoc – Economic & Community Development – Lompoc, CA

Libraries

Santa Barbara Public Library – Santa Barbara, CA

Lompoc Public Library – Lompoc, CA

Santa Maria Public Library – Santa Maria, CA

Requesting Entities

California Native Plant Society – Channel Islands Chapter – Ojai, CA

California Trout – Ventura, CA

Environmental Defense Center – Santa Barbara, CA

La Purisima Audubon Society – Vandenberg Village, CA

Santa Barbara Museum of Natural History – Santa Barbara, CA

Sierra Club – Los Padres Chapter – Santa Barbara, CA

U.S. Army Dugway Proving Ground

Federal

U.S. Fish and Wildlife Service – 2155 West Forest Street, Brigham City, UT

State

Fish Springs Wildlife Refuge Manager – Dugway, UT

Tribes

Confederated Tribes of the Goshute Indian Reservation – Ibapah, UT

Crow Tribe of Montana – Ibapah, UT

Duckwater Shoshone Tribe – Duckwater, NV

Eastern Shoshone Tribe – Ft. Washakie, WY

Ely Shoshone Tribe – Ely, NV

Hopi Tribe – Kykotsmovi, AZ

Navajo Nation – Window Rock, AZ

Northwestern Band of the Shoshone Nation – Brigham City, UT

Paiute Indian Tribe of Utah – Cedar City, UT

Pueblo of Zuni – Zuni, NM

Shoshone-Bannock Tribes of the Fort Hall Reservation – Fort Hall, ID

Skull Valley Band of Goshute Indians of Utah – Skull Valley, UT

Te-Moak Tribes of the Western Shoshone – Elko, NV

Ute Indian Tribe – Fort Duchesne, UT

Wells Band Council – Te-Moak, Wells, NV

Utah Division of Indian Affairs, Salt Lake City, UT

Requesting Entities

Mr. Steve Ericson, Citizens Education Project, Salt Lake City, UT

Mr. Richard N. Goldberger, FNA News Organization, Salt Lake City, UT

Ms. Cindy King, Utah Chapter of the Sierra Club, Salt Lake City, UT

Dr. Brian Moench, Utah Physicians for a Healthy Environment, Salt Lake City, UT

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D

Estimated Air Emissions Calculations

Appendix D

ESTIMATED AIR EMISSIONS CALCULATIONS

A. Air Conformity Application Model (ACAM) Output Data
A.1 GBSD Construction and Operation – HAFB
A.2 GBSD Construction and Operation – VSFB
A.3 GBSD Construction and Operation – DPG

B. VSFB Generators – EPA Tier III and IV Air Emissions Calculations

C. Previous Calculations – Administrative Record Purposes

Proposed Action Activities Associated with the Construction and Operation of the GBSD Test Program

Proposed Action: The Proposed Action would implement booster development, flight testing of the proposed Ground Based Strategic Deterrent (GBSD) weapon system, and GBSD Formal Training Unit (FTU) training for a new ICBM weapon system that would eventually replace the aging Minuteman III weapon system. Implementation of the test program would include facility construction or modifications at Hill Air Force Base (HAFB), Vandenberg Space Force Base (VSFB, previously named Vandenberg Air Force Base), and Dugway Proving Ground (DPG). In addition, GBSD flight test activities would be conducted from VSFB and include target impacts at U.S. Army Garrison–Kwajalein Atoll (USAG-KA) in the RMI.

Because deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently mature for operational use, both GBSD and Minuteman III flight test activities and related operations would overlap at HAFB, VSFB, and USAG-KA. Such testing would overlap for up to 10 years or until decisions are made to remove the Minuteman III weapon system from active status.

Purpose and Need: The Proposed Action would implement booster development and flight testing of the proposed GBSD weapon system. The purpose of this testing is to assess attainment of technical design parameters; verify and validate system performance capabilities (baseline requirements); and determine whether the system is operationally effective, suitable, survivable, and safe for its intended use in support of the U.S. nuclear triad.

Developed using 1960s technology and materials, the Minuteman III weapon system has exceeded its designed life expectancy. While the system remains an active, viable deterrent for the United States, many components are becoming obsolete and unsupportable, resulting in continual upgrades to maintain system reliability and performance. It is in the best interest of national security to replace the Minuteman III weapon system with a technologically and environmentally mature design before age, diminishing manufacturing sources, and material shortages make Minuteman III sustainability difficult, putting the nation at risk.

However, before the DAF can initiate the one-for-replacement of the Minuteman III missiles with the new GBSD missiles and warheads, successful developmental and operational testing under the GBSD Test Program must first occur. Such developmental and operational testing is needed to ensure the GBSD weapon system can function and achieve operational status to replace the Minuteman III and support the nuclear triad. Without the GBSD Test Program, the scheduled one-for-one replacement of the Minuteman III missiles by the new GBSD missiles and warheads, which is vital to the long-term defense and security of the United States and its allies, could be impaired or delayed.

A. ACAM Output Reports

A.1 HAFB

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location

Base: HILL AFB
State: Utah
County(s): Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Action Title: PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (EA)/OVERSEAS ENVIRONMENTAL ASSESSMENT (OEA) FOR GROUND-BASED STRATEGIC DETERRENT (GBSD) TEST

- Project Number/s (if applicable): W9113M-19-F-2215

- Projected Action Start Date: 10 / 2021

- Action Purpose and Need:

For the proposed GBSD Test Program campus at HAFB, some existing facilities would be used, along with the construction of several new facilities.

- Action Description:

The proposed approximate 22.9-acre campus, including new and existing facilities, would be located near the west side of the installation beside some of the existing Minuteman III support facilities and adjacent to other properties planned for redevelopment as part of the Falcon Hill Enhanced Use Lease.

*Training and Collaboration Center (TACC): ≈70,000 The new building would be no taller than 80 feet. [6 story building].
*Parking Structure: Construct a new approximate 560-stall, multi-level parking structure.
*Demolition: Prior to new facility construction, less than 1 acre of existing paved parking area would require demolition.
*Site Grading: Proposed Campus Area and Widening of Roadway (Georgia Street and Jonquil Lane adjacent to the building sites).
*Trenching: Extend underground electrical, communication, and water/sewer lines to each new building. Install outdoor lighting systems for streets and parking areas.
*Architectural Coating: Training and Collaboration Center (TACC) and Parking Structure.
*Paving: Surface Parking and Roadways.
-200 construction worker
*Operations: 1,660 personnel (840 new personnel)
*Back-up Generator MIF: 3-60kW (0.06MW)
*Back-up Generator SSC: 1- 1500 kW
*Back-up Generator - GBSD Launch Facility (Former Peacekeeper)
* MIF - Fuel Tank - 50-gallon Diesel
* SSC - Fuel Tank - 2,000-gallon Diesel
*LF - Fuel Tank - 4,000-gallon Diesel
*Boiler TCC HVAC - 70,000 square foot building
*Boiler MIF HVAC - 140,000 square foot building
*Boiler SSC HVAC - 173,000 square foot building

- Point of Contact

Name: Dr. Karen L. Charley-Barnes
Title: Senior Project Manager
Organization: KFS, LLC
Email: barnesk@kfs-llc.com
Phone Number: 256-713-1646

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Some existing facilities would be used, along with the construction of several new facilities
3.	Personnel	Construction Workers
4.	Personnel	Operations
5.	Emergency Generator	Mission Integration Facility (MIF)
6.	Emergency Generator	Software Sustainment Center
7.	Tanks	Mission Integration Facility (MIF)
8.	Tanks	Software Sustainment Center
9.	Heating	Training and Collaboration Center (TACC)
10.	Heating	Mission Integration Facility (MIF)
11.	Heating	Software Sustainment Center
12.	Tanks	GBSD Launch Facility (former Peacekeeper)
13.	Emergency Generator	GBSD Launch Facility (Former Peacekeeper)

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location

County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Some existing facilities would be used, along with the construction of several new facilities

- Activity Description:

Proposed facilities to be located within the designated GBSD Test Program campus at HAFB. These facilities would consist primarily of office and administrative space; laboratory areas and workrooms; high bays for missile hardware fitting, testing, and assembly; training classrooms; and equipment storage.

At HAFB, construction and modification of proposed GBSD facilities would begin in fiscal year (FY) 2021 with planned completion of all facilities by FY 2024. Temporary site preparation and construction activities are expected to require up to approximately 100 workers on site. Workers would be expected to have or find housing and related amenities/services in the local communities.

- Activity Start Date

Start Month: 10
Start Month: 2021

- Activity End Date

Indefinite: False
End Month: 8

End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	3.006734
SO_x	0.018661
NO_x	7.137807
CO	6.491866
PM 10	11.466012

Pollutant	Total Emissions (TONs)
PM 2.5	0.278569
Pb	0.000000
NH_3	0.016932
CO_2e	1912.6

2.1 Demolition Phase

2.1.1 Demolition Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2021

- Phase Duration
Number of Month: 1
Number of Days: 0

2.1.2 Demolition Phase Assumptions

- General Demolition Information
Area of Building to be demolished (ft^2): 23293
Height of Building to be demolished (ft): 0

- Default Settings Used: Yes

- Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Concrete/Industrial Saws Composite	1	8
Rubber Tired Dozers Composite	1	1
Tractors/Loaders/Backhoes Composite	2	6

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Demolition Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Concrete/Industrial Saws Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0443	0.0006	0.3176	0.3761	0.0170	0.0170	0.0040	58.563
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.1.4 Demolition Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (0.00042 * BA * BH) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
0.00042: Emission Factor (lb/ft^3)
BA: Area of Building to be demolished (ft^2)
BH: Height of Building to be demolished (ft)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (1 / 27) * 0.25 * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building being demolish (ft^2)
BH: Height of Building being demolish (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards ($1\ yd^3 / 27\ ft^3$)
0.25: Volume reduction factor (material reduced by 75% to account for air space)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.2 Site Grading Phase

2.2.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2021

- Phase Duration
Number of Month: 1
Number of Days: 0

2.2.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 1105404
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	1	8
Graders Composite	1	8
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	8
Scrapers Composite	3	8
Tractors/Loaders/Backhoes Composite	3	8

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.2.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0687	0.0013	0.3576	0.5112	0.0158	0.0158	0.0062	119.73
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.2.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)

1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.3 Trenching/Excavating Phase

2.3.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 11
Start Quarter: 1
Start Year: 2021

- Phase Duration
Number of Month: 3
Number of Days: 0

2.3.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 6182
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.3.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0687	0.0013	0.3576	0.5112	0.0158	0.0158	0.0062	119.73
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.3.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)

2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.4 Building Construction Phase

2.4.1 Building Construction Phase Timeline Assumptions

- Phase Start Date

Start Month: 2
Start Quarter: 1
Start Year: 2022

- Phase Duration

Number of Month: 24
Number of Days: 0

2.4.2 Building Construction Phase Assumptions

- General Building Construction Information

Building Category: Office or Industrial

Area of Building (ft^2): 170800
Height of Building (ft): 160
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	6
Forklifts Composite	2	6
Generator Sets Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8
Welders Composite	3	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.4.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0797	0.0013	0.5505	0.3821	0.0203	0.0203	0.0071	128.81
Forklifts Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0274	0.0006	0.1265	0.2146	0.0043	0.0043	0.0024	54.457
Generator Sets Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0340	0.0006	0.2783	0.2694	0.0116	0.0116	0.0030	61.069
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	0.0034	66.884
Welders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0260	0.0003	0.1557	0.1772	0.0077	0.0077	0.0023	25.661

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.4.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)

VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase

$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.5 Architectural Coatings Phase

2.5.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 3
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 2
Number of Days: 0

2.5.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 170800
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.5.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.5.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase

$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase

$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

2.6 Paving Phase

2.6.1 Paving Phase Timeline Assumptions

- Phase Start Date

Start Month: 6
Start Quarter: 1
Start Year: 2024

- Phase Duration

Number of Month: 3
Number of Days: 0

2.6.2 Paving Phase Assumptions

- General Paving Information
Paving Area (ft^2): 131173

- Paving Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	4	6
Pavers Composite	1	7
Paving Equipment Composite	2	6
Rollers Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.6.3 Paving Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0687	0.0013	0.3576	0.5112	0.0158	0.0158	0.0062	119.73
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.6.4 Paving Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = PA * 0.25 * (1 / 27) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
PA: Paving Area (ft^2)
0.25: Thickness of Paving Area (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards (1 yd^3 / 27 ft^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_P = (2.62 * PA) / 43560$

VOC_P: Paving VOC Emissions (TONs)
2.62: Emission Factor (lb/acre)
PA: Paving Area (ft^2)
43560: Conversion Factor square feet to acre (43560 ft2 / $acre)^2$ / acre)

3. Personnel

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Construction Workers

- Activity Description:
Temporary site preparation and construction activities are expected to require up to approximately 100 workers on site. Workers would be expected to have or find housing and related amenities/services in the local communities.

- Activity Start Date
Start Month: 2
Start Year: 2022

- Activity End Date
Indefinite: No
End Month: 2
End Year: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.915471
SO_x	0.006274
NO_x	0.809227
CO	10.390537
PM 10	0.025275

Pollutant	Total Emissions (TONs)
PM 2.5	0.022751
Pb	0.000000
NH_3	0.057661
CO_2e	925.9

3.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 0
Civilian Personnel: 0
Support Contractor Personnel: 200
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week (default)
Civilian Personnel:	5 Days Per Week (default)
Support Contractor Personnel:	5 Days Per Week (default)
Air National Guard (ANG) Personnel:	4 Days Per Week (default)
Reserve Personnel:	4 Days Per Month (default)

3.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

3.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

3.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)

VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Operations

- Activity Description:
Once all facilities are completed and usable, up to approximately 1,660 personnel would work at the campus throughout the approximate 10-year test program. This would include approximately 820 new personnel brought in from outside HAFB. The remaining approximate 840 personnel would relocate from other areas of the installation. All new military personnel, government civilians, and contractors working at the campus would be expected to have or find housing and related amenities/services in the local communities.

- Activity Start Date
Start Month: 9
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	18.166597
SO_x	0.124502
NO_x	16.058306
CO	206.189825
PM 10	0.501560

Pollutant	Total Emissions (TONs)
PM 2.5	0.451470
Pb	0.000000
NH_3	1.144231
CO_2e	18372.9

4.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 0
Civilian Personnel: 820
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week (default)
Civilian Personnel:	5 Days Per Week (default)
Support Contractor Personnel:	5 Days Per Week (default)
Air National Guard (ANG) Personnel:	4 Days Per Week (default)
Reserve Personnel:	4 Days Per Month (default)

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Emergency Generator

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Mission Integration Facility (MIF)

- Activity Description:
For GBSD, three 60 kilowatt (kW) fixed diesel generators, each with a 250-gallon fuel tank, would be added. For the program to use portions of the building, expectations are that internal build-outs and modifications (e.g., walls, electrical, raised floors, HVAC) would be needed.

- Activity Start Date
Start Month: 10
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.342507
SO_x	0.288492
NO_x	1.411769
CO	0.942816
PM 10	0.308134

Pollutant	Total Emissions (TONs)
PM 2.5	0.308134
Pb	0.000000
NH_3	0.000000
CO_2e	163.3

5.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 3

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 80.5

Average Operating Hours Per Year (hours): 100

5.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

5.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

6. Emergency Generator

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Software Sustainment Center

- Activity Description:

For GBSD, a 1.5 MW fixed diesel generator with a 2,000-gallon fuel tank would be added for backup power and placed in a sound suppression enclosure.

- Activity Start Date

Start Month: 10
Start Year: 2024

- Activity End Date

Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.732301
SO_x	0.012785
NO_x	26.489657
CO	7.036635
PM 10	0.827418

Pollutant	Total Emissions (TONs)
PM 2.5	0.827418
Pb	0.000000
NH_3	0.000000
CO_2e	1360.3

6.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 2012
Average Operating Hours Per Year (hours): 100

6.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809			1.33

6.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

7. Tanks

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Weber; Davis
Regulatory Area(s): Salt Lake City, UT; Ogden, UT; Northern Wasatch Front, UT

- Activity Title: Mission Integration Facility (MIF)

- Activity Description:
For GBSD, three 60 kilowatt (kW) fixed diesel generators, each with a 250-gallon fuel tank,

- Activity Start Date
Start Month: 10
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000454
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

7.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Vertical Tank
Tank Height (ft): 2
Tank Diameter (ft): 5
Annual Net Throughput (gallon/year): 50

7.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * H / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
H: Tank Height (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

8. Tanks

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Weber; Davis
Regulatory Area(s): Salt Lake City, UT; Ogden, UT; Northern Wasatch Front, UT

- Activity Title: Software Sustainment Center

- Activity Description:

For GBSD, a 1.5 MW fixed diesel generator with a 2,000-gallon fuel tank

- Activity Start Date

Start Month: 10
Start Year: 2024

- Activity End Date

Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.003940
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

8.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Vertical Tank
Tank Height (ft): 12
Tank Diameter (ft): 5
Annual Net Throughput (gallon/year): 2000

8.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * H / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
H: Tank Height (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

9. Heating

9.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Training and Collaboration Center (TACC)

- Activity Description:

An HVAC system for the building would include a boiler.

- Activity Start Date

Start Month: 10
Start Year: 2024

- Activity End Date

Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.034363
SO_x	7.422480
NO_x	3.436333
CO	0.859083
PM 10	0.171817

Pollutant	Total Emissions (TONs)
PM 2.5	0.042954
Pb	0.000000
NH_3	0.000000
CO_2e	3879.4

9.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 70000
Type of fuel: Fuel Oil No. 2
Type of boiler/furnace: Industrial (10 - 250 MMBtu/hr)
Heat Value (MMBtu/gal): 0.14
Energy Intensity (MMBtu/ft^2): 0.0676

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

9.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000 gal)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.2	43.2	20	5	1	0.25			22579

9.4 Heating Formula(s)

- Heating Fuel Consumption gallons per Year
$FC_{HER} = HA * EI / HV / 1000$

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBtu/gal)
1000: Conversion Factor

- Heating Emissions per Year
$HE_{POL} = FC * EF_{POL} / 2000$

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

10. Heating

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Weber; Davis
Regulatory Area(s): Salt Lake City, UT; Ogden, UT; Northern Wasatch Front, UT

- Activity Title: Mission Integration Facility (MIF)

- Activity Description:
An HVAC system for the building would include a boiler

- Activity Start Date
Start Month: 10
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.084078
SO_x	18.160920
NO_x	8.407833
CO	2.101958
PM 10	0.420392

Pollutant	Total Emissions (TONs)
PM 2.5	0.105098
Pb	0.000000
NH_3	0.000000
CO_2e	9492.0

10.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 140000
Type of fuel: Fuel Oil No. 2
Type of boiler/furnace: Industrial (10 - 250 MMBtu/hr)
Heat Value (MMBtu/gal): 0.14
Energy Intensity ($MMBtu/ft^2$): 0.0827

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

10.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000 gal)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.2	43.2	20	5	1	0.25			22579

10.4 Heating Formula(s)

- Heating Fuel Consumption gallons per Year

FC_{HER}= HA * EI / HV / 1000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement ($MMBtu/ft^2$)
HV: Heat Value (MMBtu/gal)
1000: Conversion Factor

- Heating Emissions per Year

HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

11. Heating

11.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: Software Sustainment Center

- Activity Description:

expectations are that internal build-outs and modifications (e.g., walls; electrical; raised floors; HVAC) would be needed.

- Activity Start Date

Start Month: 10
Start Year: 2024

- Activity End Date

Indefinite: No
End Month: 11
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.103897
SO_x	22.441708
NO_x	10.389680
CO	2.597420
PM 10	0.519484

Pollutant	Total Emissions (TONs)
PM 2.5	0.129871
Pb	0.000000
NH_3	0.000000
CO_2e	11729.4

11.2 Heating Assumptions

- Heating
Heating Calculation Type: Heat Energy Requirement Method

- Heat Energy Requirement Method
Area of floorspace to be heated (ft^2): 173000
Type of fuel: Fuel Oil No. 2
Type of boiler/furnace: Industrial (10 - 250 MMBtu/hr)
Heat Value (MMBtu/gal): 0.14
Energy Intensity (MMBtu/ft^2): 0.0827

- Default Settings Used: Yes

- Boiler/Furnace Usage
Operating Time Per Year (hours): 900 (default)

11.3 Heating Emission Factor(s)

- Heating Emission Factors (lb/1000 gal)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.2	43.2	20	5	1	0.25			22579

11.4 Heating Formula(s)

- Heating Fuel Consumption gallons per Year
$FC_{HER} = HA * EI / HV / 1000$

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBtu/gal)
1000: Conversion Factor

- Heating Emissions per Year
$HE_{POL} = FC * EF_{POL} / 2000$

HE_{POL}: Heating Emission Emissions (TONs)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

12. Tanks

12.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: GBSD Launch Facility (former Peacekeeper)

- Activity Description:
GBSD Launch Facility (former Peacekeeper)
Diesel
4,000-gallons

- Activity Start Date
Start Month: 10
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.007740
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

12.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 24
Tank Diameter (ft): 5
Annual Net Throughput (gallon/year): 4000

12.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

$NT = (7.48 * ANT) / ((PI / 4.0) * D * L)$

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

$WLSF = (18 + NT) / (6 * NT)$

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

$WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000$

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

13. Emergency Generator

13.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

- Activity Title: GBSD Launch Facility (Former Peacekeeper)

- Activity Description:
GBSD Launch Facility (Former Peacekeeper)
Diesel
250kW
335 hp

- Activity Start Date
Start Month: 10
Start Year: 2024

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2034

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.934650
SO_x	0.787250
NO_x	3.852500
CO	2.572800
PM 10	0.840850

Pollutant	Total Emissions (TONs)
PM 2.5	0.840850
Pb	0.000000
NH_3	0.000000
CO_2e	445.6

13.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 335
Average Operating Hours Per Year (hours): 200

13.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

13.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF CONFORMITY ANALYSIS (ROCA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:

Base: HILL AFB
State: Utah
County(s): Davis; Weber
Regulatory Area(s): Salt Lake City, UT; Northern Wasatch Front, UT; Ogden, UT

b. Action Title: PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (EA)/OVERSEAS ENVIRONMENTAL ASSESSMENT (OEA) FOR GROUND-BASED STRATEGIC DETERRENT (GBSD) TEST

c. Project Number/s (if applicable): W9113M-19-F-2215

d. Projected Action Start Date: 10 / 2021

e. Action Description:

The proposed approximate 22.9-acre campus, including new and existing facilities, would be located near the west side of the installation beside some of the existing Minuteman III support facilities and adjacent to other properties planned for redevelopment as part of the Falcon Hill Enhanced Use Lease.

*Training and Collaboration Center (TACC): ≈70,000 The new building would be no taller than 80 feet. [6 story building].
*Parking Structure: Construct a new approximate 560-stall, multi-level parking structure.
*Demolition: Prior to new facility construction, less than 1 acre of existing paved parking area would require demolition.
*Site Grading: Proposed Campus Area and Widening of Roadway (Georgia Street and Jonquil Lane adjacent to the building sites).
*Trenching: Extend underground electrical, communication, and water/sewer lines to each new building. Install outdoor lighting systems for streets and parking areas.
*Architectural Coating: Training and Collaboration Center (TACC) and Parking Structure.
*Paving: Surface Parking and Roadways.
-200 construction worker
*Operations: 1,660 personnel (840 new personnel)
*Back-up Generator MIF: 3-60kW (0.06MW)
*Back-up Generator SSC: 1- 1500 kW
*Back-up Generator - GBSD Launch Facility (Former Peacekeeper)
* MIF - Fuel Tank - 50 gallon Diesel
* SSC - Fuel Tank - 2,000 gallon Diesel
*LF - Fuel Tank - 4,000 gallon Diesel
*Boiler TCC HVAC - 70,000 square foot building
*Boiler MIF HVAC - 140,000 square foot building
*Boiler SSC HVAC - 173,000 square foot building

f. Point of Contact:

Name: Dr. Karen L. Charley-Barnes
Title: Senior Project Manager
Organization: KFS, LLC
Email: barnesk@kfs-llc.com
Phone Number: 256-713-1646

2. Analysis: Total combined direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions. General Conformity under the Clean Air Act, Section 1.76 has been evaluated for the action described above according to the requirements of 40 CFR 93, Subpart B.

Based on the analysis, the requirements of this rule are: _____ applicable
__X__ not applicable

Conformity Analysis Summary:

2021

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	0.156	70	No
NOx	0.964	70	No
CO	0.944		
SOx	0.002	70	No
PM 10	11.160		
PM 2.5	0.040	70	No
Pb	0.000		
NH3	0.000	70	No
CO2e	239.9		
Northern Wasatch Front, UT			
VOC	0.156	100	No
NOx	0.964	100	No
CO	0.944		
SOx	0.002		
PM 10	11.160		
PM 2.5	0.040		
Pb	0.000		
NH3	0.000		
CO2e	239.9		
Ogden, UT			
VOC	0.156		
NOx	0.964		
CO	0.944	100	No
SOx	0.002		
PM 10	11.160	100	No
PM 2.5	0.040		
Pb	0.000		
NH3	0.000		
CO2e	239.9		
Northern Wasatch Front, UT			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000		

SOx	0.000		
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		

2022

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	0.784	70	No
NOx	3.100	70	No
CO	7.003		
SOx	0.010	70	No
PM 10	0.179		
PM 2.5	0.114	70	No
Pb	0.000		
NH3	0.033	70	No
CO2e	1162.6		
Northern Wasatch Front, UT			
VOC	0.784	100	No
NOx	3.100	100	No
CO	7.003		
SOx	0.010		
PM 10	0.179		
PM 2.5	0.114		
Pb	0.000		
NH3	0.033		
CO2e	1162.6		
Ogden, UT			
VOC	0.784		
NOx	3.100		
CO	7.003	100	No
SOx	0.010		
PM 10	0.179	100	No
PM 2.5	0.114		
Pb	0.000		
NH3	0.033		
CO2e	1162.6		
Northern Wasatch Front, UT			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000		
SOx	0.000		
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		

2023

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	0.829	70	No
NOx	3.234	70	No
CO	7.456		
SOx	0.011	70	No
PM 10	0.122		
PM 2.5	0.118	70	No
Pb	0.000		
NH3	0.036	70	No
CO2e	1223.9		
Northern Wasatch Front, UT			
VOC	0.829	100	No
NOx	3.234	100	No
CO	7.456		
SOx	0.011		
PM 10	0.122		
PM 2.5	0.118		
Pb	0.000		
NH3	0.036		
CO2e	1223.9		
Ogden, UT			
VOC	0.829		
NOx	3.234		
CO	7.456	100	No
SOx	0.011		
PM 10	0.122	100	No
PM 2.5	0.118		
Pb	0.000		
NH3	0.036		
CO2e	1223.9		
Northern Wasatch Front, UT			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000		
SOx	0.000		
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		

2024

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.809	70	No
NOx	2.509	70	No
CO	8.693		
SOx	1.214	70	No
PM 10	0.123		
PM 2.5	0.100	70	No
Pb	0.000		
NH3	0.043	70	No
CO2e	1485.3		
Northern Wasatch Front, UT			
VOC	2.807	100	No
NOx	2.302	100	No
CO	8.641		
SOx	0.767		
PM 10	0.113		
PM 2.5	0.098		
Pb	0.000		
NH3	0.043		
CO2e	1251.9		
Ogden, UT			
VOC	2.809		
NOx	2.509		
CO	8.693	100	No
SOx	1.214		
PM 10	0.123	100	No
PM 2.5	0.100		
Pb	0.000		
NH3	0.043		
CO2e	1485.3		
Northern Wasatch Front, UT			
VOC	0.002	100	No
NOx	0.207	100	No
CO	0.052		
SOx	0.447		
PM 10	0.010		
PM 2.5	0.003		
Pb	0.000		
NH3	0.000		
CO2e	233.4		

2025

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2026

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2027

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2028

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2029

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2030

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2031

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2032

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2033

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	2.024	70	No
NOx	6.909	70	No
CO	22.037		
SOx	4.844	70	No
PM 10	0.355		
PM 2.5	0.268	70	No
Pb	0.000		
NH3	0.113	70	No
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	2.015	100	No
NOx	6.082	100	No
CO	21.831		
SOx	3.058		
PM 10	0.314		
PM 2.5	0.258		
Pb	0.000		
NH3	0.113		
CO2e	3551.8		
Ogden, UT			
VOC	2.024		
NOx	6.909		
CO	22.037	100	No
SOx	4.844		
PM 10	0.355	100	No
PM 2.5	0.268		
Pb	0.000		
NH3	0.113		
CO2e	4485.5		
Northern Wasatch Front, UT			
VOC	0.009	100	No
NOx	0.827	100	No
CO	0.207		
SOx	1.786		
PM 10	0.041		
PM 2.5	0.010		
Pb	0.000		
NH3	0.000		
CO2e	933.6		

2034

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	1.539	70	No
NOx	6.004	70	No
CO	16.750		
SOx	4.426	70	No
PM 10	0.303		
PM 2.5	0.224	70	No
Pb	0.000		
NH3	0.085	70	No
CO2e	3800.6		
Northern Wasatch Front, UT			
VOC	1.531	100	No
NOx	5.246	100	No
CO	16.561		
SOx	2.788		
PM 10	0.265		
PM 2.5	0.215		
Pb	0.000		
NH3	0.085		
CO2e	2944.7		
Ogden, UT			
VOC	1.539		
NOx	6.004		
CO	16.750	100	No
SOx	4.426		
PM 10	0.303	100	No
PM 2.5	0.224		
Pb	0.000		
NH3	0.085		
CO2e	3800.6		
Northern Wasatch Front, UT			
VOC	0.008	100	No
NOx	0.758	100	No
CO	0.190		
SOx	1.637		
PM 10	0.038		
PM 2.5	0.009		
Pb	0.000		
NH3	0.000		
CO2e	855.8		

2035 - (Steady State)

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Salt Lake City, UT			
VOC	0.000	70	No
NOx	0.000	70	No
CO	0.000		
SOx	0.000	70	No
PM 10	0.000		
PM 2.5	0.000	70	No
Pb	0.000		
NH3	0.000	70	No
CO2e	0.0		
Northern Wasatch Front, UT			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000		
SOx	0.000		
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		
Ogden, UT			
VOC	0.000		
NOx	0.000		
CO	0.000	100	No
SOx	0.000		
PM 10	0.000	100	No
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		
Northern Wasatch Front, UT			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000		
SOx	0.000		
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		

None of estimated emissions associated with this action are above the conformity threshold values established at 40 CFR 93.153 (b); Therefore, the requirements of the General Conformity Rule are not applicable.

_____ _____

Dr. Karen L. Charley-Barnes, Senior Project Manager DATE

A.2 VSFB

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location

Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (EA)/OVERSEAS ENVIRONMENTAL ASSESSMENT (OEA) FOR GROUND-BASED STRATEGIC DETERRENT (GBSD) TEST

- Project Number/s (if applicable): W9113M-19-F-2215

- Projected Action Start Date: 10 / 2021

- Action Purpose and Need:

At VAFB, a combination of new and existing facilities would be used in support of the GBSD Test Program, primarily for missile flight testing. Existing test launch facilities to be used are located towards the northern end of the installation. Most other new and existing facilities proposed for the program would be located within or near the Main Cantonment Area. Nearly all of the proposed GBSD facilities would be located in proximity to existing Minuteman III flight test and system support facilities.

- Action Description:

The new and existing facilities that would support the GBSD Test Program at VAFB. Also included are temporary construction laydown (staging) areas and access roads. The new GBSD facilities would consist of two LFs; a launch pad; a MAF for launch control; office and administrative space; laboratory areas and workrooms; training facilities; high bays for missile hardware fitting, testing, and integration; and storage for boosters, the PRS, other ordnance, and other equipment. All of the facility and construction areas. Existing facilities would require some level of restoration, reconstruction, or modifications.

- Point of Contact

Name: Dr. Karen L. Charley-Barnes
Title: Senior Project Manager - NEPA
Organization: KFS, LLC
Email: barnesk@kfs-llc.com
Phone Number: 256-713-1646

- Activity List:

	Activity Type	Activity Title
2.	Construction / Demolition	New facilities in support of the GBSD Test Program at VAFB.
3.	Personnel	Construction Workers
4.	Personnel	new personnel - 260
5.	Emergency Generator	VAFB - LF-04 (2 Generators)
6.	Emergency Generator	VAFB - LF-26 (2 Generators)
7.	Emergency Generator	GBSD Temporary Contractor Test Support Facilities (Building 8337)
8.	Emergency Generator	GBSD Temporary Contractor Test Support Facilities (Building 8339)
9.	Tanks	LF-04 Diesel 192-gallons 5 ft x 3 ft(Underground) - 2 tanks
10.	Tanks	LF-26 Diesel 192-gallons 5 x 3 (Underground)
11.	Tanks	LC-A Diesel (5) 10,000-gallons) 8 x 27 (Underground)
12.	Tanks	GBSD Temporary Contractor Test Support Facilities (Building 8337) Diesel 60-gallon 1 x 2 (Aboveground

13.	Tanks	GBSD Temporary Contractor Test Support Facilities (Building 8339) Diesel 60-gallon 1 x 2 (Above ground
14.	Personnel	FTU - 17 Instructors
15.	Personnel	FTU Students - 140
16.	Emergency Generator	Building 1900
17.	Tanks	Building 1900
18.	Emergency Generator	MAF-D0/VLC
19.	Emergency Generator	MAF D-0/VLC Generator (60kW)
20.	Tanks	MAF D-0/VLC Fuel Tank (96 gallons)
21.	Tanks	MAF D-0/VLC Fuel Tank (336 gallons)

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: New facilities in support of the GBSD Test Program at VAFB.

- Activity Description:
Existing test launch facilities to be used are located towards the northern end of the installation. Most other new and existing facilities proposed for the program would be located within or near the Main Cantonment Area. Nearly all of the proposed GBSD facilities would be located in proximity to existing Minuteman III flight test and system support facilities.

*Construct/Modification: MAF-01, Consolidated Maintenance Facility, RA/RV Booster Stage Processing Facility, GBSD Schoolhouse, Building 1800, 1860/1861.
*Site Grading:
*Trenching: Utility Corridor
*Architectural Coating
*Paving
*Construction workers and permanent personnel

- Activity Start Date
Start Month: 10
Start Month: 2021

- Activity End Date
Indefinite: False
End Month: 5
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	7.554517
SO_x	0.026907
NO_x	9.588727
CO	10.614978
PM 10	92.890972

Pollutant	Total Emissions (TONs)
PM 2.5	0.390399
Pb	0.000000
NH_3	0.006996
CO_2e	2592.3

2.1 Site Grading Phase

2.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2021

- Phase Duration
Number of Month: 2
Number of Days: 0

2.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 4447256
Amount of Material to be Hauled On-Site (yd^3): 1715
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: No
Average Day(s) worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	2	8
Other Construction Equipment Composite	2	8
Rollers Composite	1	8
Rubber Tired Dozers Composite	3	8
Scrapers Composite	6	8
Tractors/Loaders/Backhoes Composite	2	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 12
Average Hauling Truck Round Trip Commute (mile): 15

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour)

Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93

Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rollers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0539	0.0007	0.3483	0.3816	0.0205	0.0205	0.0048	67.160
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)

HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.2 Trenching/Excavating Phase

2.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2021

- Phase Duration
Number of Month: 3
Number of Days: 0

2.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 134260
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rollers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0539	0.0007	0.3483	0.3816	0.0205	0.0205	0.0048	67.160
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$
V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.3 Building Construction Phase

2.3.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2022

- Phase Duration
Number of Month: 36
Number of Days: 0

2.3.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 512300
Height of Building (ft): 4
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	7
Forklifts Composite	3	8
Generator Sets Composite	1	8
Tractors/Loaders/Backhoes Composite	3	7
Welders Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

2.3.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0797	0.0013	0.5505	0.3821	0.0203	0.0203	0.0071	128.81
Forklifts Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0274	0.0006	0.1265	0.2146	0.0043	0.0043	0.0024	54.457
Generator Sets Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0340	0.0006	0.2783	0.2694	0.0116	0.0116	0.0030	61.069
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	0.0034	66.884
Welders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0260	0.0003	0.1557	0.1772	0.0077	0.0077	0.0023	25.661

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.3.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase

$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

2.4 Architectural Coatings Phase

2.4.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date

Start Month: 2
Start Quarter: 1
Start Year: 2025

- Phase Duration

Number of Month: 3
Number of Days: 0

2.4.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information

Building Category: Non-Residential
Total Square Footage (ft^2): 513300
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.4.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.4.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

2.5 Paving Phase

2.5.1 Paving Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2025

- Phase Duration
Number of Month: 4
Number of Days: 0

2.5.2 Paving Phase Assumptions

- General Paving Information
Paving Area (ft^2): 1618636

- Paving Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Pavers Composite	1	8
Paving Equipment Composite	2	8
Rollers Composite	2	6

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.5.3 Paving Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0860	0.0014	0.5212	0.5747	0.0247	0.0247	0.0077	132.93
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0533	0.0012	0.3119	0.3497	0.0121	0.0121	0.0048	122.61
Rollers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0539	0.0007	0.3483	0.3816	0.0205	0.0205	0.0048	67.160

Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.2015	0.0024	1.4660	0.7661	0.0581	0.0581	0.0181	239.53
Scrapers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1814	0.0026	1.2262	0.7745	0.0491	0.0491	0.0163	262.89
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0407	0.0007	0.2505	0.3606	0.0112	0.0112	0.0036	66.890

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

2.5.4 Paving Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = PA * 0.25 * (1 / 27) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
PA: Paving Area (ft^2)
0.25: Thickness of Paving Area (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards (1 yd^3 / 27 ft^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_P = (2.62 * PA) / 43560$

VOC_P: Paving VOC Emissions (TONs)
2.62: Emission Factor (lb/acre)
PA: Paving Area (ft^2)
43560: Conversion Factor square feet to acre (43560 ft2 / acre)^2 / acre)

3. Personnel

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Construction Workers

- Activity Description:
At VAFB, construction and modification of proposed GBSD facilities would begin in FY 2021 with planned completion of all facilities by FY 2025. Temporary site preparation and construction activities are expected to require up to approximately 100 workers on the installation. Workers would be expected to have or find housing and related amenities/services in the local communities.

- Activity Start Date
Start Month: 1
Start Year: 2022

- Activity End Date
Indefinite: No
End Month: 8
End Year: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	1.266778
SO_x	0.015069
NO_x	0.688661
CO	8.216623
PM 10	0.198460

Pollutant	Total Emissions (TONs)
PM 2.5	0.086278
Pb	0.000000
NH_3	0.101564
CO_2e	1451.4

3.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel: 0
Civilian Personnel: 0
Support Contractor Personnel: 200
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

3.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

3.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

3.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year
$VMT_{Total} = VMT_{AD} + VMT_{C} + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_{C}: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: new personnel - 260

- Activity Description:
Once all facilities are completed and usable, approximately 260 new personnel would work on site throughout the approximate 10-year test program. All military personnel, government civilians, and contractors working at the installation would be expected to have or find housing and related amenities/services in the local communities.

- Activity Start Date
Start Month: 9
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	4.528730
SO_x	0.053871
NO_x	2.461963
CO	29.374428
PM 10	0.709493

Pollutant	Total Emissions (TONs)
PM 2.5	0.308443
Pb	0.000000
NH_3	0.363091
CO_2e	5188.9

4.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel:	0
Civilian Personnel:	260
Support Contractor Personnel:	0
Air National Guard (ANG) Personnel:	0
Reserve Personnel:	0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week (default)
Civilian Personnel:	5 Days Per Week (default)
Support Contractor Personnel:	5 Days Per Week (default)
Air National Guard (ANG) Personnel:	4 Days Per Week (default)
Reserve Personnel:	4 Days Per Month (default)

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)

VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Emergency Generator

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: VAFB - LF-04 (2 Generators)

- Activity Description:
VAFB - LF-04

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.590085
SO_x	0.497025
NO_x	2.432250
CO	1.624320
PM 10	0.530865

Pollutant	Total Emissions (TONs)
PM 2.5	0.530865
Pb	0.000000
NH_3	0.000000
CO_2e	281.3

5.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 2

- Default Settings Used: No

- Emergency Generators Consumption

Emergency Generator's Horsepower: 141
Average Operating Hours Per Year (hours): 150

5.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

5.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

6. Emergency Generator

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: VAFB - LF-26 (2 Generators)

- Activity Description:

VAFB - LF-26

- Activity Start Date

Start Month: 10
Start Year: 2025

- Activity End Date

Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.590085
SO_x	0.497025
NO_x	2.432250
CO	1.624320
PM 10	0.530865

Pollutant	Total Emissions (TONs)
PM 2.5	0.530865
Pb	0.000000
NH_3	0.000000
CO_2e	281.3

6.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 2

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 141
Average Operating Hours Per Year (hours): 150

6.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

6.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

7. Emergency Generator

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: GBSD Temporary Contractor Test Support Facilities (Building 8337)

- Activity Description:
GBSD Temporary Contractor Test Support Facilities (Building 8337)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.280395
SO_x	0.236175
NO_x	1.155750
CO	0.771840
PM 10	0.252255

Pollutant	Total Emissions (TONs)
PM 2.5	0.252255
Pb	0.000000
NH_3	0.000000
CO_2e	133.7

7.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 268
Average Operating Hours Per Year (hours): 75

7.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

7.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

8. Emergency Generator

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: GBSD Temporary Contractor Test Support Facilities (Building 8339)

- Activity Description:
GBSD Temporary Contractor Test Support Facilities (Building 8339)

- Activity Start Date
Start Month: 10

Start Year: 2025

- Activity End Date

Indefinite: No

End Month: 9

End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.560790
SO_x	0.472350
NO_x	2.311500
CO	1.543680
PM 10	0.504510

Pollutant	Total Emissions (TONs)
PM 2.5	0.504510
Pb	0.000000
NH_3	0.000000
CO_2e	267.3

8.2 Emergency Generator Assumptions

- Emergency Generator

Type of Fuel used in Emergency Generator: Diesel

Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption

Emergency Generator's Horsepower: 536

Average Operating Hours Per Year (hours): 75

8.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

8.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

9. Tanks

9.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Santa Barbara

Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: LF-04 Diesel 192-gallons 5 ft x 3 ft(Underground) - 2 tanks

- Activity Description:
LF-04 Diesel 192-gallons 5 ft x 3ft (Underground) - 2 tanks

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000514
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

9.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 5
Tank Diameter (ft): 3
Annual Net Throughput (gallon/year): 192

9.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor
$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

10. Tanks

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: LF-26 Diesel 192-gallons 5 x 3 (Underground)

- Activity Description:

LF-26 Diesel 192-gallons 5 x 3 (Underground)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000514
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

10.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 5
Tank Diameter (ft): 3
Annual Net Throughput (gallon/year): 192

10.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor
$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year
$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year
NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year
WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year
WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

11. Tanks

11.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: LC-A Diesel (5) 10,000-gallons) 8 x 27 (Underground)

- Activity Description:
LC-A Diesel (5) 10,000-gallons) 8 x 27 (Underground)

- Activity Start Date
Start Month: 10

Start Year: 2025

- Activity End Date

Indefinite: No

End Month: 9

End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.021043
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

11.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2

Chemical Category: Petroleum Distillates

Chemical Density: 7.1

Vapor Molecular Weight (lb/lb-mole): 130

Stock Vapor Density (lb/ft^3): 0.000129553551395334

Vapor Pressure: 0.0055

Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Horizontal Tank

Tank Length (ft): 27

Tank Diameter (ft): 8

Annual Net Throughput (gallon/year): 10000

11.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)

SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year
NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year
WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year
WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

12. Tanks

12.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: GBSD Temporary Contractor Test Support Facilities (Building 8337) Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Description:
GBSD Temporary Contractor Test Support Facilities (Building 8337) Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date

Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000061
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

12.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Horizontal Tank
Tank Length (ft): 2
Tank Diameter (ft): 1
Annual Net Throughput (gallon/year): 60

12.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)

VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year
NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year
WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year
WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

13. Tanks

13.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: GBSD Temporary Contractor Test Support Facilities (Building 8339) Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Description:
GBSD Temporary Contractor Test Support Facilities (Building 8339) Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9

End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000061
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

13.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Horizontal Tank
Tank Length (ft): 2
Tank Diameter (ft): 1
Annual Net Throughput (gallon/year): 60

13.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

14. Personnel

14.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: FTU - 17 Instructors

- Activity Description:

FTU 17 Instructors

- Activity Start Date

Start Month: 1
Start Year: 2028

- Activity End Date

Indefinite: No
End Month: 12
End Year: 2036

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.264296
SO_x	0.003144
NO_x	0.143680
CO	1.714286
PM 10	0.041406

Pollutant	Total Emissions (TONs)
PM 2.5	0.018001
Pb	0.000000
NH_3	0.021190
CO_2e	302.8

14.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel: 0
Civilian Personnel: 17
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 20

- Personnel Work Schedule

Active Duty Personnel: 5 Days Per Week
Civilian Personnel: 5 Days Per Week
Support Contractor Personnel: 5 Days Per Week
Air National Guard (ANG) Personnel: 4 Days Per Week
Reserve Personnel: 4 Days Per Month

14.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

14.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

14.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel

WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year
$VMT_{Total} = VMT_{AD} + VMT_{C} + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_{C}: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

15. Personnel

15.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: FTU Students - 140

- Activity Description:
FTU Students - 140

- Activity Start Date
Start Month: 1
Start Year: 2028

- Activity End Date
Indefinite: No
End Month: 12
End Year: 2036

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.544139
SO_x	0.006473
NO_x	0.295811
CO	3.529413
PM 10	0.085247

Pollutant	Total Emissions (TONs)
PM 2.5	0.037060
Pb	0.000000
NH_3	0.043626
CO_2e	623.5

15.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel:	0
Civilian Personnel:	140
Support Contractor Personnel:	0
Air National Guard (ANG) Personnel:	0
Reserve Personnel:	0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 5

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week
Civilian Personnel:	5 Days Per Week
Support Contractor Personnel:	5 Days Per Week
Air National Guard (ANG) Personnel:	4 Days Per Week
Reserve Personnel:	4 Days Per Month

15.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

15.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.114	000.003	000.084	000.992	000.047	000.020		000.023	00298.845
LDGT	000.288	000.004	000.178	001.871	000.048	000.021		000.024	00379.038
HDGV	000.600	000.011	001.339	008.875	000.183	000.078		000.045	01128.468
LDDV	000.026	000.003	000.125	000.281	000.060	000.032		000.008	00271.718
LDDT	000.094	000.003	000.533	000.594	000.112	000.082		000.008	00364.857
HDDV	000.194	000.014	004.796	001.133	000.211	000.117		000.028	01514.699
MC	004.452	000.002	001.252	023.791	000.019	000.009		000.054	00187.891

15.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)

VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

16. Emergency Generator

16.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 1900

- Activity Description:
Building 1900 200kW backup Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.280395
SO_x	0.236175
NO_x	1.155750
CO	0.771840
PM 10	0.252255

Pollutant	Total Emissions (TONs)
PM 2.5	0.252255
Pb	0.000000
NH_3	0.000000
CO_2e	133.7

16.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 268
Average Operating Hours Per Year (hours): 75

16.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

16.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

17. Tanks

17.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Building 1900

- Activity Description:
Diesel 60-gallon 1 x 2 (Aboveground)

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000077
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

17.2 Tanks Assumptions

- Chemical

Chemical Name:	Fuel oil no. 2
Chemical Category:	Petroleum Distillates
Chemical Density:	7.1
Vapor Molecular Weight (lb/lb-mole):	130
Stock Vapor Density (lb/ft^3):	0.000129553551395334
Vapor Pressure:	0.0055
Vapor Space Expansion Factor (dimensionless):	0.068

- Tank

Type of Tank:	Horizontal Tank
Tank Length (ft):	1
Tank Diameter (ft):	2
Annual Net Throughput (gallon/year):	60

17.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

$NT = (7.48 * ANT) / ((PI / 4.0) * D * L)$

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)

L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

18. Emergency Generator

18.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: MAF-D0/VLC

- Activity Description:

MAF-D0/VLC-- 150 hours

- Activity Start Date

Start Month: 10
Start Year: 2025

- Activity End Date

Indefinite: No
End Month: 8
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.800974
SO_x	0.674656
NO_x	3.301506
CO	2.204832
PM 10	0.720590

Pollutant	Total Emissions (TONs)
PM 2.5	0.720590
Pb	0.000000
NH_3	0.000000
CO_2e	381.8

18.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 386
Average Operating Hours Per Year (hours): 150

18.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

18.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

19. Emergency Generator

19.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: MAF D-0/VLC Generator (60kW)

- Activity Description:
MAF D-0/VLC Generator (60kW)---50 hours

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.064868
SO_x	0.054638
NO_x	0.267375
CO	0.178560
PM 10	0.058358

Pollutant	Total Emissions (TONs)
PM 2.5	0.058358
Pb	0.000000
NH_3	0.000000
CO_2e	30.9

19.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 93
Average Operating Hours Per Year (hours): 50

19.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

19.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

20. Tanks

20.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: MAF D-0/VLC Fuel Tank (96 gallons)

- Activity Description:
MAF D-0/VLC Fuel Tank (96 gallons)

- Activity Start Date
Start Month: 10

Start Year: 2025

- Activity End Date

Indefinite: No

End Month: 9

End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000333
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

20.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2

Chemical Category: Petroleum Distillates

Chemical Density: 7.1

Vapor Molecular Weight (lb/lb-mole): 130

Stock Vapor Density (lb/ft^3): 0.000129553551395334

Vapor Pressure: 0.0055

Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Vertical Tank

Tank Height (ft): 2

Tank Diameter (ft): 4

Annual Net Throughput (gallon/year): 96

20.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)

PI: PI Math Constant

D^2: Tank Diameter (ft)

H: Tank Height (ft)

2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * H / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)

0.053: Constant

VP: Vapor Pressure (psia)

H: Tank Height (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)

365: Number of Daily Events in a Year (Constant)

VSV: Vapor Space Volume (ft^3)

SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year
NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year
WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year
WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

21. Tanks

21.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: MAF D-0/VLC Fuel Tank (336 gallons)

- Activity Description:
MAF D-0/VLC Fuel Tank (336 gallons)

- Activity Start Date
Start Month: 10
Start Year: 2025
- Activity End Date
Indefinite: No
End Month: 9

End Year: 2035

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000901
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

21.2 Tanks Assumptions

- Chemical

Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank

Type of Tank: Vertical Tank
Tank Height (ft): 5
Tank Diameter (ft): 4
Annual Net Throughput (gallon/year): 336

21.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * H / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * H / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
H: Tank Height (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * H)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
H: Tank Height (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:

Base: VANDENBERG AFB
State: California
County(s): Santa Barbara
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (EA)/OVERSEAS ENVIRONMENTAL ASSESSMENT (OEA) FOR GROUND-BASED STRATEGIC DETERRENT (GBSD) TEST

c. Project Number/s (if applicable): W9113M-19-F-2215

d. Projected Action Start Date: 10 / 2021

e. Action Description:

The new and existing facilities that would support the GBSD Test Program at VAFB. Also included are temporary construction laydown (staging) areas and access roads. The new GBSD facilities would consist of two LFs; a launch pad; a MAF for launch control; office and administrative space; laboratory areas and workrooms; training facilities; high bays for missile hardware fitting, testing, and integration; and storage for boosters, the PRS, other ordnance, and other equipment. All of the facility and construction areas. Existing facilities would require some level of restoration, reconstruction, or modifications.

f. Point of Contact:

Name: Dr. Karen L. Charley-Barnes
Title: Senior Project Manager - NEPA
Organization: KFS, LLC
Email: barnesk@kfs-llc.com
Phone Number: 256-713-1646

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2021

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.441	100	No
NOx	2.892	100	No
CO	2.232	250	No
SOx	0.007	250	No
PM 10	92.609	250	No
PM 2.5	0.119	250	No
Pb	0.000	25	No
NH3	0.001	250	No
CO2e	653.1		

2022

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.686	100	No
NOx	2.229	100	No
CO	4.811	250	No
SOx	0.010	250	No
PM 10	0.138	250	No
PM 2.5	0.104	250	No
Pb	0.000	25	No
NH3	0.030	250	No
CO2e	995.9		

2023

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.686	100	No
NOx	2.229	100	No
CO	4.811	250	No
SOx	0.010	250	No
PM 10	0.138	250	No

PM 2.5	0.104	250	No
Pb	0.000	25	No
NH3	0.030	250	No
CO2e	995.9		

2024

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.686	100	No
NOx	2.229	100	No
CO	4.811	250	No
SOx	0.010	250	No
PM 10	0.138	250	No
PM 2.5	0.104	250	No
Pb	0.000	25	No
NH3	0.030	250	No
CO2e	995.9		

2025

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	6.553	100	No
NOx	1.106	100	No
CO	3.357	250	No
SOx	0.073	250	No
PM 10	0.162	250	No
PM 2.5	0.127	250	No
Pb	0.000	25	No
NH3	0.031	250	No
CO2e	612.3		

2026

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.769	100	No
NOx	1.553	100	No
CO	3.787	250	No
SOx	0.273	250	No
PM 10	0.356	250	No
PM 2.5	0.316	250	No
Pb	0.000	25	No
NH3	0.036	250	No
CO2e	665.9		

2027

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.769	100	No
NOx	1.553	100	No
CO	3.787	250	No

SOx	0.273	250	No
PM 10	0.356	250	No
PM 2.5	0.316	250	No
Pb	0.000	25	No
NH3	0.036	250	No
CO2e	665.9		

2028

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2029

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2030

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2031

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No

NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2032

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2033

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2034

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.859	100	No
NOx	1.601	100	No
CO	4.370	250	No
SOx	0.274	250	No
PM 10	0.370	250	No
PM 2.5	0.322	250	No
Pb	0.000	25	No
NH3	0.043	250	No
CO2e	768.8		

2035

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.660	100	No
NOx	1.186	100	No
CO	3.404	250	No
SOx	0.200	250	No
PM 10	0.275	250	No
PM 2.5	0.237	250	No
Pb	0.000	25	No
NH3	0.034	250	No
CO2e	599.1		

2036

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.090	100	No
NOx	0.049	100	No
CO	0.583	250	No
SOx	0.001	250	No
PM 10	0.014	250	No
PM 2.5	0.006	250	No
Pb	0.000	25	No
NH3	0.007	250	No
CO2e	102.9		

2037 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	0.000	100	No
NOx	0.000	100	No
CO	0.000	250	No
SOx	0.000	250	No
PM 10	0.000	250	No
PM 2.5	0.000	250	No
Pb	0.000	25	No
NH3	0.000	250	No
CO2e	0.0		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs. No further air assessment is needed.

Dr. Karen L. Charley-Barnes, Senior Project Manager - NEPA DATE

A.3 U.S. Army DPG

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location

Base: HILL AFB
State: Utah
County(s): Tooele
Regulatory Area(s): Tooele Co, UT

- Action Title: GBSD

- Project Number/s (if applicable):

- Projected Action Start Date: 10 / 2022

- Action Purpose and Need:

U.S. Army Dugway Proving Ground

- Action Description:

The proposed PSSTF would be a representative GBSD missile LF, built to the same physical specs as an operational LF for all topside and below grade structures down to the lower floors, but without the full underground missile silo. The steel and concrete structure would be furnished with both operational and non-operational equipment that is representative of what would be installed in a fielded LF facility, excluding the missile.

The low-lying facility would be situated on an approximate 1 to 1.5-acre site covered mostly with gravel. Much of the underground facility would be topped with a concrete pad. At most, the underground structure would extend approximately 35 feet in depth. A launch closure door mounted on rails would rest on top of the pad. The site would include several poles for lighting and security systems. Additionally, the site would be surrounded by a minimum 6-foot high chain link fence, surmounted by strands of barbed wire angled outward

- Point of Contact

Name: Dr. Karen Barnes
Title: Senior Project Manager - NEPA
Organization: KFS, LLC
Email: barnesk@KFS-LLC
Phone Number: 256-713-1646

- Activity List:

	Activity Type	Activity Title
2.	Construction / Demolition	The proposed PSSTF would be a representative GBSD missile LF
3.	Personnel	Construction Workers
4.	Personnel	Operations Personnel
5.	Emergency Generator	Operations: Generators-DPG
6.	Tanks	Operations: Fuel Tanks for Generator - DPG

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Tooele
Regulatory Area(s): Tooele Co, UT

- Activity Title: The proposed PSSTF would be a representative GBSD missile LF

- Activity Description:
The proposed PSSTF would be a representative GBSD missile LF

- Activity Start Date
Start Month: 10
Start Month: 2022

- Activity End Date
Indefinite: False
End Month: 3
End Month: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	1.577524
SO_x	0.026460
NO_x	9.347199
CO	10.625068
PM 10	138.290524

Pollutant	Total Emissions (TONs)
PM 2.5	0.382937
Pb	0.000000
NH_3	0.003508
CO_2e	2573.8

2.1 Site Grading Phase

2.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2022

- Phase Duration
Number of Month: 30
Number of Days: 0

2.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 435600
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	1	8
Graders Composite	1	8
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	8
Tractors/Loaders/Backhoes Composite	3	8

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0648	0.0013	0.3170	0.5103	0.0136	0.0136	0.0058	119.72
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	0.0072	132.92
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	0.0045	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	0.0173	239.51
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	0.0034	66.884

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

2.2 Trenching/Excavating Phase

2.2.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2022

- Phase Duration
Number of Month: 10
Number of Days: 0

2.2.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 79488
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.2.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0648	0.0013	0.3170	0.5103	0.0136	0.0136	0.0058	119.72
Graders Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	0.0072	132.92
Other Construction Equipment Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	0.0045	122.61
Rubber Tired Dozers Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	0.0173	239.51
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	0.0034	66.884

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

2.2.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)

$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

3. Personnel

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Tooele
Regulatory Area(s): Tooele Co, UT

- Activity Title: C.4 Construction Workers

- Activity Description:
C.4 Construction Workers

- Activity Start Date
Start Month: 10
Start Year: 2022
- Activity End Date
Indefinite: No
End Month: 9
End Year: 2025

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.263656
SO_x	0.001807
NO_x	0.233057
CO	2.992475
PM 10	0.007279

Pollutant	Total Emissions (TONs)
PM 2.5	0.006552
Pb	0.000000
NH_3	0.016606
CO_2e	266.7

3.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel: 0
Civilian Personnel: 40
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

3.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

3.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

3.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year

AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_{C} + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_{C}: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Personnel

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Tooele
Regulatory Area(s): Tooele Co, UT

- Activity Title: C.6 Operations Personnel

- Activity Description:
C.6 Operations Personnel

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2029

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.878852
SO_x	0.006023
NO_x	0.776858
CO	9.974916
PM 10	0.024264

Pollutant	Total Emissions (TONs)
PM 2.5	0.021841
Pb	0.000000
NH_3	0.055355
CO_2e	888.8

4.2 Personnel Assumptions

- Number of Personnel

Active Duty Personnel:	0
Civilian Personnel:	100
Support Contractor Personnel:	0
Air National Guard (ANG) Personnel:	0
Reserve Personnel:	0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule

Active Duty Personnel:	5 Days Per Week (default)
Civilian Personnel:	5 Days Per Week (default)
Support Contractor Personnel:	5 Days Per Week (default)
Air National Guard (ANG) Personnel:	4 Days Per Week (default)
Reserve Personnel:	4 Days Per Month (default)

4.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

4.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.295	000.002	000.223	003.377	000.009	000.008		000.023	00328.308
LDGT	000.367	000.003	000.395	004.664	000.011	000.010		000.024	00423.961
HDGV	000.747	000.005	001.118	016.415	000.026	000.023		000.045	00780.112
LDDV	000.122	000.003	000.135	002.483	000.004	000.004		000.008	00317.249
LDDT	000.269	000.004	000.392	004.291	000.007	000.006		000.008	00451.014
HDDV	000.455	000.013	004.925	001.651	000.170	000.157		000.028	01491.057
MC	002.659	000.003	000.839	013.635	000.029	000.025		000.053	00399.234

4.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)

VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Emergency Generator

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Tooele
Regulatory Area(s): Tooele Co, UT

- Activity Title: C.7 Operations: Generators-DPG

- Activity Description:
C.7 Operations: Generators-DPG

- Activity Start Date
Start Month: 10
Start Year: 2025

- Activity End Date
Indefinite: No
End Month: 9
End Year: 2029

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.045198
SO_x	0.038070
NO_x	0.186300
CO	0.124416
PM 10	0.040662

Pollutant	Total Emissions (TONs)
PM 2.5	0.040662
Pb	0.000000
NH_3	0.000000
CO_2e	21.5

5.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption

Emergency Generator's Horsepower: 81
Average Operating Hours Per Year (hours): 100

5.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

5.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

6. Tanks

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Tooele
Regulatory Area(s): Tooele Co, UT

- Activity Title: C.8 Operations: Fuel Tanks for Generator - DPG

- Activity Description:

C.8 Operations: Fuel Tanks for Generator - DPG

- Activity Start Date

Start Month: 10
Start Year: 2025

- Activity End Date

Indefinite: No
End Month: 9
End Year: 2029

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.000392
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Total Emissions (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

6.2 Tanks Assumptions

- Chemical

Chemical Name:	Fuel oil no. 2
Chemical Category:	Petroleum Distillates
Chemical Density:	7.1
Vapor Molecular Weight (lb/lb-mole):	130
Stock Vapor Density (lb/ft^3):	0.000129553551395334
Vapor Pressure:	0.0055
Vapor Space Expansion Factor (dimensionless):	0.068

- Tank

Type of Tank:	Horizontal Tank
Tank Length (ft):	5
Tank Diameter (ft):	4
Annual Net Throughput (gallon/year):	450

6.3 Tank Formula(s)

- Vapor Space Volume

$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Conversion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor

$VVSF = 1 / (1 + (0.053 * VP * L / 2))$

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

$NT = (7.48 * ANT) / ((PI / 4.0) * D * L)$

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF CONFORMITY ANALYSIS (ROCA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:

Base: HILL AFB (For U.S. Army Dugway Proving Grounds)
State: Utah
County(s): Tooele
Regulatory Area(s): Tooele Co, UT

b. Action Title: GBSD

c. Project Number/s (if applicable):

d. Projected Action Start Date: 10 / 2022

e. Action Description:

The proposed PSSTF would be a representative GBSD missile LF, built to the same physical specs as an operational LF for all topside and below grade structures down to the lower floors, but without the full underground missile silo. The steel and concrete structure would be furnished with both operational and non-operational equipment that is representative of what would be installed in a fielded LF facility, excluding the missile.
The low-lying facility would be situated on an approximate 1 to 1.5-acre site covered mostly with gravel. Much of the underground facility would be topped with a concrete pad. At most, the underground structure would extend approximately 35 feet in depth. A launch closure door mounted on rails would rest on top of the pad. The site would include several poles for lighting and security systems. Additionally, the site would be surrounded by a minimum 6-foot high chain link fence, surmounted by strands of barbed wire angled outward

f. Point of Contact:

Name: Dr. Karen Barnes
Title: Senior Project Manager - NEPA
Organization: KFS, LLC
Email: barnesk@KFS.LLC
Phone Number: 256-713-1646

2. Analysis: Total combined direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions. General Conformity under the Clean Air Act, Section 1.76 has been evaluated for the action described above according to the requirements of 40 CFR 93, Subpart B.

Based on the analysis, the requirements of this rule are: _____ applicable
__X__ not applicable

Conformity Analysis Summary:

2022

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.225		
NOx	1.197		
CO	1.648		
SOx	0.004	100	No
PM 10	15.421		
PM 2.5	0.049		
Pb	0.000		
NH3	0.002		
CO2e	360.9		

2023

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.787		
NOx	4.181		
CO	5.751		
SOx	0.012	100	No
PM 10	57.706		
PM 2.5	0.170		
Pb	0.000		
NH3	0.007		
CO2e	1240.4		

2024

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.628		
NOx	3.330		
CO	4.576		
SOx	0.009	100	No
PM 10	52.136		
PM 2.5	0.136		
Pb	0.000		
NH3	0.007		
CO2e	955.8		

2025

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.259		
NOx	0.932		
CO	2.274		
SOx	0.005	100	No
PM 10	13.039		
PM 2.5	0.039		
Pb	0.000		
NH3	0.008		
CO2e	340.3		

2026

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.231		
NOx	0.241		
CO	2.525		
SOx	0.011	100	No
PM 10	0.016		
PM 2.5	0.016		
Pb	0.000		
NH3	0.014		
CO2e	227.6		

2027

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.231		
NOx	0.241		
CO	2.525		
SOx	0.011	100	No
PM 10	0.016		
PM 2.5	0.016		
Pb	0.000		
NH3	0.014		
CO2e	227.6		

2028

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.231		
NOx	0.241		
CO	2.525		
SOx	0.011	100	No
PM 10	0.016		
PM 2.5	0.016		
Pb	0.000		
NH3	0.014		
CO2e	227.6		

2029

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.173		
NOx	0.181		
CO	1.894		
SOx	0.008	100	No
PM 10	0.012		
PM 2.5	0.012		
Pb	0.000		
NH3	0.010		
CO2e	170.7		

2030 - (Steady State)

Pollutant	Action Emissions (ton/yr)	GENERAL CONFORMITY	
		Threshold (ton/yr)	Exceedance (Yes or No)
Tooele Co, UT			
VOC	0.000		
NOx	0.000		
CO	0.000		
SOx	0.000	100	No
PM 10	0.000		
PM 2.5	0.000		
Pb	0.000		
NH3	0.000		
CO2e	0.0		

None of estimated emissions associated with this action are above the conformity threshold values established at 40 CFR 93.153 (b); Therefore, the requirements of the General Conformity Rule are not applicable.

_____ _____

Dr. Karen Barnes, Senior Project Manager - NEPA DATE

B. Vandenberg Space Force Base Generators – EPA Tier III and Tier IV Estimated Air Emissions Calculations

Table 4-15. GBSD Back-up Generators Associated with Operations at VSFB						
Type		Megawatts (Kilowatts)	Horsepower [3]	Purpose	Use Duration [1,2]	Location
1.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-04
2.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-04
3.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-26
4.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-26
5.	Diesel	0.25 MW (250kW)	386	Backup power	150 hours/year	MAF-D0/VLC
6.	Diesel	0.06 MW (60kW)	93	Backup power	50 hours/year	MAF-D0/VLC
7.	Diesel	0.2 MW (200kW)	268 hp	Backup power	75 hours/year	Building 1900
8.	Diesel	0.2 MW (200 kW)	268 hp	Backup power	75 hours/year	Building 8337
9.	Diesel	0.4 MW (400 kW)	536 hp	Backup power	75 hours/year	Building 8339

Estimated emission based on Tier III and Tier IV Exhaust Emission Standards for Heavy-Duty Off-Road Diesel Cycle Engines (ton/year).

Assumptions:

1. Generators less than 1,000 hp are calculated at Tier 3
2. Generators greater than 1,000 hp are calculated at Tier 4

Table B-2: LF-04 and LF-26 Generator - 50 hours/year Operations – VSFB [Tier 3]												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.022	0.00	0.002	0.000	0.029	0.000	0.000	0.000	0.002	0.000	0.001
Total GBSD	0.000	0.022	0.00	0.002	0.000	0.029	0.000	0.000	0.000	0.002	0.000	0.001
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

Table B-5: Building 1900 and 8337 Generator - 50hours/year Operations – VSFB [Tier 3]												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.041	0.00	0.003	0.000	0.055	0.000	0.00	0.000	0.003	0.000	0.002
Total GBSD	0.000	0.041	0.00	0.003	0.000	0.055	0.000	0.00	0.000	0.003	0.000	0.002
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

Table B-6: Building 8339 Generator - 50 hours/year Operations – VSFB [Tier 3]												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.083	0.00	0.006	0.000	0.109	0.000	0.00	0.000	0.006	0.000	0.004
Total GBSD	0.000	0.083	0.00	0.006	0.000	0.109	0.000	0.00	0.000	0.006	0.000	0.004
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

Table B-7 MAF-D0/VLC Generator - 50 hours/year Operations – VSFB [Tier 3] 336 hp												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.311	0.00	0.022	0.000	0.288	0.000	0.001	0.000	0.002	0.000	0.017
Total GBSD	0.000	0.311	0.00	0.022	0.000	0.288	0.000	0.001	0.000	0.002	0.000	0.017
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

Table B-8: MAF-D0/VLC Generator - 50 hours/year Operations – VSFB [Tier 3] – 93 hp												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.366	0.00	0.022	0.000	0.410	0.000	0.01	0.00	0.002	0.000	0.033
Total GBSD	0.000	0.366	0.00	0.022	0.000	0.410	0.000	0.01	0.00	0.002	0.000	0.033
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

C. Previous Calculations - Vandenberg Space Force Base Generators – ACAM and EPA Tier III and Tier IV Estimated Air Emissions Calculations

Table 4-13. Estimated Emissions for the Entire Operations of Proposed Action at VSFB									
Activity	Pollutant Emissions (tons)								
	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
260 Operations Additional Personnel (tpy) (1) for GBSD Test	4.53	0.05	2.46	29.37	0.71	0.31	0.00	0.36	5,188.9
17 FTU Instructors(1)	0.26	0.04	0.14	1.71	0.04	0.02	0	0.02	302.8
140 FTU Students(1)	0.54	0.01	0.3	3.53	0.09	0.04	0	0.04	623.5
Pre-Launch Preparation(1)	0.07	0.001	0.13	0.62	0.01	0.01	N/A	N/A	N/A
Flight	0	0.002	0.18	0.01	1.84	1.30	N/A	N/A	N/A
Post Launch	0.06	0.00	0.01	0.07	0.00	0.00	N/A	N/A	N/A
Two LF-04 Generators (1)	0.59	0.25	2.43	1.62	0.53	0.53	0.0	0.0	281.3
Two LF-26 Generators (1)	0.59	0.25	2.43	1.62	0.53	0.53	0.0	0.0	281.3
MAF D-0/VLC Generator (250 kW)	0.8	0.67	3.3	2.2	0.72	0.72	0	0	382
MAF D-0/VLC Generator (60kW)	0.06	0.05	0.27	0.18	0.06	0.06	0	0	31
Building 1900 Generator	0.28	0.24	1.16	0.77	0.25	0.25	0	0	133.7
GBSD Temporary Contractor TSF (Building 8337) Generator (1)	0.28	0.24	1.16	0.77	0.25	0.25	0	0	133.7
GBSD Temporary Contractor TSF (Building 8339) Generator(1)	0.56	0.47	2.3	1.5	0.50	0.50	0	0	267.3
LF-04 Fuel Tank (2) (1)	0.0010	0	0	0	0	0	0	0	0
LF-26 Fuel Tank (2) (1)	0.0010	0	0	0	0	0	0	0	0
MAF D-0/VLC (96 gallons)	0	0	0	0	0	0	0	0	0
MAF D-0/VLC (336 gallons)	0	0	0	0	0	0	0	0	0
Building 1900 Fuel Tank	0.00007	0	0	0	0	0	0	0	0
GBSD Temporary Contractor TSF (Building 8337) Fuel Tank (1)	0.00006	0	0	0	0	0	0	0	0
GBSD Temporary Contractor TSF (Building 8339) Fuel Tank (1)	0.00006	0	0	0	0	0	0	0	0
Total Operations of GBSD	8.62	2.27	2.45	43.97	5.53	4.52	0	0.42	7,626
Total Flight Test Activities	7.93	0.183	19.52	42.7	112.85	79.3	N/A	N/A	N/A
GBSD Test Program Operations	16.6	2.45	21.97	86.67	118.4	83.82	N/A	N/A	N/A

Table 4-15. GBSD Back-up Generators Associated with Operations at VSFB						
Type		Megawatts (Kilowatts)	Horsepower [3]	Purpose	Use Duration [1,2]	Location
1.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-04
2.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-04
3.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-26
4.	Diesel	0.105 MW (105 kW)	141 hp	Backup power	150 hours/year	LF-26
5.	Diesel	0.25 MW (250kW)	386	Backup power	150 hours/year	MAF-D0/VLC
6.	Diesel	0.06 MW (60kW)	93	Backup power	50 hours/year	MAF-D0/VLC
7.	Diesel	0.2 MW (200kW)	268 hp	Backup power	75 hours/year	Building 1900
8.	Diesel	0.2 MW (200 kW)	268 hp	Backup power	75 hours/year	Building 8337
9.	Diesel	0.4 MW (400 kW)	536 hp	Backup power	75 hours/year	Building 8339

Table B-3: Launch Control A Generator - 50 hours/year Operations – VSFB [Tier 4]												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.055	0.00	0.022	0.000	0.288	0.000	0.001	0.000	0.002	0.000	0.017
Total GBSD	0.000	0.055	0.00	0.022	0.000	0.288	0.000	0.001	0.000	0.002	0.000	0.017
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

Table B-4: Launch Control B Generator - 50 hours/year Operations – VSFB [Tier 3]												
Item	NO_x		ROC		CO		SO_x		PM		PM_{10}	
	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year	ton/ qtr.	tons/ year
1	0.000	0.052	0.00	0.004	0.000	0.068	0.000	0.00	0.000	0.004	0.000	0.003
Total GBSD	0.000	0.052	0.00	0.004	0.000	0.068	0.000	0.00	0.000	0.004	0.000	0.003
CEQA Significance Thresholds (ton/year)	10 tons/year		10 tons/year						15 tons/year		10 tons/year	

E

Applicable Regulations

Appendix E: Applicable Regulations

E.1. Hill Air Force Base

E.1.1 Air Quality and Climate Change

The Clean Air Act (CAA) provides the principal framework for national, state, and local efforts to protect air quality.

Federal Regulations

Under the CAA, the U.S. Environmental Protection Agency's (USEPA's) Office of Air Quality Planning and Standards (OAQPS) is responsible for setting standards, also known as National Ambient Air Quality Standards (NAAQS), for pollutants that are considered harmful to people and the environment.

OAQPS is also responsible for ensuring that these air quality standards are met, or attained (in cooperation with state, tribal and local governments) through national standards and strategies to control pollutant emissions from automobiles, factories, and other sources (USEPA 2016a). There are two types of NAAQS standards, primary and secondary. Primary standards protect against adverse health effects; secondary standards protect against welfare effects, such as damage to farm crops and vegetation and damage to buildings. The six criteria pollutants addressed in the NAAQS are carbon monoxide (CO), nitrogen dioxide (NO_2), Pb, ozone (O_3) (or smog), particulate matter less than or equal to 2.5 microns and 10 microns in diameter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2). If the levels of these pollutants are higher than the NAAQS, then the area in which the level is too high is called a nonattainment area. OAQPS closely monitors many areas for criteria pollutants and attainment (USEPA 2016a). Individual states may establish ambient standards that are more stringent. **Table E-1** summarizes the NAAQS.

Through various programs, OAQPS monitors for criteria pollutants. One such program is the Ambient Air Monitoring Program. Through this program, air quality samples are collected to judge attainment of ambient air quality standards, to prevent or alleviate air pollution emergencies, to observe pollution trends throughout regions, and to evaluate the effects of urban, land-use, and transportation planning relating to air pollution. There are other important types of pollution monitoring programs, two of which are Enhanced Ozone Monitoring and Air Pollution Monitoring (USEPA 2016a).

To work towards attainment (as detailed in the next subsection), OAQPS requires each state containing nonattainment areas to develop a written plan for cleaning the air in those areas. The plans developed are called state implementation plans (SIPs), which are a compilation of regulations, strategies, schedules, and enforcement actions designed to move the state into compliance with all NAAQS. Through these plans, the states outline efforts that they will make

to try to correct the levels of air pollution and bring their areas back into attainment (USEPA 2016a).

Table E-1. National Ambient Air Quality Standards for Six Principal Pollutants				
Pollutant		Primary/Secondary	Averaging Time	Level
Carbon Monoxide (CO)		Primary	8 hours	9 ppm
			1 hours	35 ppm
Lead (Pb)		Primary and Secondary	3-month average	0.15 µg/m^3
Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb
		Primary and Secondary	1 year	53 ppb (1)
Ozone (O_3)		Primary and Secondary	8 hours	0.070 ppm
Particulate Matter (PM)	$PM_{2.5}$	Primary	1 year	12.0 µg/m^3
		Secondary	1 year	15.0 µg/m^3
		Primary and Secondary	24 hours	35 µg/m^3
	PM_{10}	Primary and Secondary	24 hours	150 µg/m^3
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb
		Secondary	3 hours	0.5 ppm

Note: µg/m^3 = micrograms per cubic meter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns; PM_{10} = particulate matter less than or equal to 10 microns; ppb = parts per billion; ppm = parts per million

(1) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

Source: USEPA 2016a: https://www.epa.gov/criteria-air-pollutants/naaqs-table

Attainment vs. Nonattainment and General Conformity

USEPA classifies the air quality in an air quality control region (AQCR), or in subareas of an AQCR, according to whether the concentrations of criteria pollutants in ambient air exceed the NAAQS. Areas within each AQCR are therefore designated as either “attainment,” “nonattainment,” “maintenance,” or “unclassified” for each of the six criteria pollutants. Attainment means that the air quality within an AQCR is better than the NAAQS; nonattainment indicates that criteria pollutant levels exceed NAAQS; maintenance indicates that an area was previously designated nonattainment but is now attainment; and an unclassified air quality designation by USEPA means that there is not enough information to appropriately classify an AQCR, so the area is considered attainment.

The General Conformity Rule requires that any federal action meet the requirements of a SIP or Federal Implementation Plan. More specifically, CAA conformity is ensured when a federal action does not cause a new violation of the NAAQS; contribute to an increase in the frequency

or severity of violations of the NAAQS; or delay the timely attainment of any NAAQS, interim progress milestones, or other milestones toward achieving compliance with the NAAQS.

National Emissions Standards for Hazardous Air Pollutants

There are other regulations that set standards which certain emissions units must meet regardless of major or minor source permit requirements. The National Emission Standards for Hazardous Air Pollutants (NESHAPs) are stationary source standards for hazardous air pollutants (HAPs). HAPs are pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

Sources subject to NESHAPs may be required to conduct an initial performance test to demonstrate compliance. To demonstrate continuous compliance, sources may be required to monitor control device operating parameters that are established during the initial performance test. Sources may also be required to install and operate continuous emission monitors to demonstrate compliance.

New Source Performance Standards

Section 111 of the CAA authorizes USEPA to develop technology-based standards that apply to specific categories of stationary sources. These standards are referred to as New Source Performance Standards (NSPS) and are found in 40 CFR § 60. The NSPS apply to new, modified, and reconstructed affected facilities in specific source categories such as stationary engines, boilers, and fuel storage tanks. Sources subject to NSPS may be required to conduct an initial performance test to demonstrate compliance. To demonstrate continuous compliance, some NSPS require sources to utilize continuous emission monitors. Sources may also be required to monitor control device operating parameters to demonstrate continuous compliance.

New Source Review

New Source Review (NSR) is a Clean Air Act program that requires industrial facilities to install modern pollution control equipment when they are built or when making a change that increases emissions significantly. The program accomplishes this when owners or operators obtain permits limiting air emissions before they begin construction. For that reason, NSR is commonly referred to as the “preconstruction air permitting program.” The purpose of the NSR program is to protect public health and the environment, even as new industrial facilities are built and existing facilities expand. (USEPA 2020a) Specifically, its purpose is to ensure that air quality:

- Does not worsen where the air is currently unhealthy to breathe (i.e., nonattainment areas)
- Is not significantly degraded where the air is currently clean (i.e., attainment areas)

Federal Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD); i.e., 40 CFR § 52.21) applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the NAAQS. A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment.

Under the CAA, there are (1) the Title V program that requires all major stationary sources with emissions over 100 tons per year (tpy) to hold an operating permit and (2) the PSD/NSR program that requires new major sources and major sources that are undergoing major modifications to obtain a permit. A major source for NSR/PSD is defined as any source that emits or has the potential to emit either 100 tpy or 250 tpy of a regulated pollutant, dependent on the source category and attainment status of the area. The 100 tpy level is the level at which existing sources in 28 industry categories listed in the CAA are classified as major for the PSD program. The 250 tpy level is the level at which existing sources in all other categories are classified as major for PSD purposes.

PSD applies for a source with the potential to emit 250 tpy of any criteria pollutant, and a significant modification to a major stationary source (i.e., change that adds 0.6 [i.e., Pb] to 40 [i.e., SO_2] tpy to the facility's potential to emit depending on the pollutant). Additional PSD major source and significant modification thresholds apply for greenhouse gases (GHGs).

PSD regulations can also apply to stationary sources if (1) a proposed project is within 6.2 miles of national parks or wilderness areas (i.e., Class I Areas) and (2) regulated stationary source pollutant emissions would cause an increase in the 24-hour average concentration of any regulated pollutant in the Class I area of 1 microgram per cubic meter ($\mu g/m^3$) or more (40 CFR § 52.21[b][23][iii]). A Class I area includes national parks larger than 6,000 acres, national wilderness areas and national memorial parks larger than 5,000 acres, and international parks. PSD regulations also define ambient air increments, limiting the allowable increases to any area's baseline air contaminant concentrations, based on the area's Class designation (40 CFR § 52.21[c]).

State Regulations (Utah)

Utah State Implementation Plan (SIP). To protect public health, the CAA(42 United States Code [USC] § 7401) requires that federal standards be set to limit the maximum levels of pollutants in the outdoor air. Each state is responsible for developing plans to demonstrate how those standards will be achieved, maintained, and enforced. These plans make up the SIP. The plans and rules associated with them are enforced by the state, and, after federal approval, they are also federally enforceable. These plans are the framework for each state's program to protect the air.

The Utah SIP was written and approved by USEPA in the 1980s. Section 19-2-108, Utah Code Annotated, 1953, as amended, requires that prior to the initiation of construction or modification of an installation that might reasonably be expected to be a source of air pollution, the owner or operator of such source must submit to the Executive Secretary of the Utah Air Quality Board a notice of intent to construct. The law further gives the Executive Secretary the authority to require submission of plans and specifications for review prior to the initiation of construction or modification. The rules outline the types of sources which are subject to the notice of intent to construct requirement and specifically detail those types of sources which are exempted from the requirement.

Utah Administrative Code Title R307. Environmental Quality, Air Quality. Title R307 contains the rules adopted by the Air Quality Board that constitute the basis for control of air pollution sources in the state of Utah. These rules apply and are enforced throughout the state and are recommended for adoption in local jurisdictions where environmental specialists are available to cooperate in implementing rule requirements. R307 addresses the General emission standards, standards for fugitive emissions and fugitive dust, surface coating, and other emission sources for all areas of the state except for sources listed in Section IX, Part H of the state implementation placed or located in a PM_{10} non-attainment or maintenance area. (Utah Administrative Code 2020)

Climate Change and Greenhouse Gas Emissions

Climate. is determined by the long-term pattern of oceanic and atmospheric conditions at a location. Climate is described by statistics, such as means and extremes of temperature, precipitation, and other variables, and by the intensity, frequency, and duration of weather events (NOAA 2016). Changes in climate can result in impacts to local air quality. Atmospheric warming associated with climate change has the potential to increase ground-level ozone in many regions, which may present challenges for compliance with the ozone standards in the future. The impact of climate change on other air pollutants, such as particulate matter, is less certain, but research is underway to address these uncertainties. (USEPA 2020b)

Emissions of pollutants into the air can result in changes to the climate. Ozone in the atmosphere warms the climate, while different components of particulate matter (PM) can have either warming or cooling effects on the climate. (USEPA 2020b)

Greenhouse Gas. Gases that trap heat in the atmosphere are called GHGs. GHGs are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon where gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating at the surface of the earth. GHGs do not have applicable ambient standards or emission limits under the major environmental regulatory programs. On December 15, 2009, the USEPA Administrator recognized potential risks to public health or welfare, and signed an endangerment finding regarding GHGs under Section 202(a) of the federal CAA. The finding states that current and projected concentrations in the atmosphere

of the six key well-mixed GHGs—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—threaten the public health and welfare of current and future generations. (Federal Register 2009)

Utah is a member of the Climate Registry, which supports voluntary and regulatory GHG emissions reporting programs. Utah has developed and implemented GHG management policies. The state has warmed about 2°F in the last century. In the coming decades, the changing climate is likely to decrease the flow of water in Utah's rivers, increase the frequency and intensity of wildfires, and decrease the productivity of ranches and farms. (USEPA 2016c)

The GHG emissions are quantified in terms of carbon dioxide equivalent (CO_2e). Unifying emissions in terms of CO_2e allows for the comparison of different GHG based on their Global Warming Potential. Global Warming Potential is a measure of the amount of energy a ton of gas absorbs over a given period of time, relative to 1 ton of CO_2. (USEPA 2017b)

E.1.2 Hazardous Material and Waste

HAFB is required to meet state, federal, and local regulations to stay in compliance with permits. Specifically, HAFB is authorized to store hazardous waste by a State of Utah Hazardous Waste Storage Permit (USEPA ID UT0571724350). Under state and federal regulations (R315-8-4 and 29 CFR 1910.120 [p]) HAFB has a permitted emergency response plan for unplanned releases of hazardous substances. The permit is required to be current and approved by the Utah Department of Environmental Quality (UDEQ).

HAFB is also on the National Priorities List (NPL) and corrective actions are being addressed through CERCLA Superfund. CERCLA requires that Superfund sites submit 5-Year-Review reports that the USEPA reviews for determining protectiveness and effectiveness of the remediation strategy (CERCLA Section 121(c) and 40 CFR Section 300.430(f)(4)(ii)). The USEPA response letter dated 3 April 2019 indicates that the latest 5-Year-Review was completed in December 2018 (USEPA 2019a).

The U.S. Department of the Air Force (DAF) has written specific guidance for safely and effectively managing hazardous material and waste involved in carrying out its mission. AFI 32-7086 and 2019 HAFB Supplement detail hazardous substance generation, use, storage, transport, and disposal at HAFB. The 2019 Supplement and AFMAN 32-7002 are considered the Hazardous Materials Management Plan for HAFB (AFMAN 32-7002_HILLAFBSUP 2019).

AFI 32-7086 requires that DAF installations maintain an Environmental Management System (EMS). HAFB achieves this under the Hazardous Materials Cell, which provides oversight for the Hazardous Materials Management Process (HMMP) to its personnel and to contractors. Hazardous Materials Cell requires that all contractors, suppliers, partners, vendors, TDY units, or tenants that bring hazardous materials to the base follow the HMMP and coordinate via

eDASH—a SharePoint electronic dashboard tool that integrates HAFB's environmental and sustainability programs—and the standardized tracking system known as Enterprise Environmental, Safety and Occupational Health Management Information System (EESOH-MIS) (AFI32-7001_HILLAFBSUP 2019). Together these tools ensure that all hazardous substances are appropriately managed and authorized at HAFB.

HAFB also maintains program-specific plans such as an Asbestos Management Plan, Asbestos Operating Plan, Lead-Based Paint (LBP) Management Plan, Spill Prevention, Control and Countermeasures (SPCC) Plan, and an Air Quality Emergency Episode Plan.

Other applicable federal regulations and statutes include the following:

- Emergency Planning and Community Right-to-Know Act, 1986
- U.S. DOT laws and regulations, Transportation Safety Act, 1974
- Federal Insecticide, Fungicide, and Rodenticide Act, 1996
- Federal Environmental Pesticide Control Act, 1972
- Federal Facilities Compliance Act, 1992
- Revised Underground Storage Tank Regulation, 2015

E.1.3 Health and Safety

Numerous federal and state regulatory requirements have been enacted for the well-being of workers at HAFB and the general population. Regulations established by the federal Occupational Safety and Health Administration (OSHA) and USEPA ensure safe working and living conditions through enforcing standards and training requirements. For military-related actions and activities at HAFB, DoD and DAF regulations are designed to meet these standards.

Contractors working at HAFB follow applicable OSHA (29 CFR) and state regulatory requirements, except when DoD- or DAF-specific requirements apply. The Utah Occupational Safety and Health (UOSH) Act of 1973 under Utah Administrative Code, Title R614, gives the UOSH Division the mandate to administer laws and lawful orders to ensure that every employee in the state has a workplace free of recognized hazards. These standards specify health and safety requirements, the amount and type of training required for workers, the use of personal protective equipment, administrative controls and engineering controls, and permissible exposure limits for workplace stressors.

Department of Defense Instruction (DoDI) 6055.01 (*DoD Safety and Occupational Health Program*) and DoDI 6055.05 (*Occupational and Environmental Health*) set safety and health guidelines, including OSHA standards, for DoD employees. Additionally, each branch of the

military has its own policies and regulations that act to protect its personnel. Air Force Policy Directive 91-2 (*Safety Programs*) describes the overarching structure for managing DAF safety programs efficiently and effectively. AFMAN 91-203 (*Air Force Occupational Safety, Fire, and Health Standards*) provides DAF industrial and general ground safety guidance. Its purpose is to minimize loss of DAF resources and to protect DAF personnel from occupational deaths, injuries, or illnesses by managing risks. In conjunction with AFI 91-202 (*The U.S. Air Force Mishap Prevention Program*) and AFGSC Supplement to AFI 91-202, these standards ensure DAF workplaces, including HAFB, meet federal safety and health requirements.

For the storage, handling, maintenance, and transportation of missile systems, propellants, and related explosive materials at HAFB, more specific safety and safety-related U.S. DOT, DoD, and DAF regulations, directives, instructions, and procedures are applied:

- 49 CFR §§ 171-177, Chapter I (Pipeline and Hazardous Materials Safety Administration), Subchapter C (Hazardous Materials Regulations)
- DoD Directive 6055.09E, *Explosives Safety Management*
- Defense Explosives Safety Regulation (DESR) 6055.09/AFMAN 91-201, *Explosives Safety Standards*
- HAFB Instruction 91-201, *Explosives Safety Standards*.

Implementation of these regulatory requirements and procedures ensures that there is minimal risk to the health and safety of military personnel and contractors, as well as to the general public, from operations and activities on or off the installation.

E.1.4 Infrastructure

Infrastructure and utilities are governed by various federal, state, and local laws, regulations, and ordinances. On a state level, the Public Service Commission (PSC) of Utah, with assistance from the Utah Division of Public Utilities, regulates the state's investor- and cooperative-owned public utility companies. These government-regulated companies provide telecommunications, electricity, natural gas, water, and sewer systems. As of FY 2019, the PSC regulated 178 utility companies including gas, electric, telecommunications, water, sewer, and railroads in the state. Some of the public utilities regulated by the PSC include PacifiCorp, which does business in Utah as Rocky Mountain Power (electrical utility); Dominion Energy Utah (natural gas utility); and 25 private water and sewer companies (PSC 2019). The PSC does not regulate municipal utilities, cable television, wireless telephone, or internet service providers (DPU 2019).

Landfills within the state, including the HAFB Class IVb solid waste landfill are regulated and permitted by the Utah Division of Waste Management and Radiation Control in accordance with the Utah Solid and Hazardous Waste Act, Title 19, Chapter 6, and the Utah Solid Waste Permitting and Management Rules (DWMRC 2019).

Specific DAF regulations and policies for utility usage and management include the following:

- AFMAN 32-1061, *Providing Utilities to U.S. Air Force Installations*. This AFMAN applies to managing, supplying, purchasing, and selling utility services and commodities; measuring utility system performance; privatizing utility infrastructure, and managing privatized utility infrastructure on DAF installations.
- Air Force Pamphlet (AFPAM) 32-10144, *Implementing Utilities at U.S. Air Force Installations*. This pamphlet provides guidance to implement the provision of utilities at DAF installations for the consistent and effective management of energy and utility programs, including evaluation of energy/utility requirements and consumption.

All new facilities at HAFB would comply with the applicable regulatory requirements and standards for energy efficiency and sustainability, including those listed in **Section 2.2.2.2**.

E.1.5 Noise

Federal

U.S. Environmental Protection Agency. The Noise Control Act of 1972 (42 USC §4901 et seq.) established a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. The Act also serves to (1) establish a means for effective coordination of federal research and activities in noise control; (2) authorize the establishment of federal noise emission standards for products distributed in commerce; and (3) provide information to the public respecting the noise emission and noise reduction characteristics of such products.

While primary responsibility for control of noise rests with state and local governments, federal action is essential to deal with major noise sources in commerce, control of which require national uniformity of treatment. USEPA is directed by Congress to coordinate the programs of all federal agencies relating to noise research and noise control.

Department of the Air Force (DAF). AFI 48-127 governs the Occupational Nose and Hearing Conservation Program. This instruction administers the Air Force Hearing Conservation Program to prevent occupational illness and injuries under federal and DoD references. The Air Force Hearing Conservation Program is a component of the Occupational and Environmental Health Program, and is a command-driven program designed to reduce or eliminate hazardous noise exposure to workers and protect workers from the harmful effects of hazardous noise, while enhancing combat and operational capabilities. All DAF Active Duty, Reserve, and National Guard military and civilian personnel (including Reserve technicians and Reserve Component military Reserve technicians) are covered by this instruction. Contractors must comply with state and federal noise standards, and are exempt from compliance with this instruction.

E.1.6 Transportation/Traffic

At HAFB, off-installation street and highway operations are regulated primarily by the Utah Department of Transportation (UDOT). Off-installation local street operations and maintenance are managed by the local county and city municipalities. On-installation roadway operations and maintenance are managed by DoD and HAFB.

E.2. Vandenberg Space Force Base

E.2.1 Air Quality and Climate Change

Federal Regulations

See **Section E.1.1** for applicable federal regulations governing air quality.

State Regulations (California)

The California Air Resources Board (CARB). CARB focuses on California's unique air quality challenges by setting the state's own stricter emissions standards for a range of statewide pollution sources including vehicles, fuels, and consumer products. The CARB monitors levels of criteria pollutants at representative sites throughout California.

The California Ambient Air Quality Standards (CAAQS). CAAQS includes additional standards for the federally-identified criteria pollutants, as well as sulfates, visibility reducing particles, hydrogen sulfide, and vinyl chloride (chloroethene). California law continues to mandate CAAQS, although attainment of the NAAQS has precedence over attainment of the CAAQS due to federal penalties for failure to meet federal attainment deadlines. The fifth column of **Table E-2** provides the CAAQS.

Table E-2. California Ambient Air Quality Standards Principal Pollutants					
Pollutant		Primary/Secondary	Averaging Time	National	California
Carbon Monoxide (CO)		Primary	8 hours	9 ppm	9 ppm
			1 hours	35 ppm	20 ppm
Lead (Pb)		Primary and Secondary	3-month average	0.15 µg/m3	None
			30-day Average	None	0.15 µg/m^3
Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb	0.18 ppm
		Primary and Secondary	1 year	53 ppb (1)	0.030 ppm
Ozone (O_3)		Primary and Secondary	8 hours	0.070 ppm	None
			1 hour	None	0.09 ppm
			Annual	None	0.070 ppm
Particle Matter (PM)	$PM_{2.5}$	Primary	1 year	12.0 µg/m^3	12.0 µg/m^3
		Secondary	1 year	15.0 µg/m^3	None
		Primary and Secondary	24 hours	35 µg/m^3	None
	PM_{10}	Primary and Secondary	24 hours	150 µg/m^3	50 µg/m^3
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb 0.75 ppm	25 ppb 0.25 ppm
		Secondary	3 hours	0.5 ppm	None
		Primary	24 hours	0.14 ppm	0.04
Sulfate			24 hours	None	25 µg/m^3
Visibility Reducing Particles			N/A	None	10 miles
Hydrogen Sulfide (H_2S)			1 hour	None	0.03 ppm
Vinyl Chloride			24 hours	None	0.01 ppm

Note: µg/m^3 = micrograms per cubic meter; PM2.5 = particulate matter less than or equal to 2.5 microns; PM_{10} = particulate matter less than or equal to 10 microns; ppb = parts per billion, ppm = parts per million

Source: California Air Resources Board 2016.

Local Regulation

County of Santa Barbara. In conjunction with the USEPA and CARB, the Santa Barbara County Air Pollution Control District (SBCAPCD) regulates air quality in Santa Barbara County and at Vandenberg Space Force Base (VSFB).

The SBCAPCD maintains a comprehensive inventory of air pollutants released within the county. This inventory accounts for types and amounts of pollutants emitted from a wide variety of sources, including on-road motor vehicles, fuel combustion at industrial facilities, solvent and surface coating usage, consumer product usage, and emissions from natural sources. The emission inventory is used to describe and compare contributions from air pollution sources, evaluate control measures, schedule rule adoptions, forecast future pollution, and prepare clean air plans.

In 2018, there were 17 monitoring stations operating in Santa Barbara County. As indicated in **Figure E-1**, of the 17 monitoring station four stations in nearest proximity of VSFB (i.e., Vandenberg South Base, Lompoc H Street, Lompoc North, and Santa Maria).

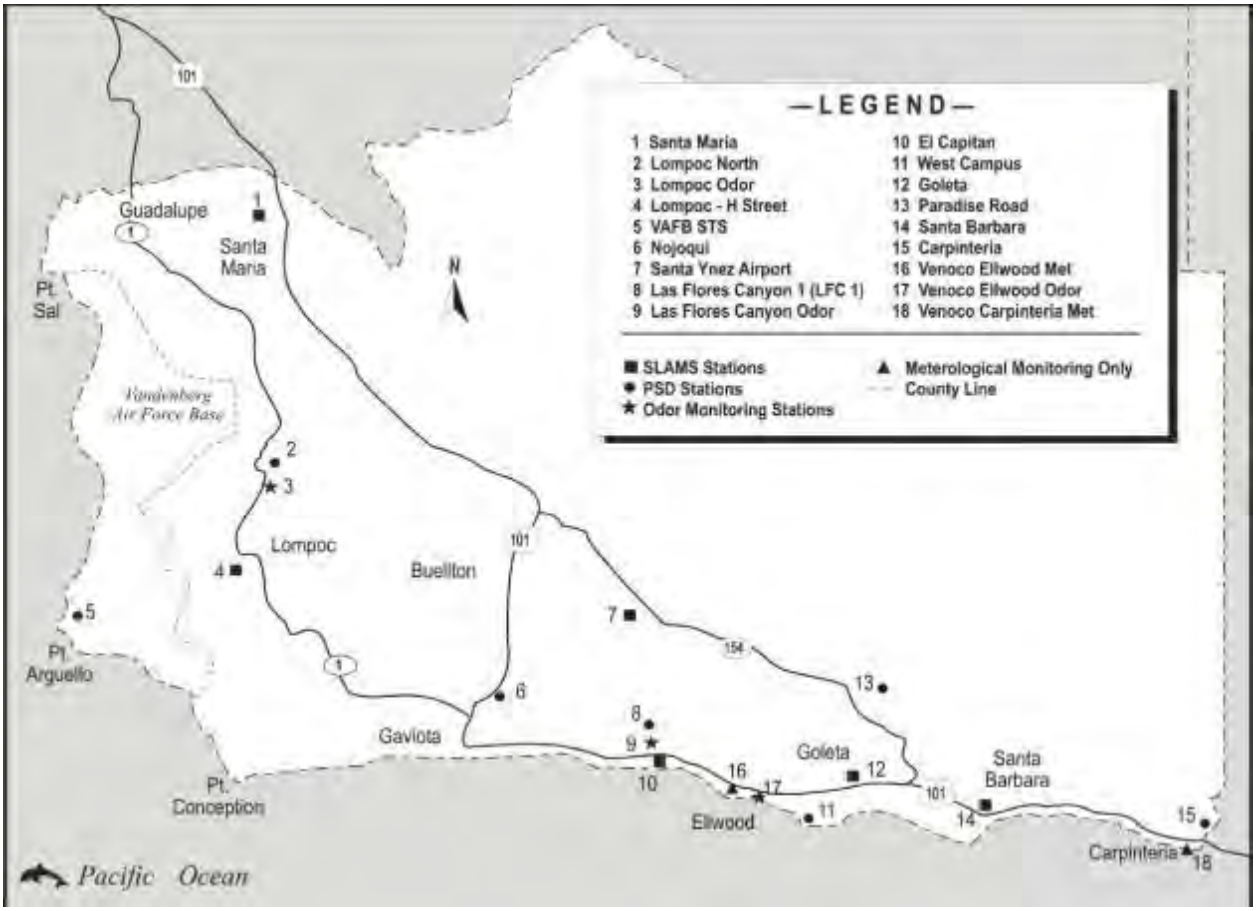

Figure E-1. Santa Barbara County Air Quality Monitoring Stations

In 2018, Santa Barbara County met the federal ambient air quality standards for all measured pollutants except PM_{10}. Countywide, there were no exceedances of the federal or state O_3 standard and all other areas within Santa Barbara County were below the federal and state ambient air quality standards during 2018. (Santa Barbara County 2018b) **Table E-3** summarizes the Attainment Status for Santa Barbara County and **Table E-4** presents a summary of the number of exceedances for the four air monitoring stations in nearest proximity of VSFB.

Table E-3. Attainment Status for Santa Barbara County, California

Pollutant	California Designation	Federal Designation
Ozone	Nonattainment-Transitional	Unclassified/Attainment
PM_{10}	Nonattainment	Attainment
$PM_{2.5}$	Unclassified	Unclassified/Attainment
CO	Attainment	Attainment
NO_2	Attainment	Unclassified/Attainment
SO_2	Attainment	Unclassified/Attainment
Sulfates	Attainment	Unclassified/Attainment
Lead	Attainment	Attainment
Hydrogen Sulfide	Attainment	Unclassified/Attainment
Vinyl Chloride	Attainment/Unclassified	Attainment/Unclassified
Visibility Reducing Particles	Attainment	Unclassified/Attainment

Note: PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, CO = carbon monoxide, NO_2 = nitrogen dioxide, SO_2 = sulfur dioxide

Source: Santa Barbara County-Air Pollution Control District 2019

Table E-4 Santa Barbara County Exceedance Summary for 2018

Monitoring Station	Pollutant (number of days that Exceeded Air Quality Standard)					
	O_3	NO_2	SO_2	CO	PM_{10}	$PM_{2.5}$
Lompoc H Street	0	0	0	0	2 (state)	2 (federal)
Lompoc North	0	0	0	–	–	–
Santa Maria	0	0	–	0	14 (state)	1 (federal)
Vandenberg South Base	0	0	0	0	27 (state)	2 (federal)

Notes: PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, O_3 = ozone, NO_2 = nitrogen dioxide, SO_2 = sulfur dioxide, CO = carbon monoxide

(1) A dash indicates that the pollutant is not measured at this location.

Source: Santa Barbara County 2018b

Climate Change

See **Section E.1.1** for an overview of federal regulatory implications.

Southern California has warmed about 3°F in the last century; all of the state is becoming warmer; and in southern California, less rain is falling as well. Sea level is likely to rise between one and four feet in the next century. Along some ocean shores, homes will fall into the water as beaches, bluffs, and cliffs erode; but along shores where seawalls protect shorefront homes from erosion, beaches may erode up to the seawall and then vanish. (USEPA 2016b).

The County of Santa Barbara established a greenhouse gas significance threshold in May of 2015. According to an approved amendment to the County of Santa Barbara's Environmental Thresholds and Guidelines Manual, all industrial and stationary source projects would be subject to a bright-line threshold of 1,000 metric tons of CO_2e tons per year (tpy) to determine if greenhouse gas emissions constitute a significant cumulative impact. Projects exceeding the 1,000 metric tons of CO_2e tpy significance threshold would be required to reduce their greenhouse gas emissions to the applicable threshold, where feasible, through onsite reductions and offsite reduction programs approved by the County of Santa Barbara.

E.2.2 Biological Resources

Endangered Species Act (ESA)

The purpose of the ESA is to conserve and recover listed species and to conserve the ecosystems upon which threatened and endangered species depend. Under Section 9 of the ESA, it is unlawful for any person subject to the jurisdiction of the United States to take ESA-listed species within the United States or territorial sea of the United States. As defined in the ESA, the term "take" means to harass, harm, pursue, hunt, wound, kill, trap, capture, or collect an ESA listed species (16 USC §§ 1532, 1538). Section 7(a)(2) of the ESA requires action proponents to consult with the USFWS or the NMFS to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species or result in the destruction or adverse modification of designated critical habitat (16 USC §§ 1531-1544). For all ESA listed species, the ESA defines "harm" as an act that kills or injures wildlife including significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (16 USC §§ 1531–1544). The ESA defines "harassment" as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, including breeding, feeding, or sheltering.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act (16 USC § 1801 et seq.) provides for the conservation and management of marine fisheries in U.S. waters. Under the Magnuson-Stevens Act, EFH consists of the waters and substrate needed by fish to spawn, breed, feed, or grow to maturity. An EFH may include U.S. waters within EEZs (seaward boundary out to a distance of 200 nm)

and covers all fish species within in a fishery management unit (50 CFR § 600.805). Under the Magnuson-Stevens Act, an adverse effect means any impact that reduces quality and/or quantity of EFH (50 CFR § 600.810). Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH (50 CFR § 600.810). EFH and its geographic boundaries are defined by regional fisheries management councils. Federal agencies must evaluate the effects of an action on EFH and must consult with NMFS on actions that may adversely affect EFH (67 FR 2343 [17 January 2002])

Marine Mammal Protection Act

All marine mammals are protected under the provisions of the MMPA (16 USC § 1361 et seq.). The MMPA prohibits any person or vessel from "taking" marine mammals in the United States or the high seas without authorization. As defined by the MMPA, Level A harassment of cetaceans is any act that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment is defined as any act that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing behavioral pattern disruptions, including but not limited to migration, breathing, nursing, breeding, feeding, or sheltering. The National Defense Authorization Act of FY 2004 (Public Law 108-136) amended the definition of harassment as it applies to military readiness activities or scientific research activities conducted by or on behalf of the federal government, consistent with Section 104(c)(3) [16 USC §1374(c)(3)]. In this Act, military readiness activities were defined as "all training and operations of the Armed Forces that relate to combat" and "the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." For military readiness activities, Level B harassment is defined as any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns to a point where such behavioral patterns are abandoned or significantly altered [16 USC §1362 (18)(B)(i) and (ii)]. Section 101(a)(5) of the MMPA directs the Secretary of the Department of Commerce to allow, upon request, the incidental (but not intentional) taking of marine mammals if certain findings are made and regulations are issued. Under the MMPA, marine mammal stocks can be listed as depleted. The term depleted is defined by the MMPA as any case in which a species or population stock is determined to be below its optimum sustainable population.

Migratory Bird Treaty Act

Birds, migratory and most native-resident bird species, are protected under the Migratory Bird Treaty Act (MBTA) (16 USC §§ 703–712), and their conservation by federal agencies is mandated by Executive Order (EO) 13186 (Migratory Bird Conservation). Under the MBTA, it is unlawful by any means or in any manner to pursue, hunt, take, capture, kill; attempt to take, capture, or kill; or possess migratory birds or their nests or eggs at any time, unless permitted by regulation. Under EO 13186, federal agencies must evaluate the effects of actions on

migratory birds with emphasis on species of concern, which were later defined as birds of conservation concern (BCC) by USFWS. Birds listed as BCC are species with the highest conservation priority that without additional conservation actions are likely to become candidates for listing under the ESA (USFWS 2008a). The 2003 National Defense Authorization Act gave the Secretary of the Interior authority to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during authorized military readiness activities. The final rule authorizing DoD to take migratory birds without a permit in such cases (72 FR 8931 [February 28, 2007]), includes a requirement that the Armed Forces must confer and cooperate with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate adverse effects of the proposed military readiness activity if the activity may result in a significant adverse effect on a population of a migratory bird species.

Other Biological Resource-Related Executive Orders

This EA/OEA also evaluated the effects of the action on biological resources as required by EO 13112, Invasive Species; EO 11990, Protection of Wetlands; EO 13089, Coral Reef Protection; and EO 13158, Marine Protected Areas.

E.2.3 Coastal Zone

The CZMA is the primary federal law regarding the management of coastal resources. Federal actions that have reasonably foreseeable effects on natural resources or land or water uses in the coastal zone, regardless of the project's location, are required to be consistent, to the maximum extent practicable, with the enforceable policies of federally approved state coastal management programs.

The California Coastal Management Program was formed through the California Coastal Act of 1972. The Federal Consistency Unit of the CCC implements the federal CZMA as it applies to federal activities, development projects, and permits and licenses within California. Federal agencies submit a consistency determination to the CCC when an action could foreseeably affect coastal resources. If a federal action is not anticipated to cause an adverse effect on coastal zone, then the federal agency may prepare a negative determination for that action. The CCC's goal is to use the federal consistency process to provide open communication and coordination with federal agencies and applicants.

E.2.4 Cultural Resources

Review of cultural resources was conducted in compliance with laws, regulations, and other authorities governing the management of cultural resources on HAFB, as specified in the HAFB Integrated Cultural Resources Management Plan (ICRMP) (HAFB 2018a). These regulations include:

- NHPA of 1966, as amended (54 USC § 306108 et seq.)

- NEPA of 1969 (42 USC § 4321 et seq.)
- Archaeological Resource Protection Act of 1979, as amended (16 USC § 470aa–470 mm)
- NAGPRA of 1990 (25 USC § 3001 et seq.) and associated regulations (43 CFR § 10)
- AFMAN 32-7003 (*Environmental Conservation*)
- EO 13007 (*Indian Sacred Sites*)

Under Section 106 of the NHPA, federal agencies must consider the effect of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. Under this process, the federal agency determines the undertaking's area of potential effects (APE), determines the NRHP eligibility of resources within the APE, and determines the effects on historic properties, all in consultation with the SHPO and other identified consulting parties. The APE is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist."

Cultural resources at VSFB are assessed for eligibility based on NRHP criteria (36 CFR § 60.4). Sites listed in or eligible for listing in the NRHP are considered historic properties. Under Section 110 of the NHPA, federal agencies such as the DAF are responsible for preservation of historic resources owned or controlled by the agency. If the qualities that make a historic property significant will be affected adversely by an undertaking, the agency, in consultation with the SHPO or the Advisory Council on Historic Preservation, must develop and evaluate alternatives or modifications of the undertaking to avoid, minimize, or mitigate those effects.

Just as at HAFB, the identification and disposition of Native American human remains and cultural items—including associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony—are subject to NAGPRA (25 USC § 3001 et seq.) and the NAGPRA Regulations (43 CFR § 10). In the event that Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered inadvertently on federal or tribal lands, activity in the area of the inadvertent discovery must cease and the protocols in NAGPRA Regulations Subpart B governing notification, consultation, and disposition must be followed (43 USC § 10.3–10.7).

E.2.5 Hazardous Material and Waste

See **Section E.1.2** for an in-depth discussion on the federal hazardous waste management regulations, including CERCLA, RCRA, and TSCA.

VSFB is a designated hazardous waste facility under RCRA. The California Environmental Protection Agency's Department of Toxic Substances Control provides regulatory oversight of

hazardous waste operations at VSFB as authorized under its RCRA Part B permit (USAF 2011b).

The federal Installation Restoration Program (IRP) was implemented at DoD facilities to identify, characterize, and restore hazardous substance release sites. As of October 2005, there were 146 IRP sites throughout VSFB (USAF 2011b).

The HazMart is the responsible party for managing VSFB's hazardous materials. It is the sole requisitioner, reviewer, distributor, issuer, and reissuer of hazardous materials (USAF 2010). VSFB's hazardous waste is managed and tracked under a multitude of plans, which incorporate appropriate federal, state, local, and DAF requirements. These include, but are not limited to:

- Solid and Hazardous Waste Compliance (AFMAN 32-7002)
- Hazardous Materials Management (AFMAN 32-7002)
- Hazardous Waste Management Plan (30 SW Plan 32-7043-A)
- Wastewater Management Plan (30 SW Plan 32-7041-A)
- Hazardous Materials Emergency Response Plan (30 SW Plan 32-4002-A)
- Spill Prevention, Control and Countermeasures Plan (30 SW 32-4002-C)
- Lead-Based Paint Management Plan (30 SW Plan 32-1002)
- Asbestos Management Plan (30 SW Plan 32-1052-A)
- Asbestos Operating Plan (32-1052-B)

E.2.6 Health and Safety

Just as described earlier for HAFB, numerous federal and state regulatory requirements have been enacted for the well-being of workers and the general population. Regulations established by the federal OSHA and USEPA ensure safe working and living conditions through enforcing standards and training requirements. For military-related actions and activities, DoD and DAF regulations are designed to meet these standards. Refer to **Section E.1.3** for a description of applicable federal, DoD, and DAF regulations, standards, and procedures. At the state level, the California Occupational Safety and Health (Cal/OSHA) Program enacted in 1973 ensures safe and healthful working conditions for all working men and women in California.

For the storage, handling, maintenance, and transportation of missile systems, propellants, and related explosive materials at VSFB, more specific safety and safety-related U.S. DOT, DoD, and DAF regulations, directives, instructions, and procedures are applied:

- 49 CFR Parts 171-177, Chapter I (Pipeline and Hazardous Materials Safety Administration), Subchapter C (Hazardous Materials Regulations)

- DoD Directive 6055.09E, *Explosives Safety Management*
- DESR 6055.09/AFMAN 91-201, *Explosives Safety Standards* DESR 6055.09/AFMAN 91-201 (U.S. Space Force Supplement), *Explosives Safety Standards*

For minimizing risks when conducting launch operations at VSFB, the following DoD and DAF safety-related instructions, standards, and procedures are applied. These documents established range safety policies, and define requirements and procedures, for ballistic and space vehicle operations at VSFB and along downrange (over-ocean) trajectories.

- DoDI 4540.01, Use of International Airspace by U.S. Military Aircraft and for Missile and Projectile Firings
- Range Commanders Council (RCC) Standard 321-17 (or the current version), *Common Risk Criteria Standards for National Test Ranges*
- AFI 91-202, The U.S. Air Force Mishap Prevention Program
- AFSPC Manual 91-710, *Range Safety User Requirements Manual*, Volumes 1–7.

As stated in **Section 2.1.3**, depending on the LF used, range safety procedures may require temporary closure of Point Sal State Beach. Additionally, in accordance with 30 SWI 91-104, *Operations Hazard Notice*, a NOTAM (for aircraft) and an NTM (for ocean vessels) must be published and circulated to warn personnel to avoid potential impact areas within established range Warning Areas off the coast, and in international airspace and waters (VAFB 2017). Such actions involve the temporary closure of relatively large, static volumes of airspace and ocean areas (i.e., hazard areas) in advance of a launch, reentry, or other rocket operations to protect air and ocean traffic from the hazards of flight activities and vehicle failures, including falling debris.

Implementation of these regulatory requirements and procedures ensures that there is minimal risk to the health and safety of military personnel and contractors, as well as to the general public, from operations and activities on or off the installation.

E.2.7 Infrastructure

Infrastructure and utilities at VSFB are governed by the same federal laws and regulations as those at HAFB, including those identified in **Section E.1.4**. At the state level, the California Public Utilities Commission (CPUC) regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies. Some of the public utilities regulated by the CPUC include Pacific Gas and Electric (PG&E) and Southern California Gas Company, as well as more than 110 investor-owned water and sewer utilities (CPUC 2018). The CPUC does not regulate municipal utilities.

The California Integrated Waste Management Act of 1989 (California Assembly Bill 939) requires proper management and disposal of solid wastes, including construction and demolition debris, as well as requirements for solid waste diversion. California Assembly Bill updated the solid waste diversion goal to 75 percent by 2020 and the VSFB landfill complies with these requirements. The Santa Barbara County Public Health Department Environmental Health Services, in conjunction with the California Department of Resources Recycling and Recovery (CalRecycle), regulates site operations and environmental compliance of the VSFB Landfill.

Similarly, all new facilities at VSFB would comply with the applicable regulatory requirements and standards for energy efficiency and sustainability, including those listed in **Section 2.2.2.2**.

E.2.8 Noise

See **Section E.1.5** for applicable regulations governing noise.

E.2.9 Socioeconomics/Environmental Justice

EO 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations - was issued by President William J. Clinton in 1994. Its purpose is to focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities.

EO 12898 directs federal agencies to:

- identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law.
- develop a strategy for implementing environmental justice.
- promote nondiscrimination in federal programs that affect human health and the environment, as well as provide minority and low-income communities access to public information and public participation.

E.2.10 Transportation/Traffic

Transportation/traffic at VSFB is subject to similar regulations as at HAFB. In California, street and highway operations are regulated primarily by the California Department of Transportation (Caltrans). Off-installation local street operations and maintenance are managed by the local county and city municipalities. On-installation roadway operations and maintenance are managed by DoD and VSFB.

E.2.11 Water

A new definition of Waters of the United States was proposed in EO 13778 in 2017, and in January 2020 the USEPA and the U.S. Army finalized the Navigable Waters Protection Rule to establish this new definition (USEPA 2020c). Wetlands are currently regulated by the USACE under Section 404 of the CWA as a subset of all "Waters of the United States." It is currently unclear if the DAF will also adopt this definition, although it appears likely based on the U.S. Army's endorsement.

The CWA (33 USC § 1251 et seq.) ensures that federal facilities prevent water pollution, obtain and comply with discharge permits, meet water quality standards, create and implement risk management plans, protect wetlands, and maintain records related to water quality. The CWA gives authority to USEPA and USACE to implement Section 404, which states that any project that has the potential to impact waters or wetlands requires a permit from USACE before any planned actions occur. Should a Section 404 permit be required, Section 401 of the CWA states that a Water Quality Certificate from the state water pollution control agency would also be required. This Water Quality Certificate would certify that the action would comply with state water quality requirements.

The CWA also mandates federal limits, through the NPDES program, on the amounts of specific pollutants that can be discharged into surface waters. The NPDES program regulates the discharge of point (i.e., end of pipe) and nonpoint sources (i.e., stormwater) of water pollution. Compliance monitoring under NPDES takes place largely at the state level, with NPDES permits issued to any facility that discharges directly into waters of the U.S. Regulated entities include industrial and municipal facilities (USEPA 2019b). The VSFB NPDES permit number is CAS000004 (VAFB 2013). The 2013 Stormwater Guidance Document sets forth Best Management Practices (BMPs) regarding stormwater pollution prevention.

The CZMA of 1972 (16 USC § 1451 et seq.) exists to manage the coastal environments of the U.S. including wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife located in coastal areas. The CZMA is administered by National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management. In California, NOAA has given authority over to the CCC for implementation of the CZMA. The review process determines whether a federal action affecting the coastal zone is consistent with federal and state requirements. This is known as a consistency determination. Its requirements are detailed in Chapter 3 of the California Coastal Act of 1976, as amended. A negative consistency determination may be applicable if the federal agency conducting the activity concludes that the activity would not affect the coastal zone. If a negative consistency determination is applicable, then Chapter 3 analysis would not be required.

The Central Coast Regional Water Quality Control Board is the local water quality governing body, and it manages the Shuman, San Antonio, Santa Lucia, and Santa Ynez watersheds. The proposed GBSD project area is located within the San Antonio and lower par Santa Ynez

watersheds, which drain into the Pacific Ocean. The Central Coast Regional Water Quality Control Board implements TMDL requirements to ensure watershed health.

E.3. Dugway Proving Ground

E.3.1 Air Quality and Climate Change

See **Section E.1.1** for applicable regulations governing air quality and climate change.

Dugway Proving Ground Environmental Management Plan

The air quality program seeks to ensure proper air quality management and take appropriate actions to comply with federal, state and army regulations as well as specific state-issued air quality permits and approval orders. This involves proper tracking of fuel-burning equipment, testing, operational, and training activities, etc. in addition to close coordination with garrison, test community, tenant, and contractor personnel. Close working relationships with the state regulators are also a very important part of this program. (DPG 2020c)

E.3.2 Biological Resources

In addition to regulatory requirements under the ESA and MBTA, as described in in **Section E.2.2** requirements under the Bald and Golden Eagle Protection Act apply to biological resources within the Proposed Action affected environment at DPG.

Bald and Golden Eagle Protection Act

This act protects both bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*) by prohibiting the take, possession, sale, purchase, export or import of eagles (16 USC § 668). This prohibition includes living or dead eagles as well as any eagle part, nest, or egg. Under the act, the definition of “take” includes pursuit, shooting at, poisoning, wounding, killing, capture, trapping, molesting, or disturbing of eagles, all of which are prohibited without a permit. Any take, including incidental take that is associated with an activity, must be authorized by a permit under the Bald and Golden Eagle Protection Act (50 CFR § 22.26).

E.3.3 Cultural Resources

The same laws, regulations, and other authorities governing the management of cultural resources at VSFB (**Section E.2.4**) also apply to DPG.

Just as at HAFB, CULTURAL resources at DPG are assessed for eligibility based on NRHP criteria (36 CFR § 60.4). Sites listed in or eligible for listing in the NRHP are considered historic properties. Under Section 110 of the NHPA, federal agencies such as the U.S. Army are responsible for preservation of historic resources owned or controlled by the agency. If the

qualities that make a historic property significant will be affected adversely by an undertaking, the agency, in consultation with the SHPO or the Advisory Council on Historic Preservation, must develop and evaluate alternatives or modifications of the undertaking to avoid, minimize, or mitigate those effects.

Identification and disposition of Native American human remains and cultural items—including associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony—are subject to NAGPRA (25 USC § 3001 et seq.) and NAGPRA Regulations (43 CFR § 10). In the event that Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered inadvertently on federal or tribal lands, activity in the area of the inadvertent discovery must cease and the protocols in NAGPRA Regulations Subpart B governing notification, consultation, and disposition must be followed (43 USC § 10.3–10.7).

E.3.4 Geology and Soils

Construction that disturbs more than one acre of land must be authorized by Utah's Department of Environmental Quality NPDES program (USAF 2019f). Additionally, DoD Guidance, Unified Facilities Criteria (UFC) 3-210-10, Low Impact Development for construction activities with a footprint larger than 5,000 ft^2 (USAF 2019f).

E.3.5 Hazardous Material and Waste

The term hazardous material and waste refers to substances defined as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC § 9601(14); Resource Conservation and Recovery Act (RCRA), 42 USC § 6921; and the Toxic Substances Control Act (TSCA), 15 USC § 53. In general, they include substances whose quantity, concentration, or physical, chemical, or toxic characteristics, could present substantial danger to public health or welfare, or the environment, when released. A hazardous material or waste can be a solid, liquid, gas, or combination with toxic, flammable, reactive, or corrosive characteristics.

CERCLA gives the USEPA the authority to respond to releases of hazardous material and waste in the environment. It also provides a federal "Superfund" to respond to emergency situations quickly. Superfund provides funding for cleanup of contaminated sites where potentially responsible parties cannot be identified; however, the USEPA is authorized to recover those funds through damages collected from the party/parties responsible for the contamination.

RCRA enables the USEPA to provide "cradle-to-grave" management of hazardous material and waste. It also details a framework for managing nonhazardous solid waste. RCRA manages hazardous material and waste from generation to disposal via a tracking and permitting process.

RCRA also established restrictions on landfills for the level of hazardous material and waste that they may accept.

TSCA Subchapters I-IV exist to regulate the manufacture, processing, distribution, use, making, storage, disposal, cleanup, and release reporting requirements for human and environmental exposure to toxic substances. Subchapter I authorizes the USEPA to gather information on chemical risks, requires companies to test for toxic effects from chemicals, and regulates chemicals with unreasonable risk. Subchapter II provides asbestos hazard emergency response for the U.S. public education system. Subchapter III provides a framework for indoor radon abatement in buildings and requires federal agencies to conduct radon studies. Subchapter IV governs lead exposure hazards. It instructs federal agencies to conduct abatement of lead-based-paint (LBP) and other lead exposures under federal, state, and local laws.

E.3.6 Health and Safety

Numerous federal and state regulatory requirements have been enacted for the well-being of workers at DPG and the general population. Regulations established by the federal Occupational Safety and Health Administration (OSHA) and USEPA ensure safe working and living conditions through enforcing standards and training requirements. For military-related actions and activities at DPG, DoD and U.S. Army regulations are designed to meet these standards. At the state level, the Utah Occupational Safety and Health (UOSH) Act of 1973 gives the UOSH Division the mandate to administer laws and lawful orders to ensure that every employee in the state has a workplace free of recognized hazards. These standards specify health and safety requirements, the amount and type of training required for workers, the use of personal protective equipment, administrative controls and engineering controls, and permissible exposure limits for workplace stressors.

DoDI 6055.01 and DoDI 6055.05 set safety and health guidelines, including OSHA standards, for DoD employees. Additionally, each branch of the military has its own policies and regulations that act to protect its personnel. Army Regulation 385-10 (*The Army Safety Program*) implements requirements of the Occupational Safety and Health Act of 1970. It provides policies on Army safety management procedures with special emphasis on responsibilities and organizational concepts.

For the use, storage, handling, maintenance, and transportation of explosive materials and related hazardous operations at DPG, more specific safety and safety-related U.S. DOT, DoD, and U.S. Army regulations, directives, and procedures are applied:

- 49 CFR Parts 171-177, Chapter I (Pipeline and Hazardous Materials Safety 21 Administration), Subchapter C (Hazardous Materials Regulations)
- DoD Directive 6055.09E, Explosives Safety Management
- DESR 6055.09, Edition 1

- Army Regulation 190-11, Physical Security of Arms, Ammunition, and Explosives
- Army Regulation 385-63, *Range Safety*
- Army Regulation 700-13, Worldwide Ammunition Logistics/Explosives Safety Review and Technical Assistance Program

Management of risk and the prevention and suppression of wildland fire at DPG is addressed in the DPG *Wildland Fire Management Plan*. The plan sets policy regarding DPG operations towards wildfire prevention, wildfire fighting, and post-wildfire reclamation. DPG also has a Memorandum of Understanding with Tooele County and a Memorandum of Understanding with the U.S. Bureau of Land Management to cooperate on fire suppression along installation boundaries. During high fire danger conditions, DPG range and training area regulations may restrict hazardous activities that could be sources of ignition (i.e., use of pyrotechnics), (DPG 2011, 2016).

Implementation of these regulatory requirements and procedures ensures that there is minimal risk to the health and safety of military personnel and contractors, as well as to the general public, from operations and activities on or off the range.

E.3.7 Infrastructure

Infrastructure and utilities at DPG are governed by the same federal laws and regulations as those at HAFB, described in **Section E.1.4**, except that U.S. Army-specific regulations and policies would apply. Similarly, all new facilities at DPG would comply with the applicable regulatory requirements and standards for energy efficiency and sustainability, including those listed in **Section 2.2.2.2**.

E.3.8 Noise

See **Section E.1.5** for applicable regulations governing noise.

E.3.9 Water

A new definition of Waters of the United States was proposed in EO 13778 in 2017, and in January 2020 the USEPA and the U.S. Army finalized the Navigable Waters Protection Rule to establish this new definition (USEPA 2020c). Wetlands are currently regulated by the USACE under Section 404 of the Clean Water Act (CWA) as a subset of all “Waters of the United States.” It is currently unclear if the DAF will also adopt this definition, although it appears likely based on the U.S. Army’s endorsement.

The CWA (33 USC § 1251 et seq.) ensures that federal facilities prevent water pollution, obtain and comply with discharge permits, meet water quality standards, create and implement risk

management plans, protect wetlands, and maintain records related to water quality. The CWA gives authority to the USEPA and the USACE to implement Section 404, which states that any project that has the potential to impact waters or wetlands requires a permit from USACE before any planned actions occur. Should a Section 404 permit be required, Section 401 of the CWA states that a Water Quality Certificate from the state water pollution control agency would also be required. This Water Quality Certificate would certify that the action would comply with state water quality requirements.

Wetlands protection is required by EO 11990, *Protection of Wetlands*. Protection and maintenance of habitat are the primary thrust of wetlands management on DPG (DPG 2016). The Conservation/Preservation Division reviews actions that may affect wetlands (DPG 2016). If necessary, projects with potential impacts are referred to the Corps of Engineers to determine if jurisdictional wetlands are implicated, establish mitigation procedures, and/or obtain permits.

The CWA also mandates federal limits, through the NPDES program, on the amounts of specific pollutants that can be discharged into surface waters. The NPDES program regulates the discharge of point (i.e., end of pipe) and nonpoint sources (i.e., stormwater) of water pollution. Compliance monitoring under NPDES takes place largely at the state level, with NPDES permits issued to any facility that discharges directly into waters of the U.S. Regulated entities include industrial and municipal facilities (USEPA 2019d).

The Utah Water Quality Act, UCA 19-5-101 *et seq*. governs both surface water and groundwater. According to the 2016 INRMP, DPG disagrees with the state on whether the Act applies to the installation, because the federal Clean Water Act waives sovereign immunity based on navigable waters of which DPG does not have any of the applicable categories of water (DPG 2016). The state and DPG are in agreement that the installation should not have to get a Clean Water Act stormwater permit for the municipal Subtitle D solid waste landfill (DPG 2016). However, the matter has been forwarded to the Environmental Protection Agency, Region 8, and a response is pending (DPG 2016).

DPG is also required to follow the Watershed Protection and Flood Prevention Act (PL 92419;68 Stat 666, as amended & 86 Stat 667; 16 USC 1001), EO 11988 – Floodplain Management, and DoD Directive 4700.4 – Natural Resources Management Program.

E.4. Downrange Test and Support Locations

E.4.1 United States Army Garrison–Kwajalein Atoll (USAG-KA)

E.4.1.1 Biological Resources

The USAG-KA ROI occurs within the RMI. As such, the evaluation of biological resources follows regulatory requirements set forth in EO 12114, Environmental Effects Abroad of Major Federal Actions, as well as those outlined in the UES as described below. Portions of the ROI outside RMI territorial waters are discussed in **Section 3.4.2.1** (Broad Ocean Area).

UES

The Compact of Free Association between the RMI and the United States (48 USC § 1921) requires all U.S. Government activities at USAG-KA and all DOD and RTS activities in the RMI to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the UES. As specified in Section 2-2 of the UES, these standards also apply to all activities occurring in the territorial waters of the RMI. Minuteman III and GBSD test activities would take place at Illeginni Islet and in Kwajalein Atoll waters, and must comply with the UES (USASMDC/ARSTRAT 2021a).

For the purposes of this EA/OEA, special status species at USAG-KA are those species protected under the UES in Section 3-4. The standards in Section 3-4 of the UES were derived primarily from 50 CFR, Sections (§§) 17, 23, 402, 424, and 450-452, which includes species listed as threatened or endangered under the ESA, species protected under the MMPA, and species protected under the MBTA. The regulatory setting under the ESA, MMPA, and MBTA are described in detail in **Section E.2.2** including relevant definitions under these Acts. The UES also includes protections for:

- All species designated by the RMI under applicable RMI statutes, such as the RMI Endangered Species Act of 1975, MMPA of 1990, Marine Resources (*Trochus*) Act of 1983, and the Marine Resources Authority Act of 1989; and
- Species protected by the Convention on International Trade in Endangered Species, or mutually agreed on by USAG-KA, USFWS, NMFS, and the RMI Government as being designated as protected species.

Under the UES, any action carried out at USAG-KA must be reviewed to determine if the action may affect UES listed species. If consultation is necessary, USFWS and NMFS are responsible for completing consultations.

E.4.1.2 Hazardous Material and Waste

The UES classifies all materials as either general-use, hazardous, petroleum products, or prohibited. UES for material and waste management (UES §3-6) are derived from a composite

of U.S. statutes and regulations addressing the use and management of hazardous material and solid waste and the RMIEPA regulations (UES §1-5.8). The UES also include a process for evaluating and, when called for, remediating sites contaminated from releases. Hazardous wastes are accumulated for up to 90 days. Any sampling and waste characterization is performed during that time prior to off-island shipment for disposal. All hazardous and regulated wastes are shipped off-island for disposal in the continental United States. The barge departs Kwajalein approximately every 2 weeks. In accordance with the UES, USAG-KA has prepared a Kwajalein Environmental Emergency Plan (KEEP) as a contingency plan for responding to releases of oil, hazardous materials, pollutants, and contaminants to the environment. The KEEP is similar to a spill prevention, control, and countermeasure plan, but it incorporates response provisions of a National Contingency Plan. The hazardous materials management plan is incorporated into the KEEP.

Several protective measures are in place under the UES, including development of a Document of Environmental Protection (DEP) for actions that might have adverse environmental effects. Each program-specific DEP summarizes procedures to monitor and mitigate potential impacts of testing activities at USAG-KA controlled islets and in RMI territorial waters. As the GBSD weapon system has the same environmental characteristics as the Minuteman III weapon system, a minor modification to the Minuteman III ICBM Modification and Fuze Modernization Final DEP will be prepared for review and signature by the UES appropriate agencies.

E.4.1.3 Noise

See **Section E.1.5** for applicable regulations governing noise.

The U.S. Army's policy under the Army Noise Management Program and the noise management requirements of Army Regulation 200-1- *Environmental Protection and Enhancement* (e.g., operational noise, noise limits for Noise Zones) are applied to USAG-KA. All Army installation (including USAG-KA) are required to implement the Army's Hearing Conservation Program as described in Department of the Army Pamphlet 7 40-501 (*Hearing Conservation Program*). Army standards require hearing protection whenever a person is exposed to steady-state noise greater than 85 dBA, or impulse noise greater than 140 dB, regardless of duration. Army regulations also require personal hearing protection when using noise-hazardous machinery or entering hazardous noise areas.

F

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Appendix F: List of Preparers

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Other Considerations Required by NEPA

Appendix G: Other Considerations Required by NEPA

G.1. Consistency with Other Federal, State, and Local Laws, Plans, Policies, and Regulations

In accordance with 40 CFR Section 1502.16(c), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of federal, regional, state, and local land use plans, policies, and controls. **Table G-1** in **Section G.1.2** identifies the principal federal and state laws and regulations that are applicable to the Proposed Action and indicates if the Proposed Action would comply with these laws and regulations.

G.1.1 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898)

An Environmental Justice analysis is included in this document to comply with the intent of EO 12898, and U.S. Army and DoD guidance. The EO states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In addition, the EO requires that minority and low-income populations be given access to information and opportunities to provide input to decision making on federal actions.

This EA/OEA has identified no human health or environmental effects by the Proposed Action that would result in disproportionately high or adverse effect on minority or low income-populations in the locations evaluated. The Proposed Action activities also would be conducted in a manner that would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination because of their race, color, national origin, or socioeconomic status.

Environmental Justice Review – USAG-KA/Illeginni Islet

Fish Investigation – USAG-KA. The U.S. Army Garrison-Kwajalein Atoll Fish Investigation Update in May 2016 noted that work was completed at the request of USAG-KA and USASMDC in accordance with USAKA Environmental Standards as required by the Compact of Free Association As Amended. Studies include groundwater, ocean water, sediment, and fish sampling. The original study aeras included Illeginni Harbor. **Figure G-1** shows the no fishing prohibited area for Illeginni.

Figure G-1. No Fishing Prohibited Area, Illeginni Harbor

Fish and water samples were collected from Kwajalein Harbor, Meck, Illeginni (USAG-KA-utilized islets), Ellep and Jerak (nondeveloped islets in the southern atoll) to discern whether previously observed contamination in fish tissue is specific to Kwajalein Harbor or is part of a wider contamination problem. Whole fish were analyzed for the first time in this study since certain contaminants may preferentially accumulate in internal structures that were not analyzed in the previous fish investigation (USACHPPM 2009). Unacceptable cancer risk for Marshallese adults at Illeginni is attributable to the pesticide chlordane.

Ongoing studies will determine if more restrictions should be added. Recommendation for this restricted area include:

- Do not eat fish from prohibited areas
- Encourage others to follow fishing bans
- Go to www.usagkacleanup.info for more information

Subsistence Fishing. A standard definition of subsistence fisheries is ‘‘local, non-commercial fisheries, oriented not primarily for recreation but for the procurement of fish for consumption of the fishers, their families, and community’’ (Schuman and Macinko 2007). Generally, it also implies the use of low tech “artisanal” fishing techniques and is carried out by people who are

very poor. Quite often, this fishing is part of a life that also relies on small-scale agriculture and other sources of income and may include some sale of fish. Subsistence fisheries can catch a large variety of species, but generally only those relatively close to shore or in fresh waters. (World Fisheries Trust 2008)

The potential impacts to subsistence fishers at the atoll from the continued testing of the Minutemen III has not been defined. No testing of depleted uranium (DU) or tungsten has been conducted in fish consumed by local population.

The Proposed Action may result in introduction of potentially hazardous materials (i.e., DU, beryllium, cadmium, chromium, and lead) into terrestrial and marine habitats. Heavy metals may accumulate in sediments and benthic invertebrates and even fish have the potential to accumulate heavy metals (Franca et al. 2005, Eisler et al. 1978). The potential for accumulation is metal specific and species specific, dependent on the trophic level of the wildlife and in some cases on metal concentrations (Chen et al 2016). There is some evidence that uranium concentrations in some freshwater invertebrates are related to uranium concentrations in water and sediments; however, uranium is not known to biomagnify in food webs (Bergmann and Graca 2019). There is also evidence that beryllium does not bioconcentrate in aquatic organisms or food webs (U.S. Department of Health and Human Services 2002). As described in Section 3.4.1.2 of the GBSD Test EA/OEA, soil and groundwater testing at Illeginni Islet indicates that beryllium and uranium in samples remain below the USEPA screening levels. Since DoD test activities primarily occur on land at Illeginni Islet, it is unlikely that marine waters or sediments would have higher concentrations of these hazardous materials than samples from Illeginni Islet. It is not expected that proposed testing would result in hazardous material concentrations in the marine environment that would result in accumulation of these chemicals in wildlife, such as mollusks or fish, or that would significantly impact marine wildlife.

As discussed in Section 4.2.4.1.2 (Hazardous Material and Waste) of the GBSD Test EA/OEA, for Minutemen III, the test RVs do not contain any fissile materials; however, they do contain batteries, high explosives, asbestos, DU, and other heavy metals. As described in Section 2.2.1 of the GBSD Test EA/OEA, the design of the GBSD Weapon System would be similar to the Minuteman III system. No Minuteman III RVs are anticipated to impact Illeginni as a result of this Proposed Action. Up to three total land RV impacts on Illeginni Islet are planned for GBSD. For soil, a previous flight test, pre-and post-test sampling revealed beryllium and tungsten were undetected, and uranium was detected in 9 out of 34 soil samples (results ranging from 1.8 mg/kg to 4.3 mg/kg), but well below the USEPA composite worker regional screening level (ingestion and inhalation) (RGNext 2020, USEPA 2020d). Illeginni Islet has no surface water; groundwater is very limited in quantity with no pathways to public or private consumption, is saline, and non-potable. The pre-and post-test sampling showed little variation in values for the water samples, with beryllium remaining undetected, tungsten exceeding residential tap water screening levels in 6 of the 12 samples (detected concentrations ranged from 2.3 micrograms

per liter [µg/L] to 990 µg/L), and uranium was detected in all 12 samples well below the USEPA MCL level for drinking water (detected concentrations ranged from 0.57 µg/L to 5.4 µg/L). Although the groundwater at Illeginni Islet shows tungsten levels above the MCL, the groundwater is not potable under the UES standards. The Minuteman III program will continue to follow the requirements of the final DEP for Minuteman III Modification and Fuze Modernization Flight Tests. For the GBSD program, a new DEP is being prepared and will be in place prior to the initial GBSD Flight Tests scheduled to begin in October 2023.

G.1.2 Federal Actions to Address Protection of Children from Environmental Health Risks and Safety Risks (EO 13045, as Amended by EO 13229 and 13296)

This GBSD Test EA/OEA has not identified any environmental health and safety risks that may disproportionately affect children, in compliance with EO 13045, as amended by EO 13229 and 13296.

Table G-1. Principal Federal and State Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	Status of Compliance
National Environmental Policy Act (NEPA) (42 USC Section 4321 et seq.); CEQ NEPA implementing regulations (40 CFR Parts 1500-1508); Army Procedures for Implementing NEPA (32 CFR Part 651)	Compliant
Clean Air Act (42 USC Section 7401 et seq.)	Compliant
Clean Water Act (33 USC Section 1251 et seq.)	Compliant
Coastal Zone Management Act (16 USC Section 1451 et seq.)	Compliant
National Historic Preservation Act (Section 106, 16 USC Section 470 et seq.)	Compliant
Endangered Species Act (16 USC Section 1531 et seq.)	Compliant
Marine Mammal Protection Act (16 USC Section 1361 et seq.)	Compliant
Migratory Bird Treaty Act (16 USC Sections 703-712)	Compliant
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 USC Section 1801 et seq.)	Compliant
Compact of Free Association between Republic of the Marshall Islands and the United States, 48 USC § 1921	Compliant
Executive Order 11988, Floodplain Management	Compliant
Executive Order 11990, Protection of Wetlands	Compliant
Executive Order 12088, Federal Compliance with Pollution Control Standards	Compliant
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions	Compliant

Table G-1. Principal Federal and State Laws Applicable to the Proposed Action (Continued)	
Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	Status of Compliance
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations	Compliant
Executive Order 13007, Indian Sacred Sites	Compliant
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	Compliant
Executive Order 13089, Coral Reef Protection	Compliant
Executive Order 13112, Invasive Species	Compliant
Executive Order 13158, Marine Protection Areas	Compliant
Executive Order 13175, Consultation and Coordination with Indian Tribal Governments	Compliant

G.2. Coastal Zone Management

The federal CZMA of 1972 establishes a federal–state partnership to provide for the comprehensive management of coastal resources. Coastal states and territories develop site-specific coastal management programs based on enforceable policies and mechanisms to balance resource protection and coastal development needs. Under the Act, federal activity in, or affecting, a coastal zone requires preparation of a Coastal Zone Consistency Determination or a Negative Determination. Any federal agency proposing to conduct or support an activity within or outside the coastal zone that will affect any land or water use or natural resource of the coastal zone is required to do so in a manner consistent with the CZMA or applicable state coastal zone program to the maximum extent practicable.

If the proposed federal activity affects coastal resources or uses beyond the boundaries of the federal property (i.e., has spillover effects), the CZMA Section 307 federal consistency requirement applies. As a federal agency, the Department of the Air Force (DAF) is required to determine whether its proposed activities would affect the coastal zone. This takes the form of either a Negative Determination or a Consistency Determination.

For compliance with Federal Coastal Zone Consistency regulations (15 CFR Part 930) and the California Coastal Management Program, the DAF anticipates that the GBSD Test Program-related actions proposed to occur within the designated coastal zone at Vandenberg Space Force Base will be consistent with the enforceable policies of the state's certified program and would not adversely affect coastal zone resources. To comply with the program's requirements, DAF submitted a negative determination to the California Coastal Commission requesting their concurrence. On April 1, 2021 the California Coastal Commission concurred with the negative determination pursuant to Section 15 CFR 930.35(d) of the NOAA implementation regulations.

G.3. Relationship Between Short-Term Use of the Environment and Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of concern. This refers to the possibility that choosing one site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

The short-term impacts of the Minuteman III/GBSD flight tests documented in this EA/OEA are negligible in their potential impacts to the environment. Therefore, the potential for impacts on the maintenance of the affected environment and the long-term productivity of the affected environment is negligible as well. No Proposed Actions would degrade beneficial uses of the local environments analyzed in this EA/OEA.