Federal Aviation Administration

Programmatic Environmental Assessment for the Shuttle Landing Facility Reentry Site Operator License

January 2021

Programmatic Environmental Assessment (PEA) for the Shuttle Landing Facility (SLF) Reentry Site Operator License

AGENCIES: Federal Aviation Administration (FAA), lead federal agency; National Aeronautics and Space Administration, U.S. Space Force, U.S. Fish and Wildlife Service, and the National Park Service, cooperating agencies.

This PEA was prepared pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S. Code 4321, et seq.); Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations Parts 1500-1508[1]); and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: The FAA is evaluating Space Florida's proposal to operate a commercial space reentry site at the SLF. To operate a commercial space reentry site, Space Florida must obtain a Reentry Site Operator License from the FAA. Issuing a license is considered a major federal action subject to environmental review under NEPA. Under the Proposed Action, the FAA would issue a Reentry Site Operator License to Space Florida to operate the SLF as a commercial space reentry site. Space Florida is proposing to support up to a total of 17 reentries over the next 5 years (2021-2025), with a maximum of 6 reentries in any 1 year.

PUBLIC REVIEW PROCESS: The FAA released the Draft PEA for public review on October 30, 2020 and held a public meeting on December 2, 2020. The FAA provided public notice of the availability of the Draft PEA through the Federal Register and the FAA website. An electronic version of the Draft PEA was made available on the FAA's website. The FAA has considered all comments received on the Draft PEA in preparing this Final PEA.

CONTACT INFORMATION: Questions regarding the Final PEA can be submitted to Ms. Stacey M. Zee, Environmental Protection Specialist, FAA, 800 Independence Avenue SW, Suite 325, Washington, DC 20591; email slfproject@icf.com.

This environmental assessment becomes a federal document when evaluated, signed, and dated by the responsible FAA official.

DANIEL P MURRAY

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Date: 2021.01.12 13:35:48 -05'00'

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Date: January 12, 2021

Daniel Murray
Manager, Safety Authorization Division

[1] CEQ's amended regulations implementing NEPA entered into effect on September 14, 2020. Agencies have discretion to apply the amended regulations to NEPA processes that were begun before September 14, 2020 (40 CFR § 1506.13). The FAA initiated its NEPA process for this action in 2019 and has decided not to apply the amended regulations. Therefore, the prior CEQ regulations continue to apply to this NEPA process.

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Office of Commercial Space Transportation
Finding of No Significant Impact
for
Programmatic Environmental Assessment for the Shuttle Landing Facility Reentry Site Operator License

Summary

The Federal Aviation Administration (FAA) prepared the attached Final Programmatic Environmental Assessment (PEA) to analyze the potential environmental impacts of activities associated with Space Florida's proposal to operate a commercial space reentry site at the Shuttle Landing Facility (SLF). The PEA was prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] § 4321, et seq.); Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] parts 1500 to 1508); and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.[2]

After reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined that the Proposed Action would not significantly affect the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing this Finding of No Significant Impact (FONSI). The FAA has made this determination in accordance with applicable environmental laws and FAA regulations.

[2] CEQ amended its regulations implementing NEPA on September 14, 2020. Agencies have discretion to apply the amended regulations to NEPA processes that were begun before September 14, 2020 (40 CFR Section 1506.13). FAA initiated its NEPA process for this action in 2019 and has decided not to apply the amended regulations. Therefore, the prior CEQ regulations continue to apply to this NEPA process.

For any questions or to request a copy of the Final PEA, contact the following FAA Environmental Specialist. A copy of the Final PEA may also be obtained from the FAA's website: https://www.faa.gov/space/environmental/nepa_docs/

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Purpose and Need

The purpose of Space Florida's proposal is to expand the capabilities at the SLF by obtaining a Reentry Site Operator License (RSOL) from the FAA to support commercial space reentry vehicle operations. The new capabilities would include the establishment of reentry corridors and recovery and post processing operations for horizontally landed reentry vehicles. Commercial space transportation companies, such as Sierra Nevada Corporation (SNC), have expressed interest to Space Florida for the use of the SLF as a reentry site. A separate environmental document that is tiered off this PEA would be prepared to consider the environmental impacts of those proposed operations.

Space Florida's need for the RSOL is to further the State's goals to support economic activity that was negatively impacted by the termination of the National Aeronautics and Space Administration (NASA) Space Shuttle program in July 2011. Space Florida's Proposed Action would promote and encourage commercial reentry vehicle operators to use the SLF for horizontal reentries and landings. For example, SNC's proposed Dream Chaser missions would support a contract with NASA for resupply of the International Space Station. These missions, by Dream Chaser and/or other horizontal vehicles, could include experiments, space tourism, for-profit reentry services, or other related commercial space activities

Proposed Action

Space Florida proposes to operate a commercial space reentry site at the SLF. Space Florida anticipates up to one reentry in 2021, increasing to up to six reentries annually by 2025. For commercial space reentry vehicle operators proposing to reenter and land at the SLF, a separate environmental document that is tiered off this PEA would be prepared. The FAA's Proposed Action is to issue an RSOL to Space Florida to operate a commercial space reentry site at the SLF.

Alternatives

Alternatives analyzed in the PEA include (1) the Proposed Action and (2) the No Action Alternative.

Under the No Action Alternative, the FAA would not issue an RSOL to Space Florida. Spaceport-related operations would continue under Space Florida's current Launch Site Operator License, LSO 18-018, with up to 62 launch operations in 2021 and 74 launch operations in 2022. The FAA assessed the potential impacts of Space Florida's Launch Site Operator License in the 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA).[3] The No Action Alternative serves as a baseline to assess the comparative impacts of the Proposed Action. The No Action Alternative would not meet the stated purpose and need.

Public Involvement

On October 30, 2020, the FAA published the Draft PEA, beginning the public comment period. A virtual public meeting was held on December 2, 2020. The public comment period ended on December 7, 2020.

Environmental Impacts

The potential environmental impacts from the Proposed Action and No Action Alternative were evaluated in the attached Final PEA for each environmental impact category identified in FAA Order 1050.1F.

Chapter 3 of the Final PEA describes the affected environment and regulatory setting. In addition, Chapter 3 identifies those environmental impact categories that are not analyzed in detail. The PEA incorporates by reference from the 2018 EA the environmental analysis relevant to the following impact categories: air quality; climate; coastal resources; farmland; hazardous materials, pollution prevention, and solid waste; land use; natural resources and energy supply; visual effects (including light emissions); and water resources.

Chapter 4 of the Final PEA provides evaluations of the potential environmental consequences of each alternative for each of the environmental impact categories analyzed in detail and documents the finding that no significant environmental impacts would result from the Proposed Action.

[3] The 2018 EA is available at: https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/space_florida/media/SLF_FONSI_ROD_and_Final_EA_with_Appendices_508_Compliant.pdf

A summary of the documented findings for each impact category, including requisite findings with respect to relevant special purpose laws, regulations, and executive orders, follows:

- **Biological Resources (including Fish, Wildlife, and Plants)**, Final PEA Section 4.1. The Proposed Action would not result in ground disturbing activities at the SLF that could result in direct impacts to federally or state-listed threatened or endangered species. Reentry vehicle operations at the SLF (up to one in 2021 and increasing up to six in 2025) would produce sonic booms over the State of Florida with a maximum overpressure of 1.1 pounds per square foot (psf), similar to natural environmental sources such as thunder. The FAA anticipates reentry operations "may affect, but would not adversely affect" Endangered Species Act listed wildlife species in the study area. The U.S. Fish and Wildlife Service concurred with the FAA's Section 7 effect determination on May 8, 2020. The Proposed Action would not significantly increase the chance of migratory bird strikes during landing activities. The SLF has an existing Wildlife Hazard Management Plan in place to reduce the risk of bird strikes and wildlife collisions. Therefore, the Proposed Action would not result in significant impacts on biological resources.
- **Department of Transportation Act, Section 4(f)**, Final PEA Section 4.2. The study area includes over 50 parks, conservation areas, wildlife management areas, and sanctuaries. Two national wildlife refuges are included within the study area, Merritt Island National Wildlife Refuge and St. Johns National Wildlife Refuge. The Proposed Action would not result in ground disturbing activities at the SLF that could cause direct impacts to Section 4(f) resources. Operations of reentry vehicles would not require the use of any Section 4(f) properties and, therefore, would not create direct impacts to Section 4(f) properties. The Proposed Action would result in up to one sonic boom in 2021 and an increase of up to six sonic booms in 2025, with the maximum sonic boom overpressure estimated to be 1.1 psf, similar in intensity to thunder. It is estimated that, on average, residents in the study area experience overpressure from thunderstorms greater than 2.09 psf more than 20 times a year. Users of the parks, conservation areas, wildlife management areas and sanctuaries located within the study area are expected to experience similar levels of thunderstorm activity. The Proposed Action would not have other effects that would substantially impair Section 4(f) resources. Therefore, the Proposed Action would not cause a constructive use (indirect impact) of Section 4(f) resources.
- **Historical, Architectural, Archeological, and Cultural Resources**, Final PEA Section 4.3. The Proposed Action does not include ground disturbing activities and would not result in any direct

effects on historic properties. The Area of Potential Effects (APE) was modeled as the area where a sonic boom overpressure of 1 psf could occur. The potential effects to the twelve historic resources located within the APE would potentially include the introduction of short-term auditory effects on noise-sensitive historic proprieties during reentry operations, and vibration caused by reentry operations. The maximum sonic boom overpressure estimated to occur within the study area would be 1.1 psf, which is below the 2 psf threshold for damage from overpressure on well-maintained structures. In terms of auditory effects, the intensity of sonic booms associated with operation of the Proposed Action would be similar in intensity to thunder. Therefore, the FAA has determined that this undertaking will have No Adverse Effect on historic properties in the APE. On August 3, 2020, the SHPO concurred with the FAA's determination that the proposed undertaking would have "No Adverse Effect" on historic properties.

- **Noise and Noise-Compatible Land Use**, Final PEA Section 4.4. The analysis used a modeled maximum of 1.1 psf for six annual reentries (four daytime reentries and two nighttime reentries) which is equivalent to C-weighted Day-Night Level (CDNL)[4] 41.2 dBC (C-weighted decibel). Noise exposure from these operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to Day-Night Level [DNL] 65 dBA [A-weighted decibel]). Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure. The potential for hearing damage is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the approximate 4 psf impulsive hearing conservation noise criterion. Although the Proposed Action would not cause significant impacts in relation to human annoyance, hearing conservations, or structural damage, the unexpected, loud impulsive noise of sonic booms could cause a startle effect in people. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf. Therefore, the Proposed Action would not cause significant effects related to noise and noise-compatible land use.
- **Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks**, Final PEA Section 4.5. A reentry vehicle operator would employ 10 to 40 people for post-reentry procedures. The potential increase of up to 40 employees from the Proposed Action would not

[4] CDNL is the C-weighted Day-Night Level (DNL). C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

significantly affect Brevard or Volusia county's labor force or result in an increase in population. The traffic levels at Cape Canaveral Spaceport[5] are currently low and have sufficient capacity to accommodate minor increases in traffic that could be associated with the up to six proposed launches annually. The Proposed Action does not include the construction or development of facilities at the SLF that would directly affect environmental justice minority and low-income populations. Similarly, operation of the Proposed Action would not result in significant impacts to any resource that would affect minority and/or low-income populations. The 33 public schools within the study area would be affected by up to one sonic boom in 2021, increasing to up to six sonic booms in 2025, with a maximum overpressure of 1.1 psf. Therefore, the potential for routine classroom disruption is negligible and would not significantly affect children's environmental health or safety. Implementation of the Proposed Action would not cause significant effects with respect to socioeconomics, environmental justice, or children's environmental health and safety risks.

Please refer to Chapter 4 of the Final PEA for a full discussion of the determination for each environmental impact category.

Chapter 4, Section 4.6 of the Final PEA provides an analysis of the potential cumulative impacts of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. The FAA has determined that the Proposed Action would not result in significant cumulative impacts in any environmental impact category.

Agency Finding and Statement

The FAA has determined that no significant impacts would occur as a result of the Proposed Action and, therefore, that preparation of an Environmental Impact Statement is not warranted and a FONSI in accordance with 40 CFR Section 1501.4(e) is appropriate.

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

[5] Cape Canaveral Spaceport includes both NASA's Kennedy Space Center, where the SLF is located, and the Cape Canaveral Air Force Station.

APPROVED: DANIEL P MURRAY Digitally signed by DANIEL P MURRAY Date: 2021.01.12 13:41:45 -05'00' DATE: January 12, 2021

Daniel Murray
Manager, Safety Authorization Division

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

A

APE	Area of Potential Effects
ATC	Air Traffic Control

B

C

CCAFS	Cape Canaveral Air Force Station
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CDNL	C-weighted DNL

D

dB	Decibel
dBC	C-weighted Decibel
DNL	Day-Night Level
DHR	Division of Historic Resources

E

EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act

F

FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FR	Federal Register
FWC	Florida Fish and Wildlife Conservation Commission

G

H

HUD	Housing and Urban Development

I

ISS	International Space Station

K

Km	Kilometer
KSC	Kennedy Space Center

L

LOA	Letter of Agreement
LSOL	Launch Site Operator License

M

MSL	Mean Sea Level

N

NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOTAMS	Notices to Airmen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
NWS	National Weather Service

O

P

psf	Pounds per square foot
PEA	Programmatic Environmental Assessment

Q

R

RCS	Reaction Control System
RSOL	Reentry Site Operator License

S

SHPO	State Historic Preservation Office
SLF	Shuttle Landing Facility
SNC	Sierra Nevada Corporation
SPCC	Spill Prevention Control and Countermeasures
STOF	Seminole Tribe of Florida

T

TDAT	Tribal Directory Assessment Tool
TFR	Temporary Flight Restriction

U

UAV	Unmanned Vehicles
U.S.	United States
U.S.C.	United States Code
USAF	United States Air Force
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USSF	United States Space Force

V

W

X

Y

Z

CHAPTER 1

INTRODUCTION

Space Florida[6] is applying for a Reentry Site Operator License (RSOL) for the Shuttle Landing Facility (SLF) (see **Figure 1-1)**, located at the Cape Canaveral Spaceport[7]. Space Florida currently holds a Launch Site Operator License (LSOL) (License Number: LSO 18-018)[8] to operate the SLF[9]. Under the Proposed Action addressed in this Programmatic Environmental Assessment (PEA), the Federal Aviation Administration (FAA) would issue a RSOL to Space Florida for the operation of a commercial space reentry site at the SLF.

This PEA analyzes the impacts of the activities associated with Space Florida's RSOL programmatic document is a type of general, broad NEPA review from which subsequent NEPA documents can be tiered, focusing on the issues specific to the subsequent action (40 CFR § 1502.2).

If commercial vehicle operators apply to the FAA for reentry licenses to conduct reentry operations at the SLF, a separate environmental document, tiering off this PEA, would be developed to support the issuance of a reentry license to the prospective reentry operator(s). The tiered environmental document would be a more detailed analysis based on vehicle specific operations. Additional information on the programmatic environmental review process and how it applies to this project is provided in **Appendix C: Using this Programmatic EA to Tier Future NEPA Reviews**.

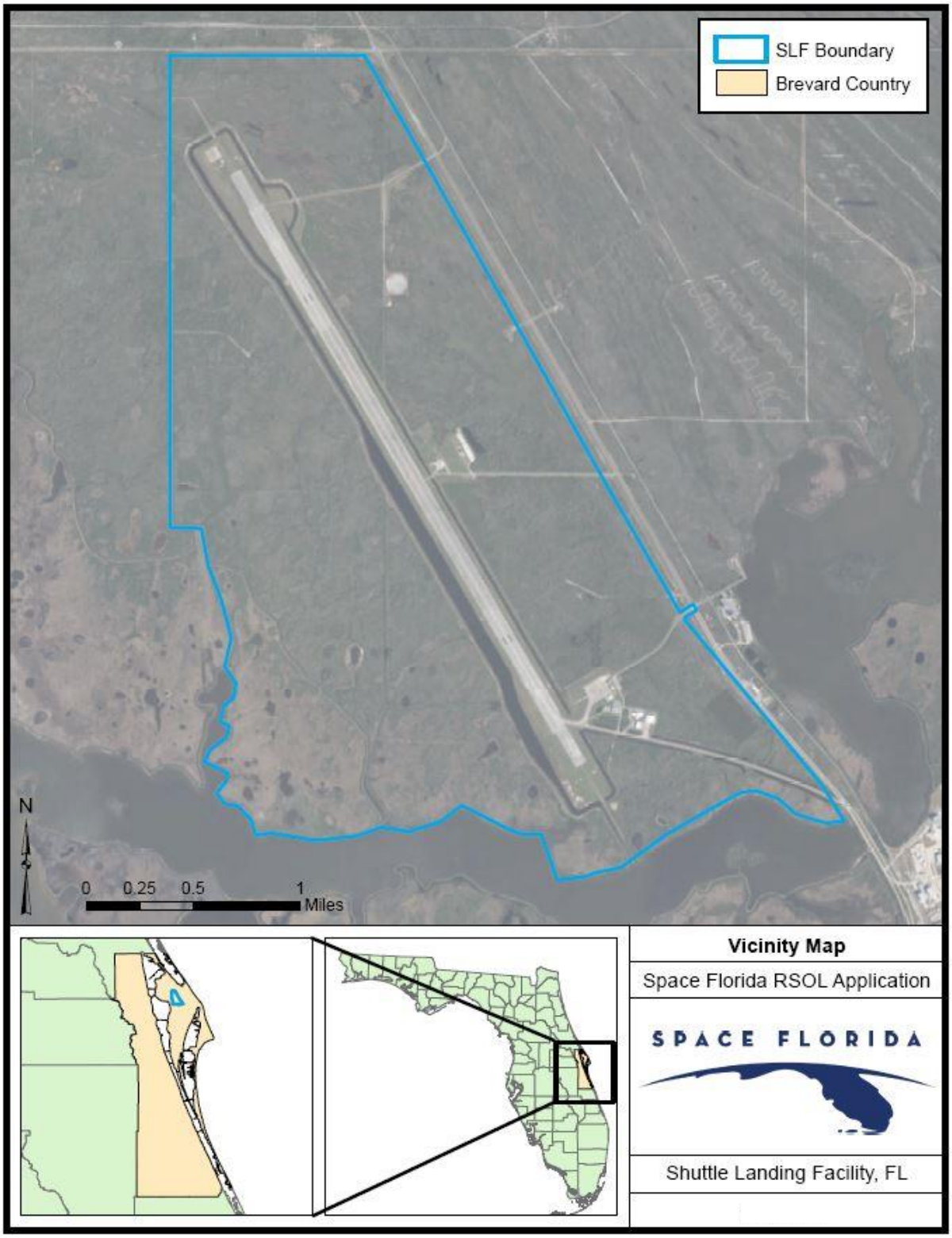
This PEA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action described in **Chapter 2**. The successful completion of the environmental review process does not guarantee that the FAA would issue a RSOL to Space Florida. The Proposed Action must also meet FAA safety, risk, and financial responsibility requirements established in 14 CFR Part 400.

Figure 1-2 shows a complete mission of a potential reentry vehicle. The SLF does not support vertical launches; therefore, launch activities for the reentry vehicle would occur at another FAA-licensed site under a separate license. The impacts of any reasonably foreseeable launch activities are covered in **Section 4.6 Cumulative Impacts**.

The launch site and launch vehicle operator require separate licenses to conduct a mission. This EA assumes the site operator and vehicle operator have the licenses, or other authorizations, to conduct a vertical launch at an approved launch site.

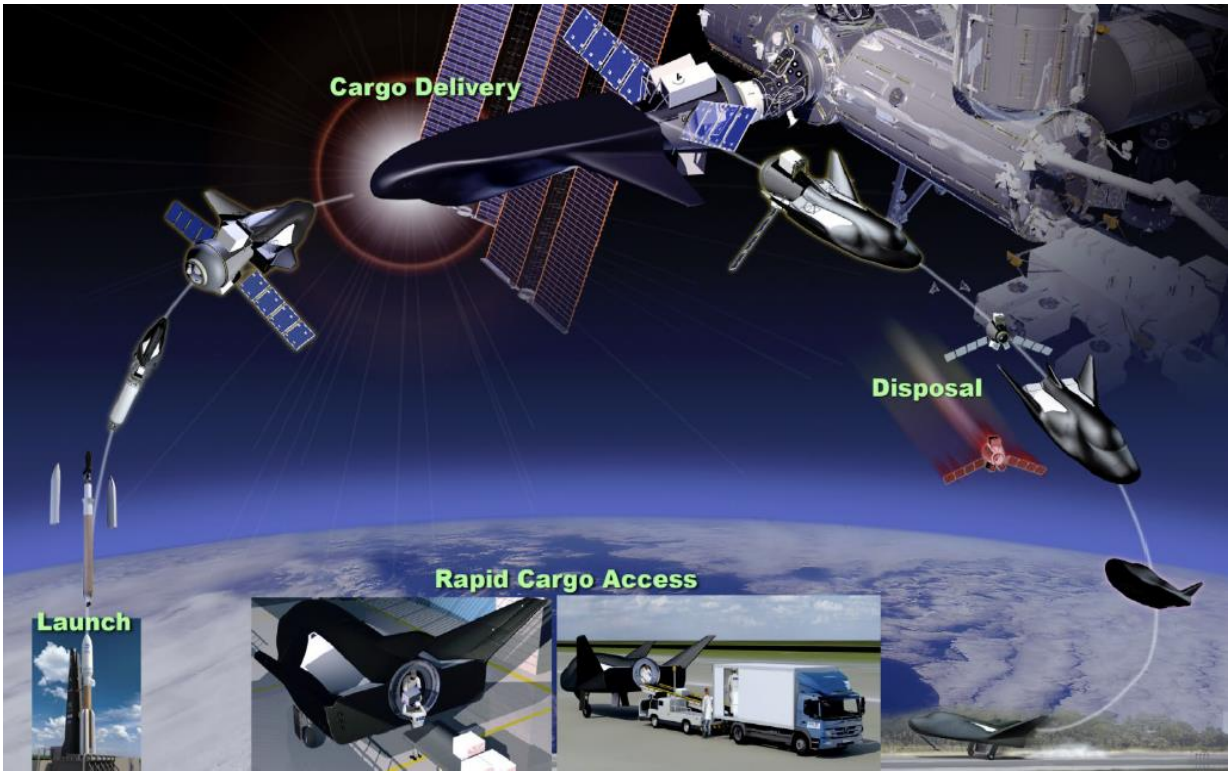
[6] As the State of Florida's aerospace economic development agency and spaceport authority, Space Florida is an independent Special District of the State of Florida, created by Chapter 331, Part II, Florida Statutes, for the purposes of fostering the growth and development of a sustainable and world-leading space industry in Florida.
[7] The Cape Canaveral Spaceport covers the same areas as the National Aeronautics and Space Administration's (NASA's) John F. Kennedy Space Center (KSC) and the Cape Canaveral Air Force Station (CCAFS). Florida Statute 331.304, states that CCAFS and John F. Kennedy Space Center may be referred to as the Cape Canaveral Spaceport.
[8] The 2018 *Final Environmental Assessment for the Shuttle Landing Facility Launch Site Operator License* (2018 EA) covers the Launch Site Operator License.
[9] In addition to the licensing requirements, Space Florida must also comply with their land agreement with NASA: *Kennedy Space Center Agreement 4412, Property Agreement between The National Aeronautics and Space Administration John F. Kennedy Space Center and Space Florida for the Transfer of Operations and Management of the Shuttle Landing Facility*.

FIGURE 1-1: VICINITY MAP



Source: (FAA, 2018)

FIGURE 1-2: REENTRY VEHICLE OPERATION



Source: (SierraNevadaCorporation, 2019)

1.1 BACKGROUND

Between 1984 and 2011, a total of 78 Space Shuttle orbiter landings occurred at the SLF located at Cape Canaveral Spaceport. During the last 20 years of the Space Shuttle program, landings at the SLF occurred at an average rate of four (4) per year, during years when the orbiter landed in Florida, and up to a maximum of eight (8) landings in 1997. Space Shuttle orbiter reentries and landings ceased in 2011 at the end of the Space Shuttle program. Starting in May 2017, the United States (U.S.) Air Force X-37B reentered and landed at the SLF, demonstrating the facility's continued ability to support orbital reentry and landing.

The FAA previously analyzed the potential environmental impacts of issuing a LSOL to Space Florida for the operation of a commercial space launch site at the SLF in the 2018 EA. The 2018 EA, which is hereby incorporated by reference, evaluated the potential environmental impacts of construction and operation of a commercial horizontal launch site at the SLF at Cape Canaveral Spaceport. The 2018 EA assessed Concept Y and Concept Z vehicles with annual launches ranging from 14 launches in 2018 to 74 launches by 2022. The FAA determined that issuing a LSOL, including construction and operation of the commercial launch site, would not significantly affect the quality of the human environment pursuant to Section 102(2)(c) of NEPA and issued a Finding of No Significant Impact (FONSI) on November 2, 2018.

The Proposed Action described in this PEA falls outside the scope of the 2018 EA because (1), the propellants and flight characteristics of the described reentry vehicle are different than the reusable

launch vehicles assessed in the 2018 EA (see **Section 2.1.1**) and (2), the proposed study area includes new areas over the state of Florida that were not analyzed in the 2018 EA (see **Chapter 3**). To focus this PEA on impacts specific to FAA's Proposed Action, valid and current information and analysis from the 2018 EA is summarized and incorporated by reference for relevant portions of the affected environment section (see Chapter 3 for more information). This PEA expands on the analysis provided in the 2018 EA to include an analysis of the potential environmental impacts of the operational activities associated with licensing the SLF as a commercial space reentry site. An electronic copy of the 2018 EA can be downloaded from the FAA website at:
https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/space_florida/media/SLF_FONSI_ROD_and_Final_EA_with_Appendices_508_Compliant.pdf

The National Aeronautics and Space Administration (NASA) is currently assessing the potential environmental impacts of Space Florida developing Blocks 2 through 6 in the area around the SLF, to accommodate future SLF operations, capabilities, and supporting infrastructure. The proposed construction of SLF Blocks will be addressed separately through an Environmental Assessment beginning in 2020 for which NASA is the lead agency.

1.2 FEDERAL AGENCY ROLES

1.2.1 Lead Agency Role

As the lead Federal agency, the FAA is responsible for analyzing the potential environmental impacts of the Proposed Action and reasonable alternatives. The issuance of an RSOL would allow the activities described in this PEA to be conducted at the SLF. As authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities* (49 *Federal Register* 7099, 3 CFR, 1984 Comp., p. 163), and Chapter 509 of Title 51 of the U.S. Code, the FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-Federal launch and reentry sites. The FAA's mission is to ensure public health and safety and the safety of property while protecting the national security and foreign policy interests of the U.S. during commercial launch and reentry operations. In addition, Congress directed the FAA to encourage, facilitate, and promote commercial space launches and reentries.

1.2.2 Cooperating Agency Roles

A cooperating agency is an agency, other than the lead agency, that has jurisdiction by law or special expertise regarding any environmental impact resulting from a proposed action or reasonable alternative. NASA, U.S. Space Force (USSF), U.S. Fish and Wildlife Service (USFWS), and the National Park Service (NPS) are cooperating agencies for this PEA due to their special expertise and jurisdictions (40 CFR §§ 1508.15 and 1508.26). The cooperating agencies and the roles of these agencies have not changed from the 2018 EA.[10]

[10] The USSF was established in 2019 within the Department of the Air Force. The Secretary of the Air Force has overall responsibility for the USSF under the Secretary of Defense (USAF, 2020).

1.3 PURPOSE AND NEED

The purpose and need provides the foundation for identifying intended results or benefits and future conditions. In addition, the purpose and need defines the range of reasonable alternatives to a proposed action.

The purpose of Space Florida's proposal is to expand the capabilities at the SLF by obtaining an RSOL from the FAA to support commercial space reentry vehicle operations. Commercial space transportation companies, such as Sierra Nevada Corporation and its Dream Chaser vehicle, have contacted and coordinated with Space Florida for the use of the SLF. The new capabilities would include the establishment of reentry corridors and recovery and post processing operations for horizontally landed reentry vehicles, such as the Dream Chaser.

Space Florida's need for the RSOL is to further the State's goals to support economic activity that was negatively impacted by the termination of the NASA Space Shuttle program in July 2011. Space Florida's Proposed Action, as described in **Chapter 2**, would promote and encourage commercial reentry vehicle operators to use the SLF for horizontal landings. For example, Sierra Nevada's future Dream Chaser missions will be in support of a contract with NASA for resupply of the International Space Station. These missions are purchased by NASA to provide a commercial resupply service, but Dream Chaser remains owned and operated by Sierra Nevada Corporation. This relationship allows the vehicle to be used to support additional missions for other government and non-government customers. These missions, by Dream Chaser and/or other horizontal vehicles, could include experiments, space tourism, for-profit reentry services, or other related commercial space activities.

1.4 AGENCY INVOLVEMENT

Space Florida distributed early coordination letters to various federal, state, and local agencies. See **Appendix A-1** for the early coordination letters and list of agencies and Native American Tribes contacted for this PEA. During the early coordination efforts, the following agencies provided comments:

- U.S. Environmental Protection Agency
- City of Titusville – Planning
- Florida Department of Environmental Protection State Clearinghouse

The FAA conducted National Historic Preservation Act Section 106 and Government-to-Government consultation with Native American Tribes and the Florida State Division of Historic Resources (the State Historic Preservation Office). See **Appendix A-2** and **Appendix A-4** for correspondence and a list of Native American Tribes contacted.

The FAA consulted with USFWS on potential impacts to biological resources. See **Appendix A-3** for Endangered Species Act Section 7 correspondence.

The FAA provided cooperating agencies with an opportunity to review and submit comments during the development of the PEA. During the Draft PEA public review period, NPS submitted one comment (see **Appendix A-6**); no other Federal agencies submitted comments during the public review period.

1.5 PUBLIC INVOLVEMENT

The FAA released the Draft PEA for public review on October 30, 2020 on the FAA Office of Commercial Space Transportation NEPA website (https://www.faa.gov/space/environmental/nepa_docs/slf_ea/). The FAA provided public notice of the availability of the Draft PEA for public review and comment through the Federal Register and local newspaper advertisements. The FAA held a virtual public meeting on December 2, 2020 and the public review period ended on December 7, 2020. The FAA received 2 public comments (see **Appendix A-6**).

The FAA also developed a project website, linked here:
https://www.faa.gov/space/stakeholder_engagement/shuttle_landing_facility/

Interested parties were able to use this link to review additional project information and subscribe to the project mailing list. For a summary of internal and external stakeholder engagement activities for this project, see **Appendix A-5**.

CHAPTER 2

PROPOSED ACTION / ALTERNATIVES

This chapter describes the Proposed Action considered in this Draft PEA. This chapter also describes a No Action Alternative. FAA Order 1050.1F, Paragraph 6-2.1 states, "An EA may limit the range of alternatives to the proposed action and no action alternative when there are no unresolved conflicts concerning alternative uses of available resources." In the absence of unresolved conflicts (**Chapter 4** provides detailed descriptions as to why there are no unresolved conflicts), the consideration of other alternatives to avoid or minimize potential effects are not warranted. Therefore, the No Action Alternative and Proposed Action described and analyzed in this PEA represent the range of reasonable alternatives commensurate with the nature of the project.

2.1 PROPOSED ACTION

This PEA expands on the analysis provided in the 2018 EA to include analysis of the potential environmental impacts of the FAA issuing Space Florida an RSOL to operate a commercial space reentry site at the SLF and support orbital reentries. This PEA also analyzes operations associated with the reentry vehicles, including the Dream Chaser vehicle, including the reentry flight path, landing, and recovery activities, which are described in the subsections below.

Applicants proposing to reenter and land at the SLF would prepare a separate environmental document that is tiered off this PEA to support their reentry operator application. This subsequent tiered EA would include details on the proposed vehicle and reentry operations and associated activities.

Under the Proposed Action, the reentry site boundary is defined as the property boundary of the SLF as shown in **Figure 1-1**.

2.1.1 Reentry Vehicle

Table 2-1 summarizes the reentry vehicle parameters. The purpose of describing these parameters is to broadly assess the potential impacts of reentry vehicle operations at the SLF. The reentry vehicle parameters considered in this PEA are based on the existing Sierra Nevada Corporation (SNC) *Dream Chaser*® spacecraft, shown in **Figure 2-1.**

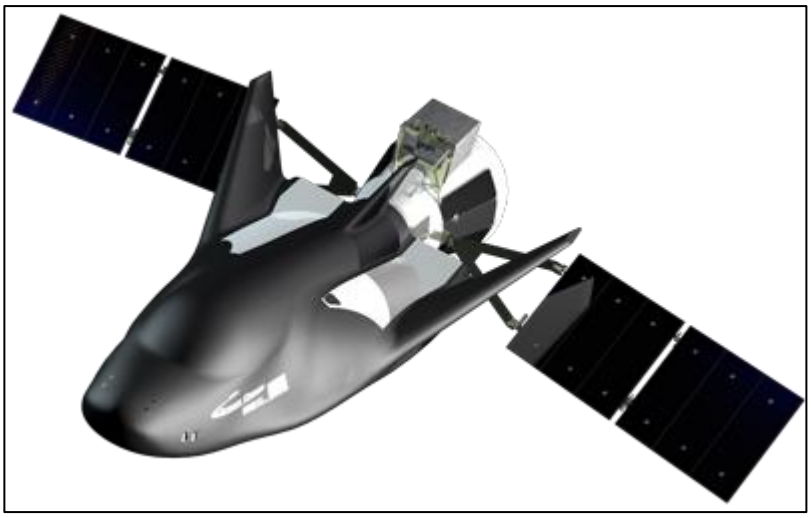
TABLE 2-1: REENTRY VEHICLE PARAMETERS

Characteristic	Data
Vehicle Length	30 ft
Wingspan	27 ft
Gross Vehicle Weight	24,600 lbs
Landing Gear Configuration	Nose skid and two rear wheels
Runway Length Required for Landing	10,000 ft
Cross-Range Capability	± 700 nmi
Propellants[1]	Hydrogen Peroxide (H_2O_2) and Kerosene (RP-1)
Return Payload Capacity	1,850 kg

[1] Dream Chaser propellants are used by a reaction control system (RCS) for orbital maneuvers, deorbit burn, and high-altitude control during reentry. The system is not used near or on the ground.

Source: (SierraNevadaCorporation, 2019)

FIGURE 2-1: REENTRY VEHICLE



Note- this picture represents the configuration of the vehicle when in orbit.
Source: (SierraNevadaCorporation, 2019)

The Dream Chaser is owned and operated by SNC. Dream Chaser missions are, in part, to support a NASA/SNC contract to resupply the International Space Station (ISS). NASA purchases these missions to provide a commercial resupply service, thus allowing the vehicle to be used to support additional missions for other government and non-government customers. If SNC applies to the FAA for a reentry license, SNC would prepare a separate EA, tiered off this PEA, for the FAA's review.

2.1.1.1 Pre-Flight Activities

The pre-flight activities that are relevant to environmental concerns include:

- notifying Space Florida before a launch of a vehicle that intends to land at the SLF,
- coordinating all operations with the control tower chief, and
- notifying other appropriate scheduling agencies in accordance with Space Florida's Scheduling and Notification Plan.

Designated Space Florida personnel would notify the reentry operator of other activities at the SLF and resolve potential conflicts for use. Space Florida would also work with the KSC Spaceport Integration Office to ensure that planned reentries would not interfere with NASA, USFWS, USSF, NPS, National Security Agency, National Geospatial-Intelligence Agency, National Oceanic and Atmospheric Administration, or other commercial operations.

2.1.2 Pre-Reentry Activities

Following procedures and plans outlined in the LSOL and RSOL, flight and ground crews would be trained for nominal and non-nominal operations before each reentry, and training would be repeated with various failure scenarios and irregular performance to ensure crew readiness.

2.1.3 Reentry Vehicle Flight Paths

This section describes the representative reentry vehicle flight paths used to assess the potential environmental impacts of Space Florida's RSOL. Specific vehicle flight paths for prospective reentry vehicle operators would be assessed in separate NEPA documents tiered from this PEA (for more information, see **Appendix C**: Using this Programmatic EA
to Tier Future NEPA Reviews).

The reentry vehicle would reenter from west/southwest on an ascending reentry trajectory before landing at the SLF. Ascending reentry trajectories would include high atmospheric overflight of Central American countries as well as overflight of the southern half of Florida, south of 29° North latitude.

The reentry vehicle would descend below 60,000 feet altitude above mean sea level (MSL) approximately 30-40 miles from the SLF prior to landing and would be operating below 60,000 MSL for less than 30 seconds before entering Cape Canaveral Restricted Airspace. The reentry vehicle would remain in the Cape Canaveral Restricted Airspace for the remainder of its reentry and landing at the SLF (for approximately 2.5 – 3 minutes). The FAA would issue Temporary Flight Restrictions (TFRs) for the reentry vehicle's operation outside of the Cape Canaveral Restricted Airspace as described in the reentry vehicle operator's Letter of Agreement (LOA) with FAA Air Traffic Control. If reentry vehicle operators apply to the FAA for a reentry vehicle license, operator-specific TFRs would be discussed in subsequent tiered NEPA documents from this PEA.

There is a potential for aircraft hazard areas to extend outside of the Cape Canaveral Restricted Airspace. Specific aircraft hazard areas will be considered as part of tiered NEPA analyses for specific reentry vehicles.

The reentry vehicle's trajectories over Florida for landings on Runway 15 and Runway 33 are shown in **Figure 2-2** and **Figure 2-3**.

2.1.4 Proposed Reentry Operations

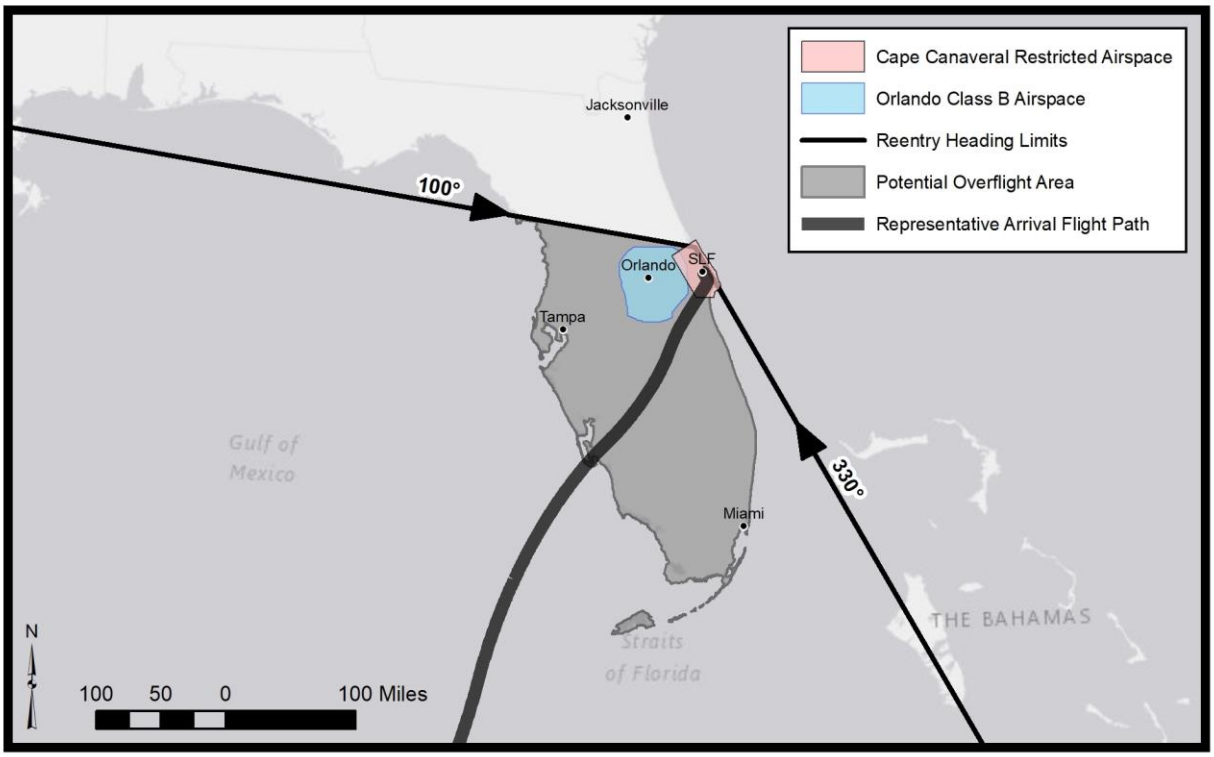
Space Florida anticipates up to 6 reentries a year (4 daytime and 2 nighttime) with a steady ramp-up beginning in 2021 (see **Table 2-2**). The reentry vehicle's cargo module would be disposed of during reentry and any surviving debris would be intentionally placed in a remote part of the Pacific Ocean in compliance with the regulations set forth in Part 435 and coordinated through the reentry vehicle license and resulting FAA Air Traffic and U.S. Coast Guard LOAs. Based on flight safety analysis conducted in developing their license application, Space Florida anticipates that there are no areas within the State of Florida that will exceed individual risk criteria limits. Therefore, Space Florida does not expect the operation of reentry vehicles to the SLF to require any closures of non-involved KSC property or public use areas (e.g., Merritt Island National Wildlife Refuge, Canaveral National Seashore).

TABLE 2-2: ESTIMATED ANNUAL NUMBER OF REENTRIES

Vehicle	2021	2022	2023	2024	2025
Reentry Vehicle	1	2	3	5	6

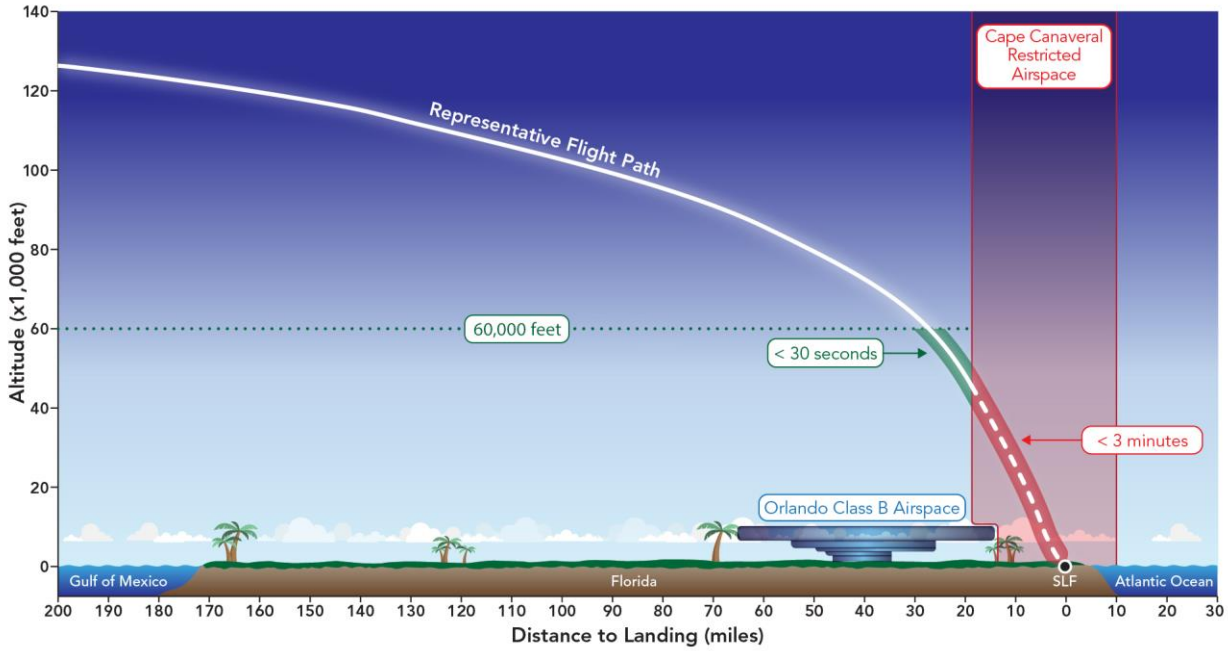
Source: (SpaceFlorida, 2019)

FIGURE 2-2: REENTRY VEHICLE FLIGHT PATH APPROACHES



Source: (SierraNevadaCorporation, 2019)

FIGURE 2-3: REENTRY VEHICLE REPRESENTATIVE FLIGHT PATH



Source: (SNC, Kimley Horn, 2020)

2.1.5 Post-Reentry Propellant Handling and Procedures

Propellant handling operations, following landing and wheel-stop, and unloading of cargo would follow procedures that are dependent on the cargo manifest needs.

This PEA presents the potential procedures operators would conduct to process their reentry vehicle. The first activity following landing is to approach and begin safing the reentry vehicle on the runway. This can include disengaging and locking out the propulsion systems, aerodynamic systems, pressurized systems, braking systems, and other safety checks for the safe handling of the reentry vehicle. The reentry vehicle operator would unload time-critical cargo (if necessary) and then tow the vehicle to a designated location, as defined in the explosive site plan. At that time, all residual propellants are removed or diluted (as required), offloaded into approved storage containers, and are transported and disposed of in an approved method.

Runway 15/33 is unavailable to other operations/activities while the reentry vehicle is stopped on the runway. After the reentry vehicle is removed from the runway, Space Florida would perform a runway inspection to ensure the safety of reopening the runway to other aircraft/spacecraft. Lastly, the reentry vehicle is prepped for transportation back to its home facility. This includes placing the reentry vehicle into a transportation safe configuration. This may include loading onto a transport fixture, folding the wings, stowing the landing gear, and/or protection of sensitive surfaces.

Space Florida and reentry vehicle operators may employ 10 to 40 people for post-reentry procedures. This could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations.

2.2 NO ACTION ALTERNATIVE

NEPA requires agencies to consider a "no action" alternative in their NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s). Thus, the No Action Alternative serves as a baseline to assess the comparative impacts of the action alternative(s), including the Proposed Action. Under the No Action Alternative, the FAA would not issue an RSOL to Space Florida. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022).

If Space Florida does not acquire an RSOL, the Space Florida business model, as briefed to the State, would no longer be viable and would require reevaluation of management of the SLF. Space Florida would not be able to sponsor the permitted and priority use for commercial space operation as identified in the NASA Use Permit.[11] Furthermore, NASA has contracted with commercial companies, such as SNC, to provide commercial resupply with the requirement of landing at the SLF. Given the commercial designation of the mission in the contract between SNC and NASA, FAA licenses are required by both the vehicle operator and the site in order to conduct missions. The No Action Alternative would prohibit the execution of the contract in support of NASA ISS resupply. Existing operations would continue at the SLF.

The No Action Alternative would not satisfy the FAA's need to fulfill its responsibilities under EO 12465 and Chapter 509 of Title 51 of the U.S. Code for oversight of commercial space launch activities and would not satisfy Space Florida's need to further the State's goals to support economic activity that was negatively impacted by the termination of the NASA Space Shuttle program in July 2011. This need is also consistent with direction in the National Space Transportation Policy (November 21, 2013).

[11] Space Florida promotes economic development activities for space industry needs, including attracting, retaining, and expanding aerospace or supply chain businesses that create economic opportunities in Florida. Space Florida responded to a NASA request, or, Notice of Availability for proposals to operate and manage the SLF. In 2013, the NASA selected Space Florida to manage and operate the SLF. In June 2015, Kennedy Space Center transferred the management, development, and operation of the SLF to Space Florida.

CHAPTER 3

AFFECTED ENVIRONMENT

This chapter provides a description of the geographic area that the Proposed Action may affect as required by FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures.*

The study area for this PEA is the geographic area that could be directly or indirectly affected by the Proposed Action. The Proposed Action would not result in ground disturbing activities or directly affect the Shuttle Landing Facility (SLF). Therefore, the study area for this PEA is based on the composite of landings on Runway 15 or Runway 33 and the resulting combined footprint of the reentry vehicle's 1.0 pounds per square foot (or psf) sonic boom noise contour as it descends to land at the SLF (see **Section 3.4** for further description about how the sonic boom was calculated). The study area encompasses about 280 square miles including portions of Brevard and Volusia counties and extends over a portion of the Atlantic Ocean (see **Figure 3-1**).

The Proposed Action in the PEA is not expected to result in impacts to several environmental categories described below. Although the study area in this PEA is not the same as the study area in the 2018 EA, they are located in the same two counties and the affected environment is expected to be similar. Therefore, per Section 1502.21 of the CEQ Regulations, this PEA incorporates by reference from the 2018 EA the environmental analyses relevant to the below impact categories:

- **Air Quality**: There would be no combustion from reentry vehicles once the deorbit burn completes, so the Proposed Action would not significantly affect air quality.
- **Climate**: There would be no combustion from reentry vehicles once the deorbit burn completes, so the Proposed Action would not significantly affect climate.
- **Coastal Resources**: The Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Florida Coastal Management Program and would not adversely affect coastal resources, create plans to direct future agency actions, propose rulemaking that alters uses of the coastal zone that are inconsistent with the Program, or involve Outer Continental Shelf leases.
- **Farmland**: The operation of reentry vehicles would not disturb soils, nor would the operations significantly effect air quality, water quality, or noise in a way that may affect farmlands. For more information on noise impacts, see **Section 3.4** and **4.4**,
- **Hazardous Materials, Pollution Prevention, and Solid Waste**: Operations at the SLF would involve the use and storage of hazardous materials that are similar to those currently handled at the SLF. Significant quantities of additional hazardous materials would not be permanently stored onsite. Under the Proposed Action, hazardous material use, storage, and disposal would comply with applicable regulations, thus minimizing the potential effects from those materials. Due to the limited number of reentries under the Proposed Action, the increase in hazardous waste generation would be minimal.
- **Land Use**: Reentry vehicle operations would be compatible with the existing operations that occur at the SLF, so the Proposed Action would not significantly impact land use.
- **Natural Resources and Energy Supply**: Reentry vehicle operations would not place excessive demands on local supplies of natural resources, fuel, or energy. Therefore, the Proposed Action would not significantly impact Natural Resources and Energy Supply.

- **Visual Effects (including Light Emissions)**: As required by NASA, lighting that is visible from the exterior of the proposed facilities would comply with the KSC Exterior Lighting Guidelines, the LMP, and requirements of the USFWS Biological Opinion for KSC impacts to threatened and endangered species. The operation of reentry vehicles at the SLF would be visually similar to aircraft currently operating at the SLF. Therefore, the Proposed Action would not cause significant impacts from light emissions or visual effects.
- **Water Resources**: Operation of reentry vehicles and facilities would not affect wetlands. The measures required by Space Florida's NPDES permit, Environmental Resources Permit, SPCC Plan, and the SLF emergency spill plan would ensure the Proposed Action would not cause surface water quality impacts which would exceed applicable water quality standards, or contaminate public drinking water supplies. The Proposed Action does not include develop or construction activities and would therefore not impact floodplains or groundwater. Therefore, the Proposed Action would not significantly impact water resources.

This chapter describes in detail only those environmental impact categories that have the potential to be affected by the Proposed Action; which include:

- **Section 3.1**- Biological Resources (including fish, wildlife, and plants)
- **Section 3.2**- Department of Transportation Act, Section 4(f)
- **Section 3.3**- Historical, Architectural, Archaeological, and Cultural Resources
- **Section 3.4**- Noise and Noise-Compatible Land Use
- **Section 3.5**- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

This information establishes a baseline for use in determining the potential effects of the Proposed Action and No Action Alternative.

3.1 BIOLOGICAL RESOURCES

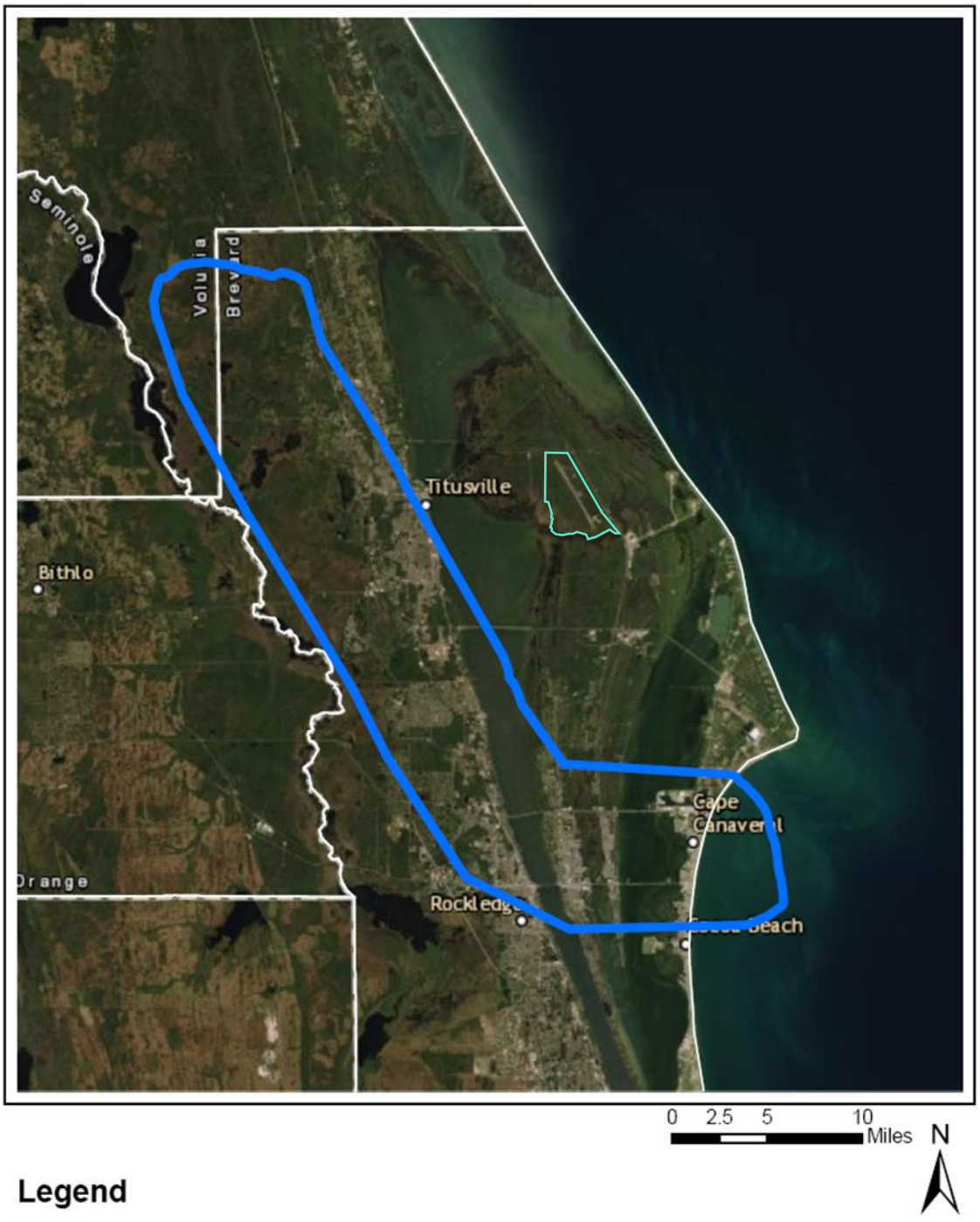
The study area encompasses a variety of habitats ranging from developed land to undeveloped forested land and aquatic environments. Federally listed and/or state-listed threatened or endangered species may use these habitats. **Table 3-1** lists the federally listed and state-listed threatened and endangered species that the U.S. Fish and Wildlife Service (USFWS) and Florida Fish and Wildlife Conservation Commission (FWC) identify as having the potential to occur in the counties within the study area.

Bald eagles, protected by the Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668 et seq.), have been observed in the study area. There are 23 known active bald eagle nests within the study area (see **Figure 3-2**). **Figure 3-2** reflects 2019 conditions; therefore, there could be additional bald eagle nests in the area. Golden eagles are not present in the study area.

The study area also intersects areas designated as Marine Protected Areas of the Merritt Island National Wildlife Refuge (NWR) and critical habitat for the West Indian Manatee (USFWS, 2016b).

The Proposed Action would have no effect on plants of any kind because there are no ground-disturbing activities. Therefore, given the lack of impacts, plant species are not included in **Table 3-1**.

FIGURE 3-1: STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019)

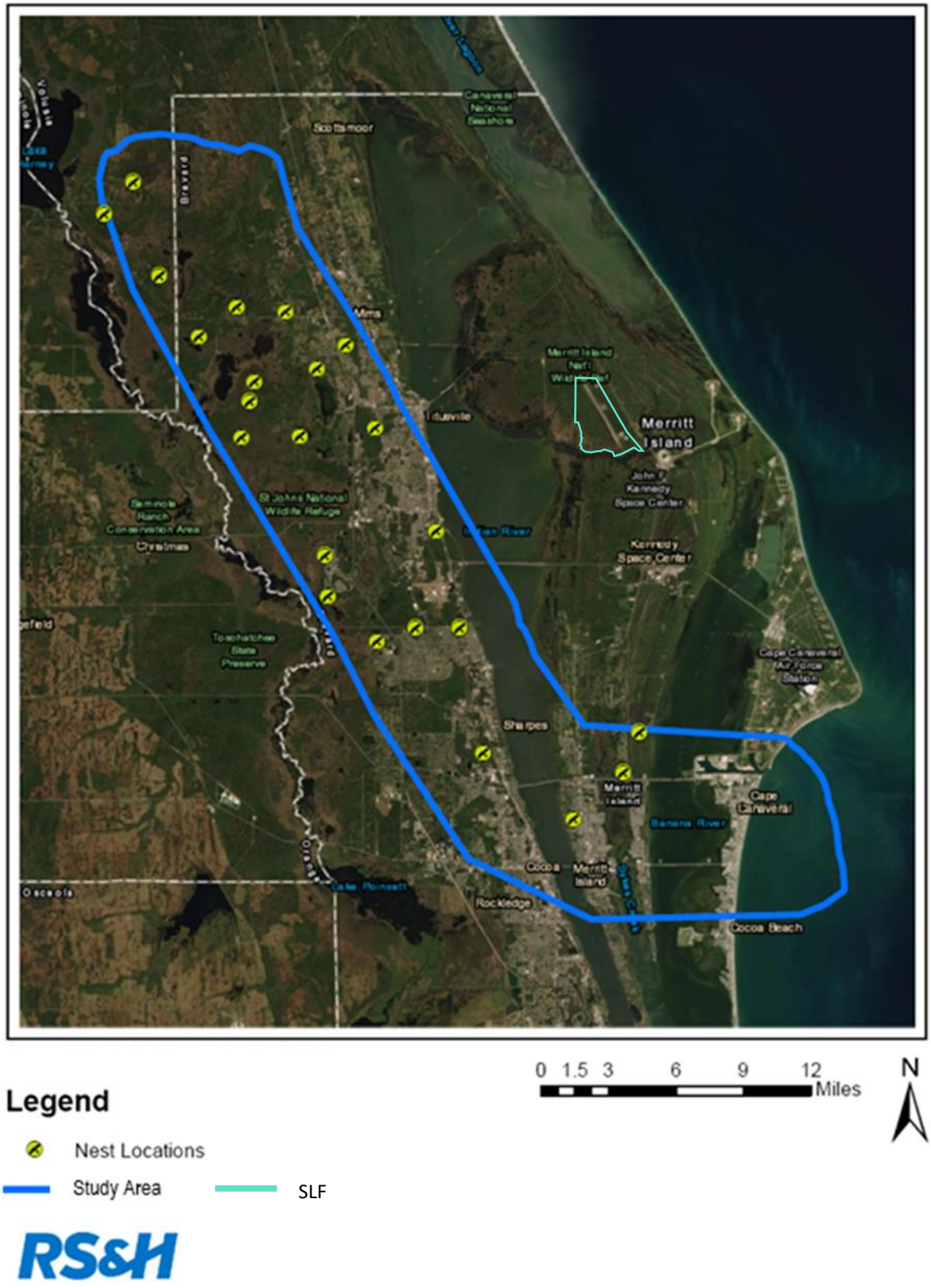
TABLE 3-1: FEDERALLY LISTED AND STATE-LISTED THREATENED AND ENDANGERED SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA

Common Name (*Scientific Name*)	Federal Status	State Status
Birds		
Audubon's Crested Caracara (*Polyborus plancus audubonii*)	Threatened	Threatened
Eastern Black Rail (*Laterallus jamaicensis ssp. jamaicensis*)	Proposed Threatened	Proposed Threatened
Everglades Snail Kite (*Rostrhamus sociabilis plumbeus*)	Endangered	Endangered
Florida Sandhill crane (*Grus canadensis pratensis*)	N/A	Threatened
Florida scrub-jay (*Aphelocoma coerulescens*)	Threatened	Threatened
Least tern (*Sternula antillarum*)	N/A	Threatened
Piping Plover (*Charadrius melodus*)	Threatened	Threatened
Red Knot (*Calidris canutus rufa*)	Threatened	Threatened
Red-Cockaded woodpecker (*Picoides borealis*)	Endangered	Endangered
Southeastern American kestrel (*Falco sparverius paulus*)	N/A	Threatened
Wood stork (*Mycteria americana*)	Threatened	Threatened
Black skimmer (*Rynchops niger*)	-	Threatened
Little blue heron (*Egretta caerulea*)	-	Threatened
Reddish egret (*Egretta rufescens*)	-	Threatened
Roseate spoonbill (*Platalea ajaja*)	-	Threatened
Snowy plover *(Charadrius nivosus*)	-	Threatened
Tricolored heron (*Egretta tricolor*)	-	Threatened
Florida burrowing owl (*Athene cunicularia floridana*)	-	Threatened
Mammals		
Southeastern Beach Mouse (*Peromyscus polionotus niveiventris*)	Threatened	Threatened
West Indian Manatee (*Trichechus manatus*)	Threatened	Threatened
North Atlantic Right Whale (*Eubalaena galcialis*)	Endangered	-
Reptiles		
Atlantic Salt Marsh Snake (*Nerodia clarkia taeniata*)	Threatened	Threatened
Eastern Indigo snake (*Drymarchon corais couperi*)	Threatened	Threatened
Gopher Tortoise (*Gopherus polyphemus*)	Candidate	Threatened
Green sea turtle (*Chelonia mydas*)	Threatened	Endangered
Hawksbill sea turtle (*Ertmochelys imbricata*)	Endangered	Endangered
Kemp's Ridley sea turtle (*Lepidochelys kemnoi*l)	Endangered	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Endangered
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened	Threatened
Fish		
Smalltooth Sawfish (P*ristis pectinate*)	Endangered	-

Note: N/A = species is not federally listed as threatened or endangered, or species is federally listed as threatened or endangered but has been determined to not be in study area based on USFWS threatened and endangered species county lists.

Sources: (Florida Natural Areas Inventory, 2019) (USFWS, 2019) (FWC, 2018)

FIGURE 3-2: BALD EAGLE NESTS (APPROXIMATE LOCATION) IN THE STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019) (FWC, 2019)

3.2 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966, Section 4(f), now codified as 49 U.S.C. § 303(c), protects significant publicly owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites. The term historic resource includes prehistoric and historic districts, sites, buildings, structures, or objects listed in, or eligible for listing in, the National Register of Historic Places (NRHP) (see **Section 3.3** for further details). The FAA is the ultimate decision maker for Section 4(f) determinations but is also responsible for soliciting and considering the comments of the official(s) with jurisdiction over Section 4(f) properties.

Figure 3-3 shows the location of the cooperating agency management area boundaries in the study area. As listed in **Table 3-2**, the study area includes over 50 parks, conservation areas, wildlife management areas, and sanctuaries. The two national wildlife refuges within the study area are described in more detail below. **Figure 3-4** shows the National Wildlife Refuges in study area.

3.2.1 Merritt Island National Wildlife Refuge

The purposes of Merritt Island NWR stem from the Migratory Bird Conservation Act (16 USC §715d, §715i), the North American Wetlands Conservation Act [16 USC §4401(2)(b)], and Public Law 93-626 [16 USC §459(j)]. The purposes of Merritt Island NWR include conservation, protection, and management of migratory birds, threatened and endangered species, and wildlife and habitat diversity; preservation and protection of outstanding natural, scenic, scientific, ecologic, and historic values; and providing for outdoor recreation use and enjoyment.

While operational areas of Kennedy Space Center (KSC), including the SLF, are not under USFWS management, USFWS does respond to certain natural resource issues in those areas in accordance with KCA-4412, *Property Agreement between the National Aeronautics and Space Administration John F. Kennedy Space Center and Space Florida for the Transfer of Operations and Management of the Shuttle Landing Facility* between Space Florida and NASA KSC, in consultation with the USFWS.

Merritt Island NWR management activities in and around the study area include managing wildland fire, conducting prescribed burns, conducting mechanical habitat management activities, controlling non-native plants and animals, conducting wildlife and habitat survey and inventory activities, and providing opportunities for wildlife-oriented public use activities. These, along with other activities, are further described in the Comprehensive Conservation Plan of Merritt Island NWR. Merritt Island NWR has an annual visitation of over 1.6 million people.

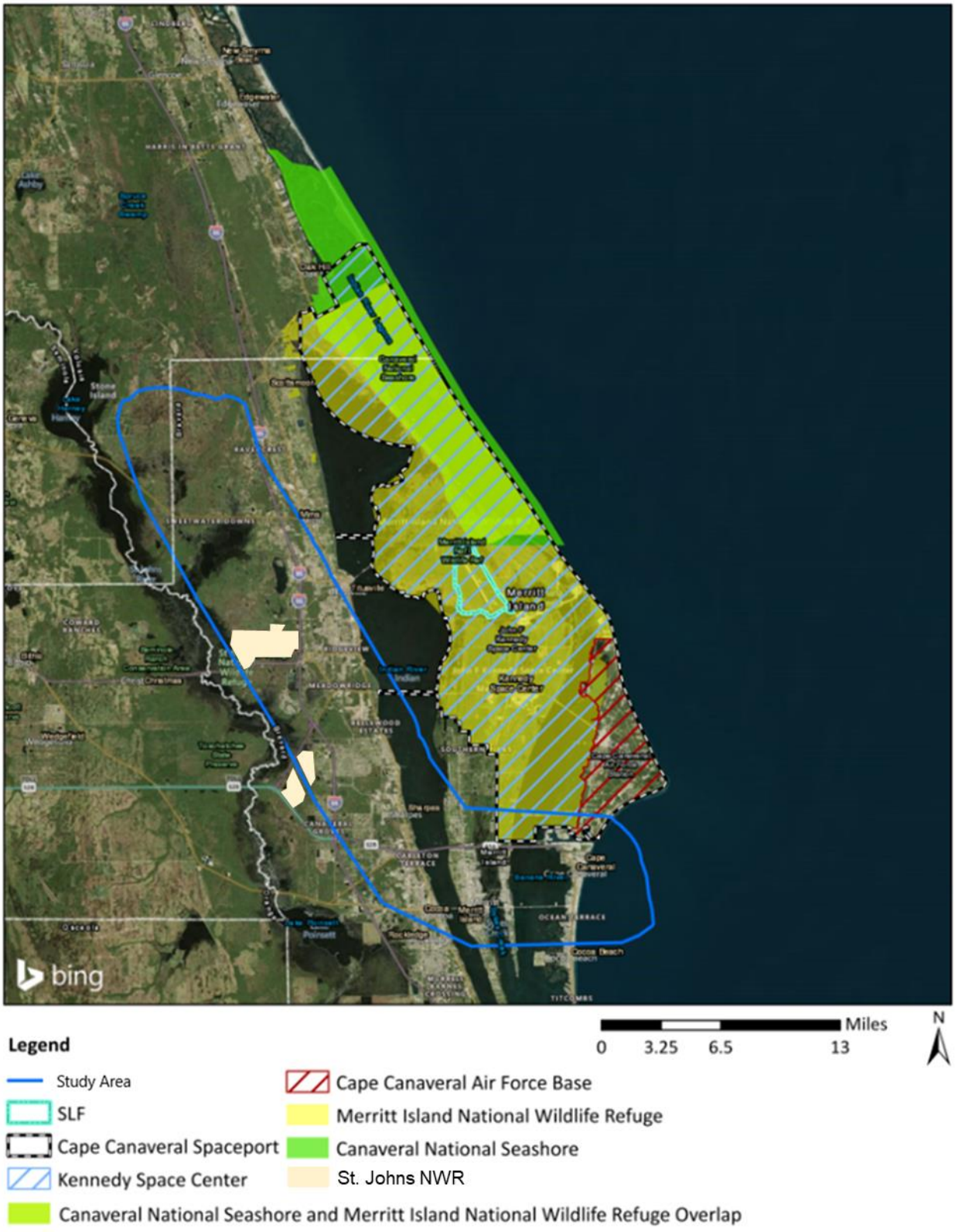
The Merritt Island NWR is also part of the Great Florida Birding and Wildlife Trail, which is a network of 510 wildlife viewing sites across the state (Fish & Wildlife Foundation of Florida Inc., 2015).

TABLE 3-2: PARKS, CONSERVATION AREAS, WILDLIFE MANAGEMENT AREAS, AND SANCTUARIES IN THE STUDY AREA

Resource Name	Resource Name
Banana River Park	Lee Wenner Park
Bird Lake Marsh	McFarland Park
Bird Lake Marsh	Manatee Sanctuary Park
Blue Heron Water Reclamation Facility & Wetland Area	Manatee Cove Park
Bracco Park	Merritt Island National Wildlife Refuge
Cameron Barkley Rotary Memorial Park	Mitchell Ellington Park
Canaveral Marshes Conservation Area	Nicol Park
Canaveral City Park	Pineda Park
Carl E Anderson Park	Pineview Park
Center Street Park	Provost Park
Chain of Lakes Park	Port St. John Boat Ramp
Cherie Down Park	Osteen Park
Cocoa Ocean Beach	River Lakes Conservation Area
Danny Strickland Park	Riverfront Park
Don Mo Stradley Memorial Park	Rodney S. Ketcham Park
Enchanted Forest Sanctuary	Rotary Park Merritt Island
Fay Park	St Johns National Wildlife Refuge
Fox Lake Park	Salt Lake Wildlife Management Area
Friendship Park	Seminole Ranch Conservation Area
Harry and Harriette Moore Memorial Park	Shepard Park
Hatbill Park	Stuart Park
Holder Park	Travis Park
Intercoastal Waterway Park	Taylor Park
Jetty Park	Ulumay Wildlife Sanctuary
Jim Hensley Park	Veterans Memorial Park
Joe Lee Smith Park	Waterway Park
Junny Rios Martinez Park	Watts Park
Kelly Park	William J Menzo Park
Kennedy Point Park	Woody Simpson Park
Kings Park	Wuesthoff Park
Lori Wilson Park	W.W. James Park

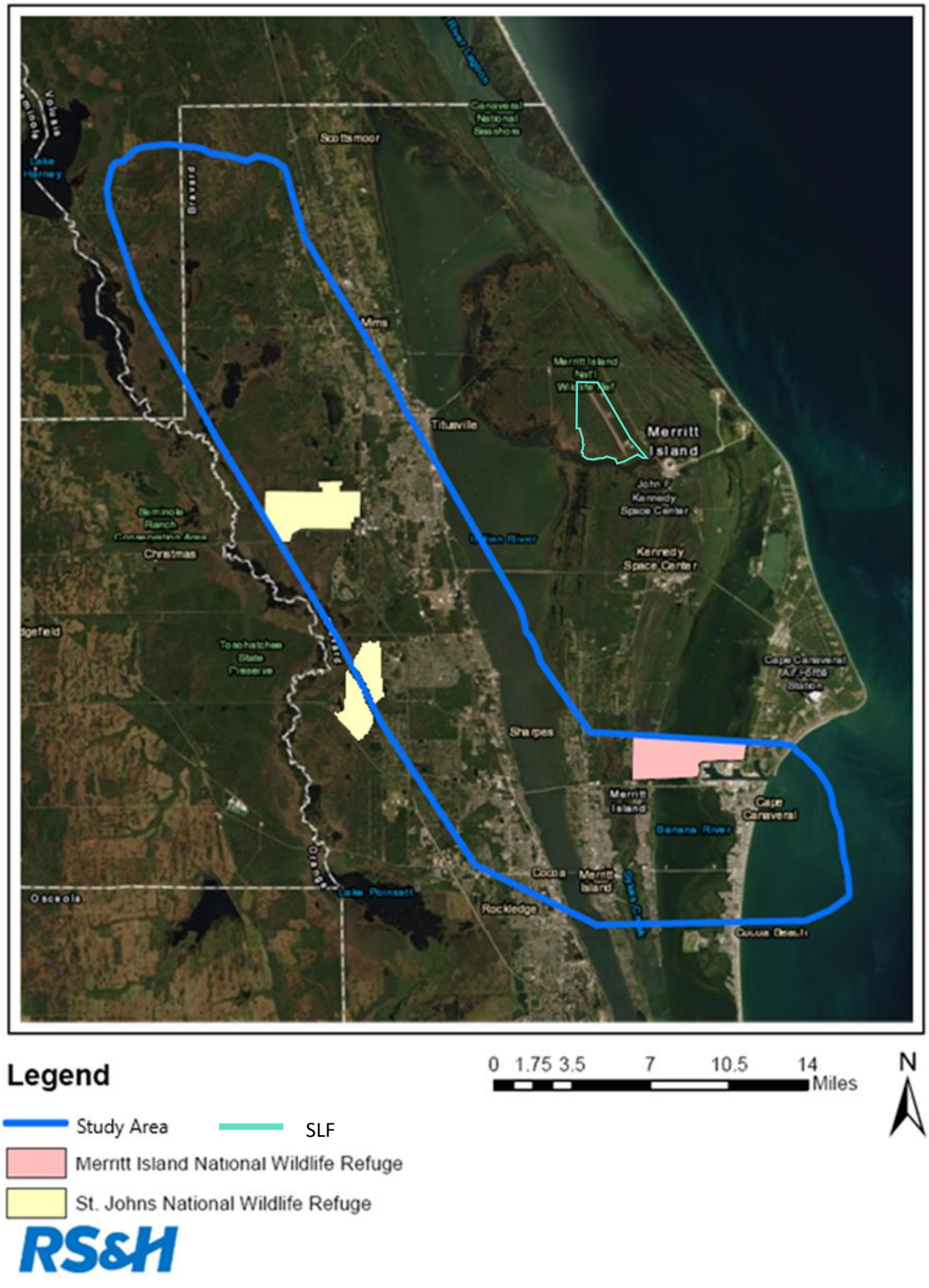
Sources: (Brevard, 2019) (USFWS, National Wildlife Refuge, 2019) (FWC, 2019) (Florida, 2019) (Cocoa, 2019) (Beach, 2019).

FIGURE 3-3: COOPERATING AGENCY MANAGEMENT AREA BOUNDARIES



Source: (RS&H, 2019) (Bing, 2019) (FAA, 2018) (USFWS, 2019)

FIGURE 3-4: NATIONAL WILDLIFE REFUGES IN STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019) (USFWS, 2019)

3.2.2 St. Johns National Wildlife Refuge

The St. Johns NWR was established in 1971 and protects 19 federal and state listed species. The purposes of St. Johns NWR stem from the Endangered Species Act (16 USC §1534) and the National Wildlife Refuge System Administration Act [16 USC §668d(a)(2)]. The purposes of St. Johns NWR include conservation of threatened and endangered species and conservation, management, and restoration of wildlife and habitat for future generations. The St. Johns NWR refuge is managed primarily through prescribed burning to maintain habitat for many species classified as threatened, endangered and species of special concern. Waterfowl use is primarily blue-winged teal and ring-necked ducks. Greater and lesser yellowlegs, blacknecked stilts and killdeer are also seen. Turkey and black vultures frequent the area, as well as occasional hawks (USFWS, 2019) .

3.3 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act requires a federal agency to consider the effects of its undertaking on historic properties in accordance with 36 CFR Part 800. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and other parties, including Indian tribes.

Historic, architectural, and cultural resources are sites recorded by the Florida Division of Historical Resources as Florida historical markers or resources that are in or eligible for listing in the National Register of Historic Places (NRHP).

3.3.1 Area of Potential Effects

In accordance with 36 CFR § 800.4(a)(1), the FAA has established an Area of Potential Effects (APE) for the proposed undertaking (i.e., Proposed Action). The FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The Proposed Action does not include ground-disturbing activities; therefore, archaeological resources are not considered in this PEA, and the APE is the same as the study area and encompasses the sonic boom footprint (see **Section 4.4**).

3.3.2 Section 106 Consultation

The FAA initiated Section 106 Consultation with the Florida SHPO and sent a formal Section 106 consultation letter to the SHPO on March 2, 2020 (see **Appendix A**: Agency Coordination). The letter described the proposed undertaking (i.e., Proposed Action) APE and requested SHPO concurrence on the determination of the APE. The SHPO provided concurrence with the APE on March 10, 2020. The FAA sent the Florida SHPO a finding of effect letter on March 26, 2020, stating that the proposed project would have no adverse effect on historic properties. The SHPO concurred with the FAA's determination on August 3, 2020.

3.3.3 Government-to-Government Consultation

In accordance with Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*, FAA Order 1210.20 *American Indian and Alaska Native Tribal Consultation Policy and Procedures*, and 36 CFR § 800.2(c)(2)(B)(ii), the FAA identified Native American tribes that may have an interest in the counties within the APE:

- Catawba Indian Nation,
- Chitimacha Tribe of Louisiana,
- Coushatta Tribe of Louisiana,
- Eastern Band of Cherokee Indians,
- Jena Band of Choctaw Indians,
- Miccosukee Tribe of Indians of Florida,
- Muscogee (Creek) Nation,
- Poarch Band of Creek Indians, and
- Seminole Tribe of Florida.

These tribes were identified using the U.S. Housing and Urban Development (HUD) Tribal Directory Assessment Tool (TDAT), a web-accessible database that contains information about federally recognized Indian tribes and their geographic areas of current and ancestral interest. For this PEA, the TDAT database was queried for Florida counties that intersect the APE. The APE is the same area as the study area, and therefore encompasses portions of Brevard and Volusia counties.

The FAA initiated Section 106 and Government-to-Government consultation with tribes on March 31, 2020. The Seminole Tribe of Florida (STOF) responded on April 23, 2020, that the proposed Undertaking falls within the STOF Area of Interest, but they were not aware of any sites of religious or cultural significance located in the APE and had no objections at that time. No other tribes responded to the FAA's consultation letter as of October 2020.

3.3.4 Historic Resources

Research information on historic properties within the APE was obtained from the National Park Service (NPS) National Register of Historic Places (NRHP) and the Florida Master Site File. **Table 3-3** lists the NRHP-listed and NRHP-eligible sites in the APE. **Figure 3-5** shows the location of these sites in relation to the APE.

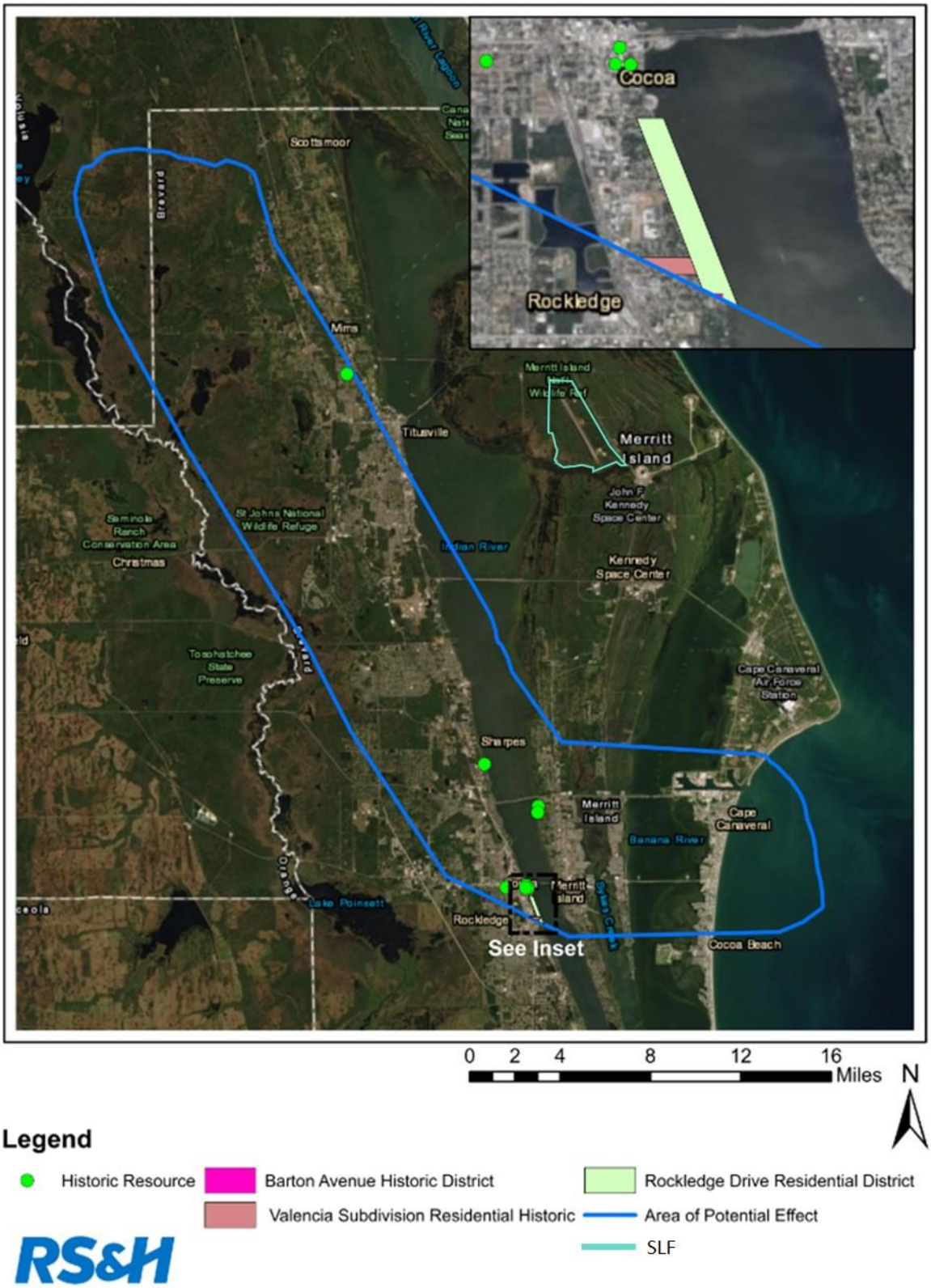
TABLE 3-3: NRHP RESOURCES IN THE APE

Resource Name	Resource Type
Aladdin Theater	Listed in NRHP
Barton Ave Residential District	Listed in NRHP
Cape Canaveral Air Force Station	Listed in NRHP
City Point Community Church	Listed in NRHP
Cocoa Junior High	Eligible for NRHP
Cocoa Post Office	Eligible for NRHP
Dr. George E Hill House	Listed in NRHP
J.R. Field, Homestead	Listed in NRHP
La Grange Church and Cemetery	Listed in NRHP

Resource Name	Resource Type
Porcher House	Listed in NRHP
Rockledge Drive Residential District	Listed in NRHP
Valencia Subdivision Residential Historic	Listed in NRHP

Sources: (NPS, National Register of Historic Places, 2019) (DHR, 2019)

FIGURE 3-5: NRHP RESOURCES IN THE APE



Source: (ESRI, 2019) (RS&H, 2019) (DHR, 2019)

3.4 NOISE AND NOISE-COMPATIBLE LAND USE

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. FAA Order 1050.1F, Exhibit 4-1 defines the FAA's significance threshold for noise and noise compatible land use as follows. "The action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB."

When a vehicle moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the vehicle is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. Sonic booms are classified as transient noise events and sonic boom levels are described in units of peak overpressure in pounds per square foot (psf). Sonic boom peak overpressures are used to assess single event noise impacts (BRRC, 2019).

Sonic booms are evaluated on a single-event basis in relation to hearing conservation and structural damage criteria. Although FAA Order 1050.1F does not have guidance on hearing conservation or structural damage criteria, it recognizes the use of supplemental noise analysis to describe the noise impact resulting from sonic booms and assist in the public's understanding of the potential noise impact. For example, the National Institute for Occupational Safety and Health (OSHA, 2017) and Occupational Safety and Health Administration (OSHA, 2017) state that levels should not exceed 140 dB peak sound pressure level, which equates to a sonic boom level of approximately 4 psf.

Sonic booms can also be associated with structural damage. A large degree of variability exists in damage experience, and much of the damage depends on the pre-existing condition of a structure. For example, most damage claims are for brittle objects, such as glass and plaster. The probability of a window breaking at 1 psf ranges from one in a billion (Sutherland, 1990) to one in a million (Higgins, 1976). Damage to plaster occurs at similar ranges to glass damage. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf (Nakaki, 1989) below which damage is unlikely.

According to the Final Programmatic EIS for Commercial Reentry Vehicles, thunder overpressure resulting from lightning strikes at a distance of 0.6 mile (1 kilometer) is almost indistinguishable from that of a sonic boom (FAA, 1992). According to the National Weather Service lightning statistics, Brevard County experiences approximately 22,000 lightning strikes a year (National Weather Service, 2018). When accounting for the population density of Brevard County and the affected area of the thunder overpressure of a lightning strike within 0.6 mile, it is estimated that each resident in Brevard County experiences more than 20 events a year with an overpressure greater than 2.09 psf (FAA, Office of Commercial Space Transportation, 1992). The average resident in Brevard County is exposed to thunder overpressure events caused by lightning on a regular basis in excess of the psf levels used to establish the extent of the study area.

The current noise environment in the study area includes vertically launched rockets that take off from launch complexes at Cape Canaveral Spaceport. Some vertically launched rockets have stages which return to land. These returning stages result in sonic booms that are heard by residents within the study area. Other existing sources of noise within the study area include aircraft operations, orbital test vehicles, construction vehicles and equipment, surface transportation vehicles (e.g., personal cars), urban/residential noise, and natural noise (e.g., nature).

Further details and information related to sonic booms is provided in *Shuttle Landing Facility Reentry Site Licensing Sonic Boom Analysis* in **Appendix B**: of this PEA.

3.5 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, CHILDREN'S HEALTH AND SAFETY RISKS

This section describes the existing demographics of the study area as they relate to socioeconomics, environmental justice, and children's environmental health and safety risks.

Due to Brevard County's greater concentration of population, the majority of workers associated with the Proposed Action are likely to reside in Brevard County. U.S. Census Bureau information for Brevard County is the basis of the socioeconomic and environmental justice analyses. The analysis of children's environmental health and safety is limited to the study area.

3.5.1 Socioeconomics

Population, housing, labor force, and surface transportation data for Brevard County is included as the basis for evaluating potential socioeconomic impacts in **Chapter 4** of this PEA.

Population – **Table 3-4** lists the population growth from 2010 to 2018 in Brevard County. Data for the State of Florida and U.S. is included for comparison purposes. Between 2010 and 2018, the Brevard County population increased 9.8 percent. Comparatively, the population in Florida increased 13.3 percent and the population in the U.S. increased 6.0 percent.

TABLE 3-4: POPULATION CHANGE BETWEEN 2010 AND 2018

Area	2010	2018	Percent Change
Brevard County	543,376	596,849	9.8%
Florida	18,801,310	21,299,325	13.3%
United States	308,745,538	327,167,434	6.0%

Source: (U.S. Census Bureau, 2019).

Housing – **Table 3-5** lists the total and vacant housing units in Brevard County. Information from the State of Florida and the U.S. is included for comparison purposes. About 17 percent of the housing units in Brevard County are vacant. Comparatively, there are about 19 percent and 12 percent vacant housing units in Florida and the U.S., respectively.

Labor Force – According to the U.S. Census Bureau, there are 239,195 employed civilians 16 years of age and older in Brevard County, and the unemployment rate is approximately 3.1 percent. Comparatively, Florida and the U.S. have an unemployment rate of approximately 3.1 percent and 3.7 percent, respectively (U.S. Census Bureau, 2019).

TABLE 3-5: HOUSING UNITS

Area	Total Units	Vacant Units (Percentage)
Brevard County	271,005	17.3%
Florida	9,051,851	18.9%
United States	132,741,033	12.2%

Note: the U.S. Census Bureau considers vacant housing units those for rent; rented but not occupied; for sale; sold but not occupied; for seasonal, recreational, or occasional use; for migrant workers; and other vacant units.
Source: (Census, 2019).

Surface Transportation – There are several major roadways that intersect the study area. Major roadways in Brevard County include Interstate 95, State Road 528, and U.S. Highway 1. NASA Parkway provides access to CCAFS to the east and Titusville via the Indian River Bridge to the west. Secondary and access roads to specific facilities are designed to accommodate the anticipated type of traffic and payloads that reach each facility. NASA Parkway is the primary entrance and exit for cargo, tourists, and personnel to KSC. Currently, the south (main) gate on SR 401, serves as the primary entrance and exit to CCAFS for cargo and NASA personnel. (NASA_, 2019)

Transport of rocket components and payloads at KSC, which includes the SLF, is a common occurrence.

First Responders – NASA KSC provides emergency fire and rescue services at the SLF. This protection includes fire and ambulance services staffed by paramedics and firefighters. An airport rescue firefighting facility was completed in 2007 at the south-field site of the SLF. Fire Station No. 2 is a 20,000-square-foot fire station with drive-thru bays for emergency vehicles, sleeping quarters for emergency personnel, and dining facilities. The USFWS are the first responders to events or activities within the Merritt Island NWR and St. Johns NWR, including law enforcement and fire management responses. Additional health care services are available at nearby public hospitals in Titusville, Rockledge, and Cocoa Beach. Law enforcement in the study area is provided by Brevard and Volusia County sheriff departments and local police departments.

3.5.2 Environmental Justice

FAA Order 1050.1F, which is consistent with USDOT Order 5610 on Environmental Justice, establishes the guidance for assessing environmental justice impacts. **Table 3-6** describes the persons in poverty within Brevard County, as well as the State of Florida and the U.S. Brevard County's percentage of persons in poverty is lower than the State of Florida, but slightly higher than the U.S.

According to the U.S. Census Bureau and shown in **Table 3-7**, about 26 percent of the population in Brevard County and about 29 percent of the population in Volusia County are minorities. Comparatively, a greater percentage of the Florida and U.S. population are minorities.

TABLE 3-6: POVERTY LEVEL

Area	Percentage
Brevard County	12.4%
Volusia County	15.2%
Florida	13.6%
United States	11.8%

Source: (Census, 2019).

TABLE 3-7: MINORITY POPULATION

Area	Percentage
Brevard County	25.9%
Volusia County	28.8%
Florida	46.5%
United States	39.4%

Source: (Census, 2019).

3.5.3 Children's Environmental Health and Safety Risks

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885) is the primary Executive Order related to Children's Environmental Health and Safety Risks. Executive Order 13045 directs federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children. As **Table 3-8** shows, Brevard County has a greater percentage of children than Volusia County, but less than Florida and U.S.

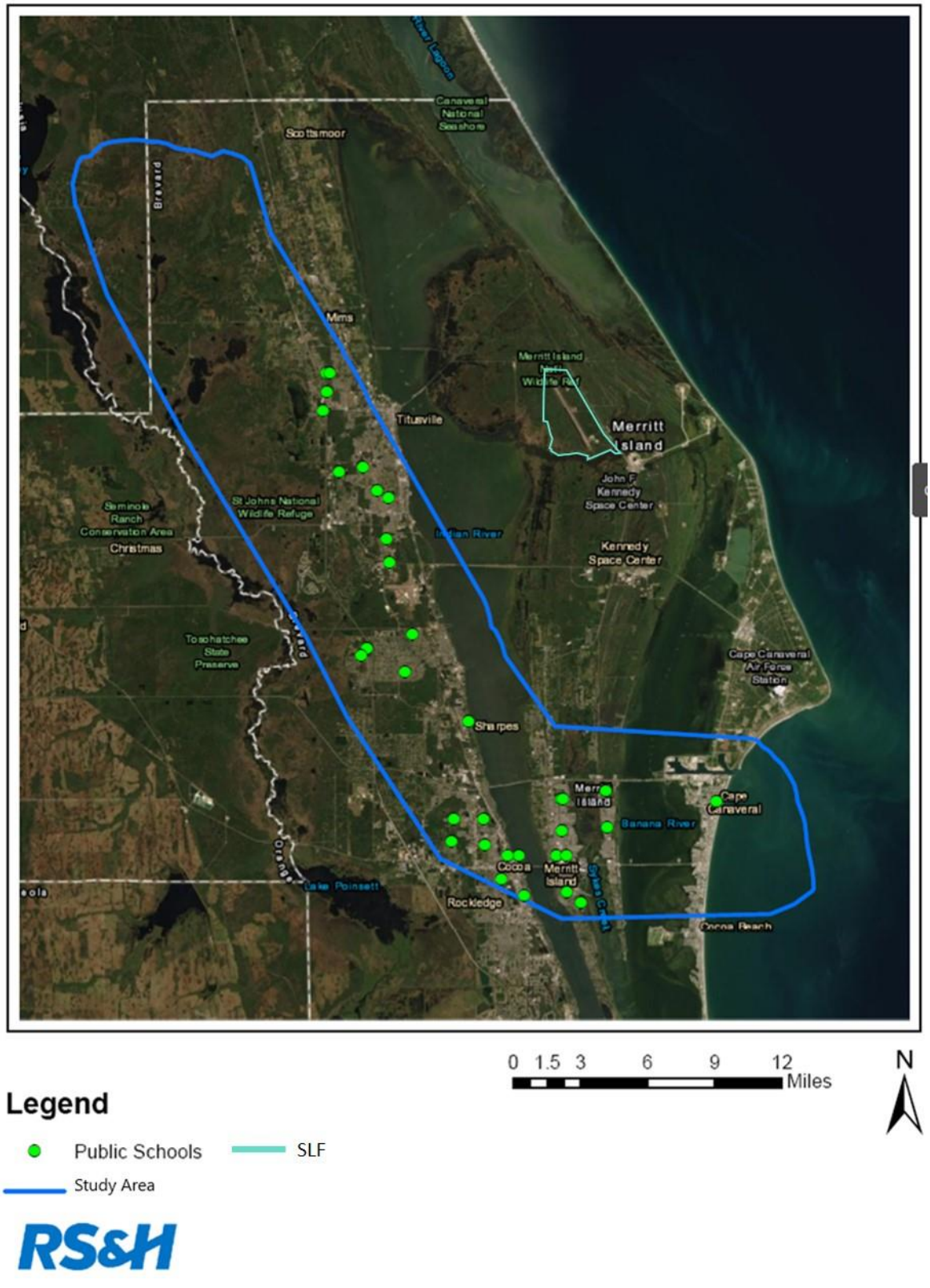
TABLE 3-8: PERCENT OF CHILDREN UNDER 18

Area	Percentage
Brevard County	18.2%
Volusia County	17.7%
Florida	19.9%
United States	22.4%

Source: (Census, 2019).

The study area includes the public schools within the Brevard County School system. As shown in **Figure 3-6**, there are 33 public schools located within the study area. There are no Volusia County schools within the study area.

FIGURE 3-6: PUBLIC SCHOOLS IN THE STUDY AREA



Source: (ESRI, 2019) (RS&H, 2019) (ESRI, 2019a)

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

This chapter presents an analysis of the potential environmental impacts from implementation of the Proposed Action compared to the No Action Alternative. The analyses in this chapter are consistent with the policy and procedures provided in FAA Orders 1050.1F and the guidance provided in the FAA Order 1050.1F Desk Reference. The significance thresholds identified in this chapter are those presented in FAA Order 1050.1F, Exhibit 4-1. This chapter also describes potential cumulative effects.

In accordance with CEQ Regulations, this PEA integrates the requirements of NEPA and other planning and environmental review procedures required by applicable law or agency practice. This integration allows the appropriate review procedures to run concurrently rather than consecutively (40 CFR § 1500.2(c)). This chapter includes the environmental analyses associated with applicable federal statutes, executive orders, and regulations.

As **Chapter 2** describes, reentry vehicle operations would begin as early as 2021 and continue operating through 2025. This PEA evaluates the study years 2021 and 2025 to compare the potential environmental effects of the Proposed Action compared to the No Action Alternative. The reentry vehicle design parameters and forecast number of operations described in **Chapter 2** (**Table 2-1** and **Table 2-2**) are used for assessing the potential effects of reentry vehicle operations at the SLF.

The Proposed Action would result in up to one reentry vehicle operation at the SLF in 2021, and up to six operations in 2025. A sonic boom would occur during each flight of the reentry vehicle over the State of Florida. As the primary driver of potential environmental impacts from the Proposed Action, the analyses in this chapter evaluate the effects of these sonic boom events on the following environmental impact categories:

- **Section 4.1** - Biological Resources (including Fish, Wildlife, and Plants)
- **Section 4.2** - Department of Transportation Act, Section 4(f)
- **Section 4.3** - Historic, Architectural, Archeological, and Cultural Resources
- **Section 4.4** - Noise and Noise-Compatible Land Use
- **Section 4.5** - Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks.

The study area shown in **Figure 3-1** is the area in which the sonic boom produced by reentry activities would be 1.0 psf or greater and includes portions of two Florida counties, Brevard and Volusia. The sonic boom analysis produced results indicating that the reentry events could result in a maximum 1.1 psf sonic boom (see **Appendix B**: for further details).

The FAA would not alter the dimensions (shape and altitude) of the airspace structure to accommodate the Proposed Action. Temporary closures of airspace may be necessary to ensure public safety during the proposed operations; this would be addressed in tiered environment reviews to this PEA when the FAA considers a reentry license application from a potential reentry vehicle operator. Per the procedures defined in their letter of agreement (LOA), reentry vehicle operators would notify Air Traffic Control (ATC) and schedule their operations in advance to minimize interruption of airspace operations, and Notices to Airmen (NOTAMs) would be issued to inform other airspace users of upcoming closures (see **Appendix D**: Airfields and Airspace for further details).

4.1 BIOLOGICAL RESOURCES

FAA Order 1050.1F, Exhibit 4-1, defines the FAA's significance threshold for biological resources, which states, "The U.S. Fish and Wildlife Service or the National Marine Fisheries Service determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat." In addition to the threshold above, FAA Order 1050.1F, Exhibit 4-1, provides factors to consider in evaluating the context and intensity of potential environmental impacts on biological resources. These factors are not intended to be thresholds. If these factors exist, there is not necessarily a significant impact; rather, the FAA must evaluate these factors in light of context and intensity to determine if there are significant impacts. Factors to consider that may be applicable to biological resources include, but are not limited to, situations in which the Proposed Action would have the potential for:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);
- Adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum populations levels required for population maintenance.

4.1.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue a RSOL. Spaceport-related operations would continue under the current license (LSO 18-018). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not differ from existing conditions with respect to biological resources.

4.1.2 Proposed Action

This section describes the Proposed Action's potential effect on federally and state-listed species, migratory birds, and measures to reduce wildlife strikes. Potential impacts on common fish and wildlife within the study area are not anticipated to differ from those identified in the 2018 EA.

4.1.2.1 Federally and State-listed Species

As **Chapter 3** describes, the Proposed Action would not result in ground disturbing activities at the SLF that could result in direct impacts to federally or state-listed threatened or endangered species. Operational impacts associated with the Proposed Action could potentially cause noise impacts to federally or state-listed species in the study area. The modeling results indicate that a reentry vehicle could produce a maximum 1.1 psf sonic boom over the State of Florida, which would have a similar

overpressure as natural environmental sources such as thunder. The area that has the potential to be exposed to the 1.0 psf sonic boom is the study area.

According to the Final Programmatic EIS for Commercial Reentry Vehicles, "Thunder overpressure resulting from lightning strikes at a distance of 1 km (0.6 mile) is estimated to be near 100 N/m2, [2.09 psf] and is almost indistinguishable from that of a sonic boom" (FAA, 1992). According to the National Weather Service (NWS), Brevard County can experience more than 22,000 lightning strikes a year (NWS, 2019). Wildlife are exposed to overpressure events greater than the 1.0 psf level within the study area on a regular basis. Literature suggests that many animal species do not experience lasting adverse effects to sonic booms with low overpressures (1.0 psf or less) (FAA, 2014) (Manci, 1988).

In the event a marine mammal (e.g., West Indian Manatee) or sea turtle was present in the study area during a reentry, and the area was exposed to a sonic boom, the boom would not affect the mammal. The sonic boom footprint is low intensity (similar to thunder). The sound pressure produced by the sonic boom during reentry would not affect submerged marine mammals or sea turtles because there is very little sound transmitted between the air-water interface.

As described in the FAA's March 2, 2020 letter to the USFWS, based on the lack of observed adverse effects to wildlife in scientific studies and the lack of known adverse effects to ESA-listed species over decades of launch operations at Cape Canaveral Spaceport, the FAA anticipates reentry operations (sonic booms) "*may affect, but would not adversely affect*" ESA-listed wildlife species in the study area (see **Appendix A**: Agency Coordination). USFWS concurred with the FAA's Section 7 effect determination on May 8, 2020.

4.1.2.2 Migratory Birds

There is the potential for migratory birds, including bald eagles, to use the habitat in the vicinity of the SLF. In terms of potential bird strikes, the 2007 SLF EA described the average collision rate of an aircraft with a bird species is 0.08 percent (NASA, 2007). The 2018 SLF EA described operations of launch vehicles would represent about a 3.78 percent increase in aircraft activity at the SLF and would not significantly increase the chance of a bird strike during takeoff and landing activities. Operation of the reentry vehicles at the SLF would increase vehicle activity (up to one reentry operation in 2021 and up to six reentry operations in 2025 but would not significantly increase the chance of a bird strike during landing activities.

Also, as described above, the reentry vehicle would produce sonic booms over the State of Florida. These events would generate similar overpressure to natural environmental sources, such as thunder. As noted above, thunder is a very frequent occurrence in the study area. For these reasons, the Proposed Action would not significantly affect migratory birds.

4.1.2.3 Existing Measures Reducing Wildlife Strikes

The SLF has a Wildlife Hazard Management Plan in place to reduce the risk of bird strikes. Management measures include inspecting runways for birds/wildlife, managing habitat near launch areas to discourage use by wildlife, use of air cannons and other scare tactics along runways, and a communications protocol

to alert vehicles of collision danger (NASA, 2012). These measures reduce the risk of impacts to birds and wildlife, as well as improving the safety of reentry vehicles landing at the SLF.

4.2 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

Resources protected by Section 4(f) consist of publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance; and publicly or privately-owned land from a historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.

FAA Order 1050.1F, Exhibit 4-1 provides the FAA's significance threshold for Section 4(f), which states, "The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a 'constructive use' based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource."

The study area was reviewed for any Section 4(f) properties. For Section 4(f) purposes, a Proposed Action constitutes a "use" of a property in one of two ways:

1. Physical use: The action physically occupies and directly uses the Section 4(f) property. An Action's occupancy or direct control (via purchase) causes a change in the use of the Section 4(f) property.
2. Constructive use: The Action indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, feature, or attributes.

This assessment uses the information consistent with the requirements of FAA Order 1050.1F, Exhibit 4-1 and **Appendix C:** Using this Programmatic EA
to Tier Future NEPA Reviews. The potential for constructive use of the Section 4(f) resources identified in **Section 3.3** is described below.

4.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not differ from existing conditions with respect to Section 4(f) resources.

4.2.2 Proposed Action

As **Chapter 3** describes, the Proposed Action would not result in ground disturbing activities at the SLF that could cause direct impacts to Section 4(f) resources. **Section 3.2** identifies over 50 parks, conservation areas, wildlife management areas, and sanctuaries in the study area. **Figure 3-4** shows the location of the national wildlife refuges in the study area. Operations of reentry vehicles would not require the use of any Section 4(f) properties and, therefore, would not require the physical use (direct impact) of Section 4(f) properties.

The Proposed Action would result in one sonic boom in 2021 and up to six sonic booms in 2025. The maximum sonic boom overpressure estimated to occur within the study area would be 1.1 psf. The intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. It is estimated that, on average, each resident in the study area experiences the overpressure from a lightning strike greater than 2.09 psf more than 20 times a year. Users of the parks, conservation areas, wildlife management areas and sanctuaries located within the study area likely experience similar levels of lightning activity.

Additionally, the Proposed Action would not have other effects that would substantially impair Section 4(f) resources. For these reasons, the Proposed Action would not cause a constructive use (indirect impact) of Section 4(f) resources.

4.3 HISTORIC, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

FAA Order 1050.1F does not define a significance threshold for historical, architectural, archaeological, and cultural resources; however, it does provide a factor to consider in evaluating the context and intensity of potential environmental impacts. This would occur when the action would cause a finding of Adverse Effect through the Section 106 process. An adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).

Potential impacts to historic resources were assessed by determining any potential indirect impacts from noise and vibration that could potentially:

- Alter the visual, audible, or atmospheric characters of the property, if the setting contributes to the property's qualification for the NRHP.
- Cause neglect of the property resulting in the property's deterioration or destruction.

Overpressure caused by sonic booms has been associated with the potential for structural damage, specifically for brittle materials such as glass and plaster. The probability of a window breaking when exposed to a sonic boom with a 1.0 psf overpressure ranges from one in a billion to one in a million, depending on the condition of the glass, while the threshold for damage from overpressure on well-maintained structures is greater than 2 psf (BRRC, 2019). The results of the sonic boom analysis indicate that the maximum overpressure associated with operation of the Proposed Action would be 1.1 psf (see **Appendix B**: for further details).

As described in **Section 3.3**, the FAA determined an APE in consideration of potential effects to historic properties from implementation of the Proposed Action. The APE is the same as the study area and encompasses the area where a sonic boom overpressure of 1 psf could occur. The SHPO issued concurrence with the APE on March 11, 2020.

4.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022).

Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. The No Action Alternative would not affect historic, architectural, archeological, or cultural resources within the APE.

4.3.2 Proposed Action

The FAA has established the APE for the Proposed Action in consideration of potential effects to historic properties. No ground disturbing activities will occur in the APE. Noise modeling was conducted as part of the project to establish the APE.

Indirect effects to cultural resources refer to potential effects to the property's use, physical features, or the area in a manner that may change the integrity of the property's significant historic features. Examples of indirect effects include introducing an atmospheric or visual feature or changing the noise characteristics of the area. Operation of reentry vehicles would increase flight activity at the SLF. As described previously, the Proposed Action would not result air quality or visual (light or viewshed) impacts.

Information on historic properties within the APE was obtained from the NRHP and the Florida Master Site File. An assessment of the Proposed Action's potential direct and indirect effects is described below.

4.3.2.1 Direct Effects

The Proposed Action would not result in any direct effects on historic properties.

4.3.2.2 Indirect Effects

The potential effects for architectural resources include the introduction of short-term auditory effects on noise-sensitive historic properties during operations, and vibration caused by operation of the Proposed Action. Twelve historic resources located within the APE would potentially be affected (see **Table 3-3)**.

The potential for sonic boom impacts is evaluated on a single-event and cumulative basis in relation to human annoyance, hearing conservation and structural damage criteria. The modeled maximum peak overpressure is approximately 1.1 psf. A modeled maximum of 1.1 psf translates to an equivalent CDNL[12] of 41.2 dBC. Noise caused by the proposed reentry vehicle operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA).[13] The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf criterion described above.

4.3.2.3 FAA's Finding of Effect

The descent of the reentry vehicle would generate a sonic boom. The Proposed Action would result in one sonic boom in 2021 and up to six sonic booms in 2025. The maximum sonic boom overpressure estimated to occur within the study area would be 1.1 psf. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf. In terms of auditory effects, the

[12] CDNL is the C-weighted Day-Night Level (DNL). C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.
[13] Areas exposed to DNL 65 dBA or lower are compatible with all land uses.

intensity of sonic booms associated with operation of the Proposed Action would be similar to thunder in intensity. It is estimated that, on average, each resident in the study area experiences the overpressure from a lightning strike greater than 2.09 psf more than 20 times a year (FAA, Office of Commercial Space Transportation, 1992). Users of the historic properties located within the study area likely experience similar levels of lightning activity.

Therefore, noise effects associated with the reentry vehicle would not have an adverse effect on historic properties in the APE. Based on the results of the studies and an assessment of effects to historic properties, the FAA has determined that this undertaking will have No Adverse Effect on historic properties.

The FAA sent a formal Section 106 consultation letter to the SHPO on March 26, 2020 describing the FAA's determination that the proposed undertaking would have "No Adverse Effect" to historic properties. The SHPO provided concurrence with the FAA's no adverse effect to historic properties determination on August 3, 2020 (see **Appendix A**: Agency Coordination).

4.4 NOISE AND NOISE-COMPATIBLE LAND USE

Research shows that the loudness of individual events, the number of events during a given period, and the time of day in which noise events occur influences the sensitivity to noise. The Day-Night Average Sound Level (DNL) accounts for these factors by accumulating the sound energy generated by all noise events during the course of a given period (an annual average day) with a 10 dB penalty to sound levels occurring between 10:00 p.m. and 6:59 a.m. This 10 dB penalty means that one nighttime sound event is equivalent to 10 daytime events of the same level.

FAA Order 1050.1F, Exhibit 4-1 defines the FAA's significance threshold for noise and noise compatible land use as follows. "The action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the No Action alternative for the same timeframe. For example, an increase from DNL 65.5 dB to 67 dB is considered a significant impact, as is an increase from DNL 63.5 dB to 65 dB."

Noise analyses and evaluations of potential impacts for reentry vehicles can vary substantially from approaches used by the FAA for civil aircraft and airports for several reasons. One reason is the low-frequencies component of the spectral characteristic of the reentry vehicle noise. Such low frequency noise can propagate for much longer distances than that of jet or propeller aircraft noise and can be perceived as a "rumbling" noise. Also, reentry vehicles create sonic booms when they operate above the speed of sound. As a result, noise modeling and assessment for reentry vehicles differs from modeling and assessment of civil aircraft and airports. Nevertheless, the basic elements of FAA noise assessment for NEPA, including the proximity of noise sensitive receptors and the DNL 65 dB significance threshold, are applicable. Since sonic boom measurements results are typically presented in terms of psf, a conversion is

needed to obtain CDNL[14] values. This allows for a comparison to FAA's significance threshold in DNL. The psf metric is used to determine potential structural damage to buildings, while CDNL is applied during the assessment of potential human annoyance.

4.4.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative.

4.4.2 Proposed Action

The FAA-approved sonic boom model, PCBOOM, was used to analyze the potential noise of the supersonic landing of the proposed reentry vehicle at the SLF. Noise exposure less than the significance threshold of CDNL 60 dBC for impulsive noise sources, is equivalent to the DNL 65 dBA threshold for significant aviation noise impacts. Four daytime reentries and two nighttime reentries (six reentries total annually) would result in a modeled maximum of 1.1 psf, which is equivalent to CDNL 41.2 dBC. The Proposed Action's noise exposure would be less than the significance threshold of DNL 65 dBA (equivalent to CDNL 60 dBC).

The potential for hearing damage is negligible, as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criterion described previously. The potential for structural damage is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

Although the Proposed Action would not cause significant impacts in relation to human annoyance, hearing conservations, or structural damage; the unexpected, loud impulsive noise of sonic booms may cause a startle effect in people. When humans are exposed to impulse noises with similar characteristics on a regular basis, they tend to become conditioned to the stimulus and the resulting startle reaction is generally not displayed. The physiological effects of single sonic booms on humans (FAA, 1992) for the levels produced by a reentry vehicle are presented in **Table 4-1**.

The Proposed Action's modeled maximum peak overpressure is approximately 1.1 psf, which would have the potential to result in a mixed pattern of startled response behavioral effects. See **Appendix B**: for further information.

TABLE 4-1: PHYSIOLOGICAL EFFECTS OF SINGLE SONIC BOOMS ON HUMANS

Sonic Boom Overpressure	Behavioral Effects
0.3 psf	Orienting, but no startle response; eyeblink response in 10% of subjects; no arm/hand movement.

[14] CDNL is the C-weighted DNL. C-weighting is preferred over A-weighting for impulsive noise sources with large low-frequency content such as sonic booms.

Sonic Boom Overpressure	Behavioral Effects
0.6 - 2.3 psf	Mixed pattern of orienting and startle responses; eyeblink in about half of subjects; arm/hand movements in about a fourth of subjects, but not gross bodily movements

Source: (FAA, 1992)

4.5 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

FAA Order 1050.1F does not define significance thresholds for Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks; however, it does identify the following factors to consider in evaluating the context and intensity of potential environmental impacts. Socioeconomics considerations include the potential of the action to:

- "Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; or
- Produce a substantial change in the community tax base."

Environmental justice considerations include the potential of the action to lead to a disproportionately high and adverse impact to low-income and/or minority populations from:

- "Significant impacts in other environmental impact categories; or
- Impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population."

Considerations for children's environmental health and safety risks include the potential of the action to lead to a disproportionate health or safety risk to children.

U.S. Census demographic data were used to evaluate the potential effects of Proposed Action compared to the No Action Alternative.

4.5.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue an RSOL. Spaceport-related operations would continue under the current license, LSO 18-018 (up to 62 operations in 2021 and 74 operations in 2022). Space Florida would continue to operate and serve forecast activity. Future development at the SLF would be subject to review under NEPA and is not assumed under this alternative. There would be no change in socioeconomic trends or in those relating to environmental justice or children's environmental health and safety risks.

4.5.2 Proposed Action

The following subsections describe the potential effects of the Proposed Action on socioeconomics, environmental justice, and children's environmental health and safety risks.

4.5.2.1 Socioeconomics

The following analysis describes the potential effects of the Proposed Action on population and housing, labor force, and transportation and why those effects would not be significant.

Population and Housing - As described in **Section 2.1**, a reentry vehicle operator may employ 10 to 40 people for post-reentry procedures. Employees could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations. As stated in **Chapter 3**, the majority of workers associated with the Proposed Action are likely to reside in Brevard County. Therefore, the Proposed Action would not result in an increase in population for Brevard and Volusia counties.

The Proposed Action would not require the relocation of existing residents or disrupt or divide the physical arrangement of an established community. About 18 percent of the housing units in Brevard County and Volusia counties are vacant. Therefore, there is available housing in the area should potential future employees seek housing near the SLF.

Labor Force - The potential increase of up to 40 employees from the Proposed Action would not significantly affect Brevard or Volusia county's labor force. The Proposed Action would not require the relocation of any businesses and, therefore, would not decrease the existing labor force or local fiscal revenue, cause extensive relocation of community businesses that would cause severe economic hardship for affected communities, or produce a substantial change in the community tax base. The nature, timing, and extent of this other development (including potential effects on labor force and local revenue) cannot be foreseen at this time and is not included in this analysis.

Transportation – This PEA assumes there would be an increase of up to 40 employees at the SLF from the Proposed Action. Traffic levels at Cape Canaveral Spaceport are currently low and have sufficient capacity to accommodate minor increases in traffic for new traffic (compared to the No Action Alternative) that could be associated with up to six proposed launches annually in 2025. Therefore, the Proposed Action would not significantly disrupt local traffic patterns and substantially reduce the levels of service of roads serving the SLF and its surrounding communities.

4.5.2.2 Environmental Justice

As **Section 3.5** describes, there are minority and low-income populations in Brevard and Volusia counties. The Proposed Action does not include construction or the development of facilities at the SLF that would directly affect environmental justice minority and low-income populations. Similarly, operation of the Proposed Action would not result in significant impacts to any resource that would affect minority and/or low-income populations. The following section describes the analysis of environmental justice impacts.

USEPA "EJSCREEN" is an environmental justice mapping and screening tool that provides a nationally consistent dataset and approach for combining environmental and demographic indicators (i.e., percent low-income; percent minority; less than high school education; linguistic isolation; individuals under age 5 and individuals over age 64) (USEPA, 2019a).

Figure 4-1 and **Figure 4-2** show minority and low-income percentiles within the study area, respectively. **Table 4-2** shows minority and low-income comparison data of the study area, State of Florida, USEPA region, and the U.S.

TABLE 4-2: STUDY AREA DEMOGRAPHIC INDICATORS

Demographic Indicator	Study Area	Florida Average	EPA Region Average	U.S. Average
Minority Population	22%	44%	38%	38%
Low-Income Population	36%	37%	38%	34%
Demographic Index	29%	41%	38%	36%

Source: (USEPA, 2019)

The analysis of potential environmental justice impacts also considered noise. The significance threshold for impulsive noise sources is CDNL 60 dBC (equivalent to DNL 65 dBA). As described in **Section 4.4**, a modeled maximum of 1.1 psf for six reentries (four daytime reentries and two nighttime reentries) is equivalent to CDNL 41.2 dBC. Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance. As noted previously, the potential for hearing damage is negligible because the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criterion. The potential for structural damage to a disproportional number of environmental justice communities in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than 2 psf.

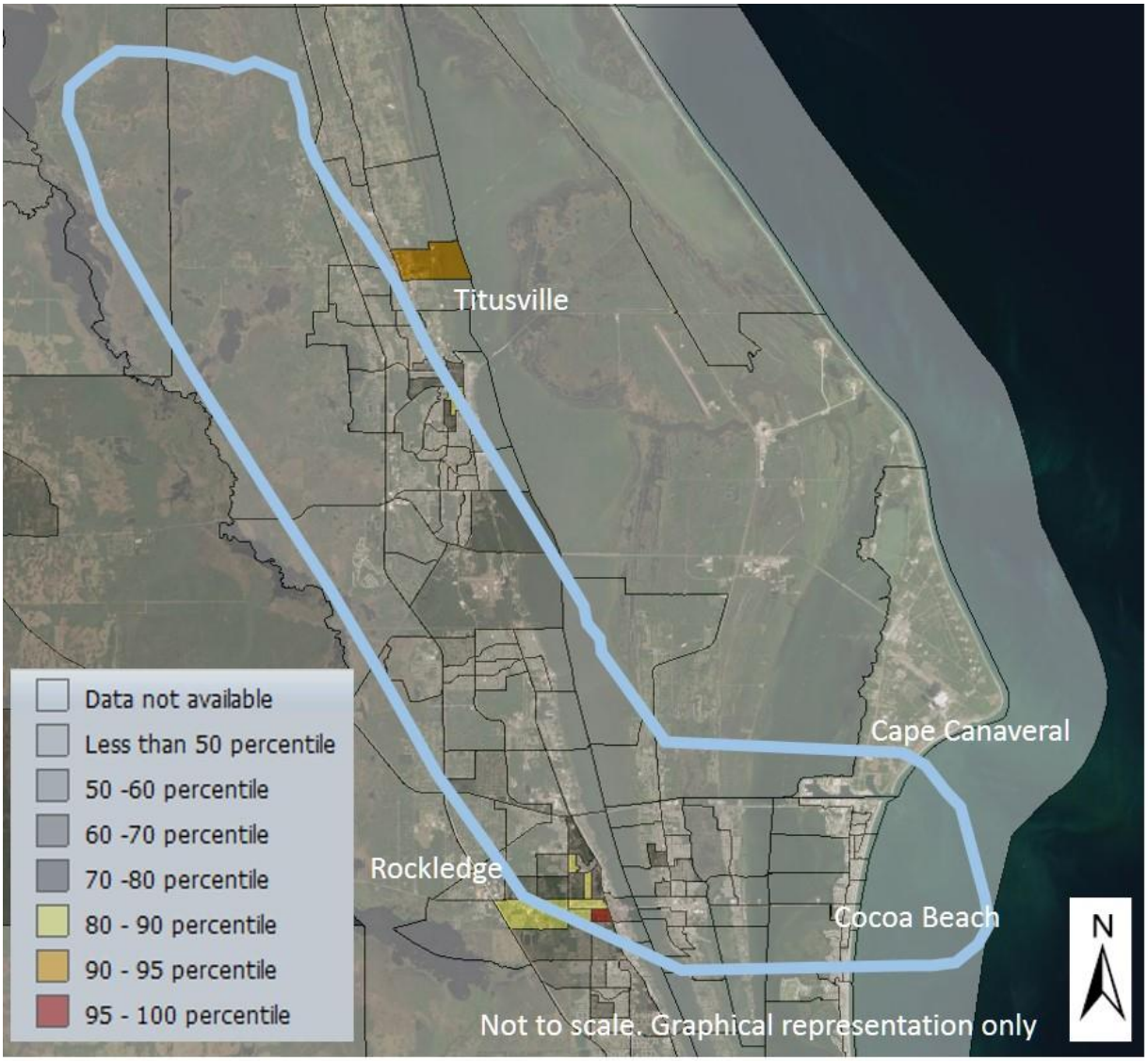
Overall, the Proposed Action would not have disproportionately high or adverse human health or environmental affects to minority or low-income populations.

4.5.2.3 Children's Environmental Health and Safety Risks

The Proposed Action does not include construction or the development of facilities at the SLF and would not directly affect surrounding communities. Access to the SLF requires security clearance or escort by approved access by unaccompanied children. As described below, operation of the Proposed Action would not affect environmental impact categories that would represent an environmental safety risk to children.

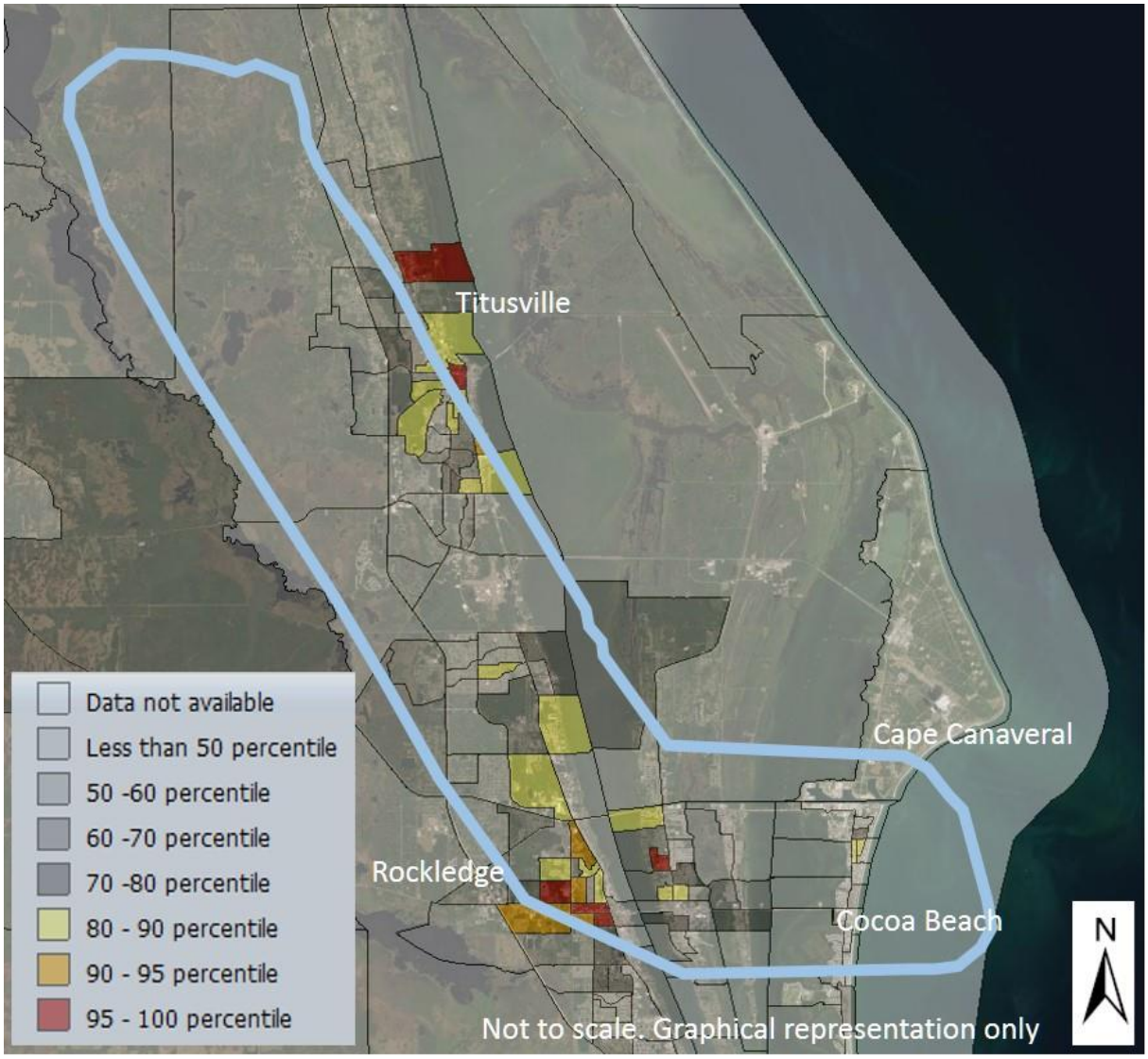
The 33 public schools within the study area would be affected by up to one sonic boom in 2021 and up to six sonic booms in 2025. Therefore, the potential for routine classroom disruption is negligible.

FIGURE 4-1 : STUDY AREA MINORITY PERCENTILES



Source: (USEPA, 2019)

FIGURE 4-2: STUDY AREA LOW-INCOME PERCENTILES



Source: (USEPA, 2019)

As described in **Section 4.4**, a modeled maximum of 1.1 psf for six annual reentries (four daytime reentries and two nighttime reentries) is equivalent to CDNL 41.2 dBC. Noise exposure from these operations would be less than the significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). Therefore, the proposed reentry vehicle operations do not pose a significant impact with regards to human annoyance as the noise exposure.

The potential for hearing damage is negligible because as the modeled sonic boom overpressure levels over land are substantially lower than the ~4 psf impulsive hearing conservation noise criteria.
The potential for structural damage to any of the 33 public schools in the study area is unlikely as the modeled sonic boom overpressure levels over land are less than the 2 psf threshold for potential

structural damage. Therefore, the Proposed Action would not significantly affect children's environmental health and/or safety.

4.6 CUMULATIVE IMPACTS

Cumulative impacts are defined by CEQ in 40 CFR § 1508.7 as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Additionally, CEQ describes in *Considering Cumulative Effects under NEPA* that, "each resource, ecosystem and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." The CEQ regulations require the analysis and disclosure of the Proposed Action's potential cumulative effects (40 CFR §§ 1508.25(a)(2) and (3)). The disclosure of potential cumulative effects informs the public if the Proposed Action, when considered with other projects occurring in the past, present, or reasonably foreseeable future, would contribute to potentially significant cumulative effects.

When a prospective vehicle operator applies to operate a reentry vehicle at SLF, the applicant would prepare separate environmental document, tiering off this PEA. Cumulative environmental impacts related to vehicle operations under that reentry vehicle license would be analyzed, if appropriate.

Past, present, and reasonably foreseeable future cumulative projects were listed and analyzed in the 2018 EA. Since some future projects are in various stages of conceptual development and are speculative at this time, it is not possible to fully quantify the effects associated with them. Projects in early planning phases do not provide enough data to ensure reasonable analyses and are subject to change.

In order to contribute to a cumulative impact, the Proposed Action must first cause an impact to a specific environmental impact category. For that reason, cumulative effects are only considered for those resources that the Proposed Action would affect to some degree. Implementation of the Proposed Action would cause less than significant adverse environmental effects.

The spatial boundary for this cumulative analysis is the study area, which encompasses sufficient area to capture the extent of the Proposed Action's ability to contribute to potentially significant cumulative effects. As discussed earlier, the primary driver of potential impacts is noise. As described in **Section 4.4**, the Proposed Action's reentries would result in a modeled maximum of 1.1 psf, which is equivalent to CDNL 41.2 dBC. This noise exposure would be less than the significance threshold of DNL 65 dBA (equivalent to CDNL 60 dBC) and compatible with Section 4(f) Resources and Historic, Architectural, Archaeological, and Cultural Resources.[15]

The existing returning stages of vertical rockets to Cape Canaveral Spaceport have resulted in sonic booms that would intersect with the study area. Other existing sources of noise within the study area

[15] According to FAA Order 1050.1F Desk Reference, Exhibit 11-3, recreational land uses exposed to less than DNL 65 dBA are considered compatible.

include aircraft operations, orbital test vehicles, construction vehicles and equipment, surface transportation vehicles (e.g., personal cars), urban/residential noise, and natural noise. In the event a marine mammal (e.g., West Indian Manatee) or sea turtle was present during the descent of a reentry vehicle or returning vertical rocket stage, and the area was exposed to a sonic boom, the boom would not affect the mammal. The sonic boom footprint is low intensity (similar to thunder). The sound pressure produced by the sonic boom during reentry would not affect submerged marine mammals or sea turtles because there is very little sound transmitted between the air-water interface.

The development at Cape Canaveral Spaceport and the SLF has brought more business to the area in the past, and future development is likely to do the same. Space Florida continues to be sought by prospective operators with vehicles in various stages of conceptual development interested in utilizing the SLF. In the reasonably foreseeable future, prospective operators seeking licenses for experimental permits, high-altitude manned-balloon vehicles, and/or unmanned aerial vehicles (UAVs) could propose operations at the SLF. While these prospective operators are not anticipated to contribute to potential significant noise impacts, they could result in other environmental impacts such as a visual and socioeconomic impact to the region. For example, a prospective operator's high-altitude manned balloon operation would be visually different than a vertical rocket's rapid ascent/descent or the landing of a reentry vehicle. The Proposed Action would contribute slightly to this economic activity, which would increase the number of employees working in the area and associated need for public services. Brevard County is expected to have sufficient housing to meet the needs of new employees. Additionally, the local municipalities have sufficient public services (water, power, police, and fire services) to support this growth.

Therefore, the Proposed Action, in addition to past, present, and reasonably foreseeable future actions, is not anticipated to cause significant cumulative effects to Biological Resources, DOT Section 4(f) Resources, Historic, Architectural, Archaeological or Cultural Resources or Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety.

CHAPTER 5

LIST OF PREPARERS

5.1 LEAD AGENCY

The FAA is the lead agency for the preparation of this EA. Responsibility for review of this EA rests with the FAA. Listed below are the identities of the principal FAA individuals that participated in the preparation of this EA, in accordance with Section 1502.7 of the CEQ Regulations and FAA Order 1050.1F.

Stacey M. Zee

Position:	Environmental Protection Specialist, FAA Office of Commercial Space Transportation
Education:	Master of Science, Environmental Policy and Management, University of North Carolina; Bachelor of Science, Natural Resources Management, Cornell University
Experience:	Ms. Zee has over 20 years of environmental impact assessment experience.

5.2 PRINCIPAL PREPARERS

Responsibility for preparation of this EA rests with Space Florida. Listed below are the employees of Space Florida and the consulting firms responsible for the preparation of this EA. The consultant to Space Florida has experience in environmental planning. It is recognized that no one individual can be an expert in all of the environmental analysis presented in this EA. As such, an interdisciplinary team of technicians and experts in various tops was required to prepare this EA.

Mark Bontrager

Position:	Vice President, Spaceport Operations
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Position:	Director, Environmental Health and Safety
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5.2.1 RS&H, Inc.

David Alberts

Position:	Senior Environmental Planner, Southeast Region Environmental Service Group Leader
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Richard Rogers

Position:	Project Manager, Spaceport Planning Leader
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Monica Hamblin

Position:	Environmental Planner
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William "Bill" Willkie

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Experience:	Mr. Willkie has over 30 years of aviation environmental planning experience. His professional experience includes management and/or technical leadership of NEPA studies for airport development and airspace actions, as well as noise compatibility studies under Federal Aviation Regulations Part 150 for commercial airports across the nation.

5.2.2 Kimley Horn and Associates

Brian Gulliver

Position:	Leader, Aerospace and Spaceport Practice
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Elyse Mize

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5.2.3 Blue Ridge Research and Consulting, LLC

Michael M. James

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Alexandria R. Salton

Position:	Senior Engineer
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CHAPTER 6

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APPENDIX A: AGENCY COORDINATION

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APPENDIX B: SLF REENTRY SITE LICENSING SONIC BOOM ANALYSIS

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APPENDIX C: USING THIS PROGRAMMATIC EA TO TIER FUTURE NEPA REVIEWS

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APPENDIX D: AIRFIELDS AND AIRSPACE

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