

DRAFT

Spaceport Camden Environmental Impact Statement

March 2018



**Federal Aviation
Administration**

**Office of Commercial
Space Transportation**

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SPACEPORT CAMDEN
DRAFT ENVIRONMENTAL IMPACT STATEMENT
CAMDEN COUNTY, GEORGIA

VOLUME I
EXECUTIVE SUMMARY AND CHAPTERS 1 – 11
March 2018

Prepared by:

Federal Aviation Administration

Office of Commercial Space Transportation



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DOCUMENT ORGANIZATION

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TITLE: Spaceport Camden Draft Environmental Impact Statement (EIS), Camden County, Georgia

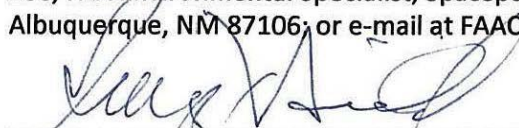
AGENCIES: Federal Aviation Administration (FAA) Office of Commercial Space Transportation, lead agency; National Aeronautics and Space Administration, cooperating agency; National Park Service, cooperating agency.

PUBLIC REVIEW PROCESS: The FAA is submitting this Draft EIS for review pursuant to the following public law requirements: Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA) as amended (42 United States Code [U.S.C.] §§4321 et seq.); Council on Environmental Quality NEPA implementing regulations (40 Code of Federal Regulations Parts 1500–1508); Section 4(f) of the Department of Transportation (DOT) Act (49 U.S.C. §303); Section 106 of the National Historic Preservation Act (54 U.S.C. §§300101 et seq.); FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*; Executive Order (EO) 11988, Floodplain Management; DOT Order 5650.2, Floodplain Management and Protection; EO 11990 Protection of Wetlands; DOT Order 5660.1A Preservation of the Nation's Wetlands; and the Coastal Zone Management Act. In accordance with the applicable requirements, the FAA is initiating a public review and comment period for the Draft EIS. The U.S. Environmental Protection Agency (USEPA) Notice of Availability of the Draft EIS in the *Federal Register* starts the 45-day comment period. To ensure that FAA has sufficient time to include public input in the Final EIS, written comments from the public should be submitted by May 7, 2018.

The FAA is holding public hearings on April 11 and 12, 2018, from 5:30–8:30 p.m. at Camden County Public Service Authority Recreation Center Community Room, 1050 Wildcat Drive, Kingsland, GA 31548. The Draft EIS and more information about public involvement may be found at the FAA website: https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, ABSTRACT: The Draft EIS for the Camden County, Georgia, spaceport evaluates the potential environmental impacts that may result from FAA's proposed action of issuing a Launch Site Operator License to the Camden County Board of Commissioners. The license would allow the County to offer the commercial space launch site, Spaceport Camden, to commercial launch operators to conduct launches of liquid-fueled, small to medium-large lift-class, orbital and suborbital vertical launch vehicles. Development of the launch site includes construction of supporting buildings and infrastructure. Operation would include up to 12 vertical launches and up to 12 associated launch vehicle first-stage landings per year; in support of the launches, there would be up to 12 wet dress rehearsals and up to 12 static fire engine tests per year. Alternatives under consideration include the Proposed Action, the Ocean-Landing Only Alternative (an alternative for ocean-only first-stage landings), and the No Action Alternative. The Proposed Action is the Preferred Alternative. Under the No Action Alternative, FAA would not issue a Launch Site Operator License to Camden County and the County would not purchase the property. No activities related to constructing or operating a commercial spaceport would occur at the site. The property would continue to be owned by the private landowner in accordance with its current industrial zoning.

FOR FURTHER INFORMATION: Written comments on this document should be directed to Ms. Stacey M. Zee, FAA Environmental Specialist, Spaceport Camden EIS, c/o Leidos, 2109 Air Park Road SE, Suite 200 Albuquerque, NM 87106, or e-mail at FAACamdenSpaceportEIS@Leidos.com



Dr. George C. Nield
Associate Administrator for
Commercial Space Transportation

3/6/2018

Date

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EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) has prepared this Draft Environmental Impact Statement (EIS) to evaluate the potential environmental impacts that may result if FAA issues a Launch Site Operator License to the Camden County Board of Commissioners (the County) to operate a commercial space launch site, called Spaceport Camden, on the Atlantic seaboard in Camden County, Georgia (Exhibit ES-1).

The County could offer the commercial space launch site to vertical launch vehicle operators for the orbital and suborbital launch of small to medium-large, liquid propellant launch vehicles. Orbital launch vehicles are classified based on the maximum payload weight in pounds according to orbital inclination; at 90-degrees inclination: small is less than or equal to 3,300 pounds; medium is greater than 3,300 to less than or equal to 8,400 pounds; medium-large is greater than 8,400 to less than or equal to 15,000 pounds. Launch operations would include preparatory activities to ready and test launch vehicles and systems, including mission rehearsals and static tests, and for any first-stage landings on the space launch site or returns to the launch site after landing on a barge located about 200 to 300 miles off shore in the Atlantic Ocean.

The operation of commercial space launch sites are licensed by the FAA under Title 14 Code of Federal Regulations (CFR) Part 420, and the County intends to apply to FAA for a Launch Site Operator License. Because issuance of this license would be a major Federal action, this EIS has been prepared by FAA's Office of Commercial Space Transportation to assist in its decision-making process as required by the National Environmental Policy Act of 1969 (NEPA) as amended (42 United States Code [U.S.C.] §§4321 et seq.), Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500–1508), and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures.

This EIS evaluates the potential direct, indirect, and cumulative environmental impacts of construction and operation of the proposed launch site that would result from FAA's Proposed Action to issue a Launch Site Operator License to the County for Spaceport Camden. The launch vehicle operator would be required to obtain a license to launch the specific vehicle or class of vehicle from the launch site. Impacts evaluated in this EIS include those related to construction and operation of the proposed Spaceport Camden, including impacts that could result from the launches of a representative launch vehicle. Future proposed activities that are outside the scope of this EIS could require additional environmental analysis under NEPA. A supplemental environmental analysis could be required when one or more of the parameters of the proposed construction or launch activities fall outside what is analyzed in this EIS.

ES.1 Purpose and Need (Draft EIS Chapter 1)

ES.1.1 Camden County Board of Commissioners Purpose and Need

The purpose of the County's proposal to construct and operate Spaceport Camden is to allow the County to offer a commercial space launch site to a growing number of small to medium-large lift-class, orbital and suborbital, vertical launch vehicle operators to conduct commercial launches from the east coast of the United States.

The need for the proposed commercial space launch site is to further the goals of Camden County as established in the County's Strategic Plan 2018, 2023, 2032 to create a strong regional economy with diverse job opportunities based on four major pillars of economic growth and sustainment, one of which is developing a world-class spaceport that would also attract businesses to support its operation.

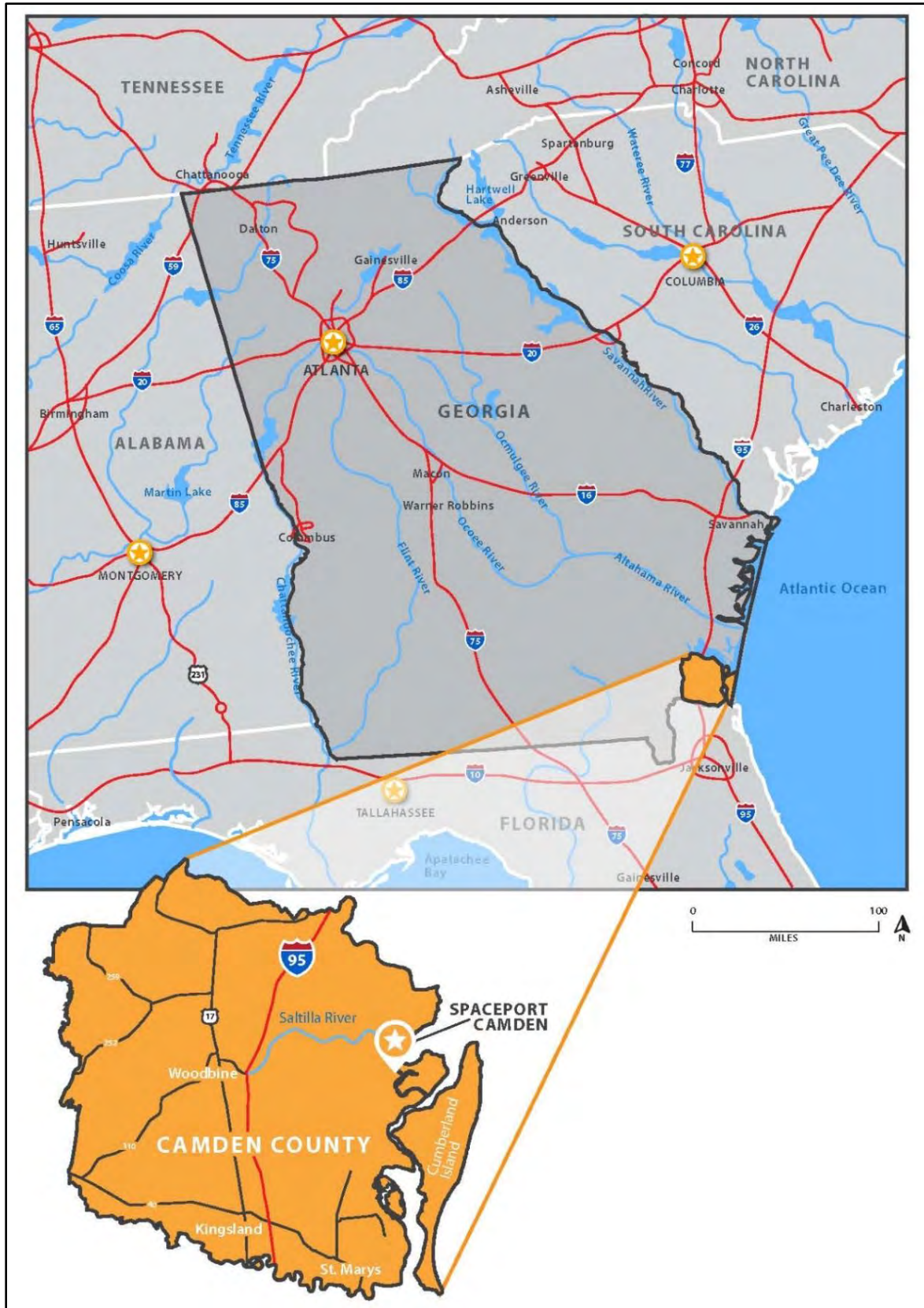


Exhibit ES-1. Proposed Spaceport Camden Location

ES.1.2 FAA's Purpose and Need

The purpose of FAA action in connection with the County's proposal is to fulfill FAA's responsibilities as authorized by EO 12465, Commercial Expendable Launch Vehicle Activities (49 *Federal Register* [FR] 7099, 3 CFR, 1984 Comp., p. 163), and the Commercial Space Launch Act of 2015 (51 U.S.C. §§50901–50923) as amended by the U.S. Commercial Space Launch Competitiveness Act of 2015 (Public Law 114-90) for oversight of commercial space launch activities, including issuing Launch Site Operator Licenses for the operation of commercial space launch sites, and launch licenses to operate expendable and reusable orbital and suborbital launch vehicles.

The need for the FAA action of issuing a Launch Site Operator License and launch licenses results from the statutory direction from Congress under the Commercial Space Launch Act to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States and to encourage, facilitate, and promote commercial space launch and reentry activities by the private sector in order to strengthen and expand U.S. space transportation infrastructure.

ES.2 Public Involvement (Draft EIS Chapter 1)

FAA gathered input from the public during the scoping process, which is an early and open process for determining the range of issues to be addressed in the EIS. Detailed information about the scoping process, public scoping comments, and public scoping meetings, can be found on the FAA's *Spaceport Camden EIS* website:

http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents/progress/camden_spaceport.

FAA is providing the Draft EIS to the public for review and comment. FAA will consider all comments on the Draft EIS and will respond to substantive comments in the Final EIS. In accordance with 40 CFR §1506.6 and §1503.4, FAA must provide the public and interested agencies with an opportunity to review and comment on this Draft EIS and must formally respond to those comments in the Final EIS. The Draft EIS review and comment period was initiated with the publication of the U.S. Environmental Protection Agency's Notice of Availability (NOA) in the *Federal Register* on March 16, 2018. In addition, FAA published a NOA in the *Federal Register* on March 16, 2018, indicating that the Draft EIS was available for review online at:

https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents/progress/camden_spaceport/

and in hard copy format at the following local libraries:

- Camden County Public Library, 1410 Georgia Highway 40, Kingsland, Georgia 31548
- St. Marys Public Library, 100 Herb Bauer Drive, St. Marys, Georgia 31558
- Brunswick-Glynn County Library, 208 Gloucester Street, Brunswick, Georgia 31520
- St. Simons Island Public Library, 530A Beachview Drive, St. Simons Island, Georgia, 31522

The FAA sent notification of the publication of the Draft EIS to members of Congress; Federal, State, and local elected and appointed government officials and other agencies; Native American tribal officials; and libraries. The FAA sent notification of the publication of the Draft EIS to media outlets; special interest groups; organizations; affected landowners; and interested members of the public who requested to be notified of the Draft EIS, as listed in Appendix A, *Public Involvement/Agency Coordination and Consultation*. The FAA provided e-mail notification of the availability of the Draft EIS and the website location to everyone on the distribution list who had a valid e-mail address; those

persons without valid e-mail addresses who provided a mailing address were notified via postcard. Notifications were also placed in local newspapers indicating the availability of the Draft EIS in the “Georgia” insert of the *Florida Times Union* (March 11 and April 8, 2018), the *Tribune & Georgian* (March 8 and April 5, 2018), and the *Brunswick News* (March 10 and April 7, 2018). The NOA, local newspaper advertisements, Draft EIS distribution letters, and the website also provided notification of public hearings occurring to gather public input on the Draft EIS.

The public hearings are scheduled to take place on April 11 and 12, 2018, at the Camden County Public Services Authority Recreation Center located at 1050 Wildcat Drive in Kingsland, Camden County, Georgia. Hearings are scheduled to start at 5:30 p.m. with an open house and poster session, a formal presentation running from 6:30 p.m. to 6:50 p.m., and a formal commenting period from 7:00 p.m. to 8:30 p.m.

Regional notification of the Draft EIS availability was also provided by placing NOAs on March 11, 2018, in the following newspapers: *The Island Packet* (Hilton Head, South Carolina); *Savannah Morning News* (Savannah, Georgia); main section of the *Florida Times-Union* (Jacksonville, Florida); and the *St. Augustine Record* (St. Augustine, Florida).

The Draft EIS public comment period lasts for 45 days, from March 16, 2018, to May 7, 2018. Persons or agencies wishing to have their comments considered for the Final EIS are encouraged to provide their comments no later than May 7, 2018. In accordance with 40 CFR §1503.4, FAA will assess and consider comments, both individually and collectively, and will respond to all substantive comments in the Final EIS.

ES.3 Licenses, Permits and Approvals (Draft EIS Chapter 1)

Two FAA licenses would be required for commercial space launch operations at Spaceport Camden: a Launch Site Operator License and a launch license. The Launch Site Operator License would authorize Camden County to operate Spaceport Camden, and the launch license would authorize any launch operator proposing to launch a vehicle from the launch site. This EIS addresses FAA issuance of the Launch Site Operator License; issuance of launch licenses would require further environmental review to determine whether the launch parameters fall within the scope of this EIS. Additional environmental analysis would be required if the launch parameters do not fall within the scope of this EIS.

ES.4 Proposed Action and Alternatives (Draft EIS Chapter 2)

This *Spaceport Camden EIS* evaluates three alternatives: the Proposed Action, the Ocean-Landing Only Alternative, and the No Action Alternative.

In addition to the Launch Site Operator License (14 CFR Part 420), any commercial launch operator would be required to obtain a launch license from the FAA for operation of their vehicle(s) from Spaceport Camden. This EIS addresses issuance of a Launch Site Operator License; the FAA’s issuance of such launch licenses will require discrete environmental reviews.

Also under consideration is an *Ocean-Landing Only Alternative* and a *No Action Alternative*.

ES.4.1 Proposed Action (Preferred Alternative)

Under the Proposed Action, which is the Preferred Alternative, the FAA would issue a Launch Site Operator License to the County. The Proposed Action is the Preferred Alternative because it provides launch vehicle operators with the most flexibility in terms of landing options (both land and sea) and is logistically the most practical. The proposed launch site would be constructed within an existing 11,800-acre industrial site, consisting of property currently owned by the Union Carbide Corporation

1 and Bayer CropScience, shown in Exhibit ES-2. The spaceport (the boundary is outlined in blue in Exhibit
2 ES-2) would be constructed on the uplands portion of this site. The total 11,800 acres of these two
3 properties would provide an appropriate buffer to ensure the safety of the public.

4 **Construction Activities**

5 The facilities of the proposed Spaceport Camden would encompass less than 100 noncontiguous acres
6 as shown in Exhibit ES-2 and Exhibit ES-3. Related infrastructure (e.g., roads and utilities) would also be
7 improved within the existing industrial site. Each of the launch site facilities and the western boundary
8 of the site would be fenced to provide security and control access. The Spaceport Camden boundary,
9 which is fully within the uplands portion of the property, is outlined in dark blue on Exhibit ES-2. Note
10 that the location of one of the facilities, the Alternate Control Center and Visitor Center, is located
11 outside of the Spaceport Camden site boundary on what is currently Bayer CropScience property.
12 Should the County not purchase the property nor reach an agreement to build on Bayer CropScience
13 property, this facility would have to be relocated. Alternative locations for the facility would be
14 assessed to determine the need for additional environmental impact analysis and documentation. The
15 remainder of the property, much of which is marshland, would be used as buffer.

16 Onsite infrastructure improvements would include improvements to existing internal roads,
17 construction of new roadways, and new electrical distribution, water distribution, and septic systems on
18 the launch site. However, electricity and water are available on the adjoining Bayer CropScience
19 property, and there is an acceptable access road to the launch site. No improvements to the offsite
20 infrastructure would be needed to support Spaceport Camden.

21 Construction of the facilities and infrastructure would occur concurrently and last approximately
22 15 months, the length of time needed for construction of the Vertical Launch Facility. Construction
23 activities would occur during daylight hours, five days per week. It is anticipated that about 40 to
24 50 construction workers would be required for the construction of the facilities and about 20 additional
25 construction workers would be required for the construction of new infrastructure (water, sewer,
26 drainage, and roads). Launch site construction activities would not commence until after the NEPA
27 process, including issuance of a Record of Decision, has been completed and any required permits or
28 approvals have been granted.

29 **Operations**

30 Operations would consist of up to 12 launches and up to 12 associated launch vehicle first-stage
31 landings per year. Other operations, including up to 12 static fire engine tests and up to 12 wet dress
32 rehearsals per year, are also proposed for the launch site. One of the 12 launches could be a night
33 launch. All vehicles would launch to the east, over the Intracoastal Waterway, Cumberland Island
34 National Seashore and/or Little Cumberland Island, and the Atlantic Ocean. For purposes of analysis in
35 the EIS, FAA is considering a range of launch and landing trajectories ranging from 83 to 115 degrees
36 from true north. This range is depicted in Exhibit ES-4. The launch trajectories used for any launch
37 would be specific to each particular launch operator's mission.

38 As part of the launch license evaluation process, FAA conducts a policy review, payload review, financial
39 determination, and safety review. For FAA to complete a safety review, an individual launch operator is
40 required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, trajectory
41 specific hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements. Any
42 proposed trajectories, launch vehicles, and/or propellant types identified during the licensing process
43 that are outside the scope of those addressed in this EIS would require additional environmental review.



Exhibit ES-2. Proposed Spaceport Camden Regional Location

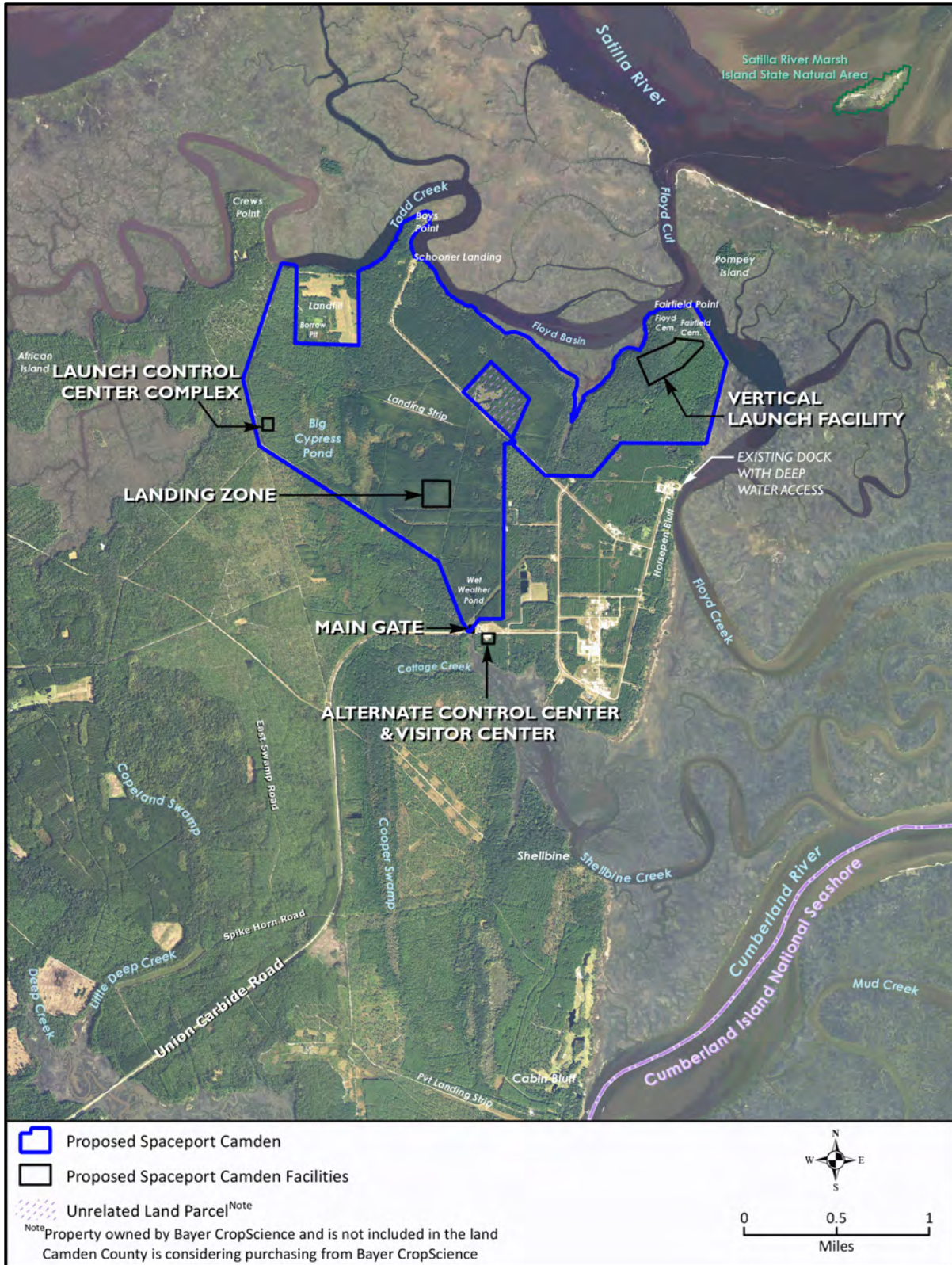


Exhibit ES-3. Proposed Spaceport Camden Site Plan

Note: The parcel of land identified in the exhibit as “not part of proposed Spaceport Camden” is property owned and utilized by Bayer CropScience and is not included in the land Camden County is considering purchasing from Bayer CropScience.

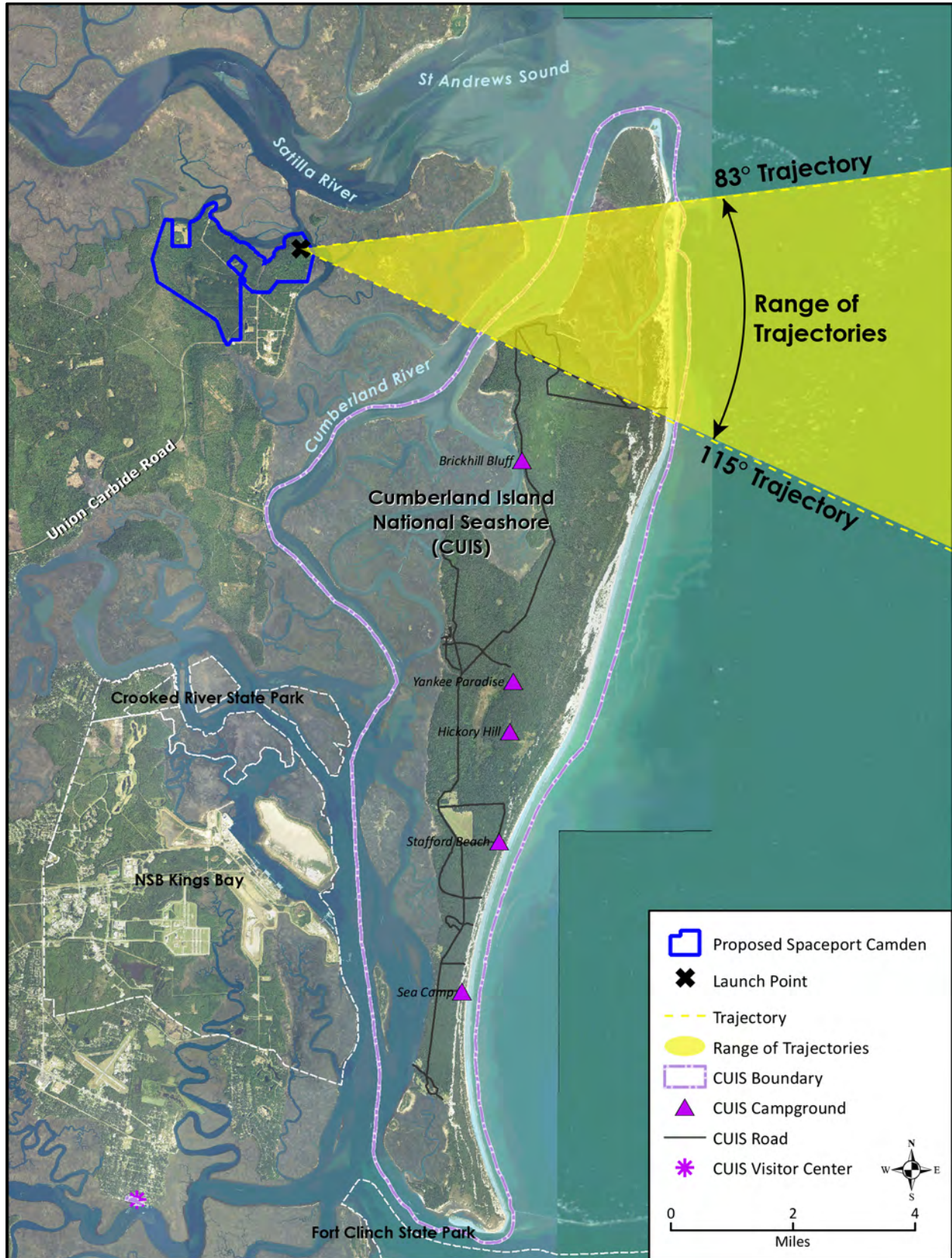


Exhibit ES-4. Spaceport Camden Range of Launch Trajectories

Spaceport Camden would be available to a range of launch operators, each of which offers various launch vehicles. While these vehicles would include small to medium-large lift class and use liquid propellants, they would have different design and operating specifications. Since a specific launch vehicle cannot be identified until a launch operator is identified and a variety of launch vehicles would be candidates to be launched from the launch site, a representative medium-large lift-class launch vehicle is used in this EIS to evaluate the potential environmental impacts of launches from the launch site. A medium-large lift-class launch vehicle may have a gross liftoff weight of approximately 750,000 to 1,500,000 pounds with an approximate length of 200 to 250 feet. The representative launch vehicle considered for purposes of this EIS uses liquid oxygen and a special grade of kerosene known as RP-1 as propellants. The determination of the applicability of the analysis performed using the representative launch vehicle to a specific launch vehicle would be made by FAA. Should a launch operator's launch vehicle differ from the representative launch vehicle, the need for additional NEPA documentation would be evaluated.

The first stage of the launch vehicle could land at Spaceport Camden, land on a barge about 200 to 300 miles off shore in the Atlantic Ocean, or drop into the Atlantic and not be recovered. For launches where the first stage would be recovered, the return of the first stage (either landing at the Landing Zone or returned by vessel after landing on a barge in the Atlantic Ocean) and first-stage refurbishment would complete the launch operations. Any proposed trajectories, launch vehicles, and/or fuel types or changes to the maximum number or timing of launches identified during the licensing process that are outside the scope of those addressed in this EIS would require additional environmental review.

Pre-Launch Activities

Pre-launch activities would include mission rehearsals, static fire engine tests, and coordination with governmental agencies and media outlets to provide notification of these launch operation activities and establish secure areas in the vicinity of the vertical launch area. A Security Plan, developed by Camden County in cooperation with the launch operator, would outline a process (e.g., the establishment of closure areas) to prevent the public and other nonauthorized personnel from accessing the area during hazardous operations in accordance with 14 CFR Parts 417 and 420.

Mission rehearsals are performed to verify that all vehicle and ground systems are functioning properly and that all procedures are properly written. After final systems checkout, there would typically be two mission rehearsals. These rehearsals would allow for team training and coordination of activities between the mission-specific launch operator crew and other operations personnel. One dry dress rehearsal (a launch rehearsal performed without loading propellants on board the launch vehicle) and one wet dress rehearsal (a launch rehearsal performed with vehicle propellant loading) would be performed to verify full launch readiness. During a wet dress rehearsal, the launch procedures would be followed up to a pre-programmed abort just prior to first stage engine ignition.

Static fire engine tests are performed to verify engine control and performance as well as launch pad systems performance. Static fire engine tests include all of the activities associated with a wet dress rehearsal, with the additional action of igniting the first stage engines. During a static fire engine test, the launch vehicle engines would typically be ignited for approximately two seconds but could be ignited for up to seven seconds, then shut down. The launch vehicle would be held in place during the test to prevent launch.

Public Notification

Public access in the vicinity of the launch site would be restricted during launches, wet dress rehearsals, and static fire engine tests. Closures would involve securing both land and water areas (referred to as closure areas, the sizes of which would vary for each operation). Public notification would be required prior to establishing the closure areas.

Camden County and/or the launch operator would post written notices of the date, time, and the proposed closure area at several locations in the area as well as an advertisement in local newspapers. Camden County and/or the launch operator would also coordinate with local government agencies with regard to launch operations requiring public notification.

Security and Safety Zones

As part of the licensing process, Camden County and the launch operator would jointly develop a Security Plan that defines the process for ensuring that any unauthorized persons or occupied vessels, trains, aircraft, cars, trucks, all-terrain vehicles, or other vehicles are not within FAA-approved hazard area or, if they are, that they conform to criteria in 14 CFR Parts 417 and 420; the hazard area encompasses areas that could potentially be affected by debris from a launch accident. In the event of a launch accident, only some portions of the hazard area would be impacted. The Security Plan would include safety and security personnel for each launch operation activity and roadblocks and other security checkpoints to ensure the public remains clear of the area. Camden County and/or the launch operator also would develop and implement agreements and plans with local authorities whose support is needed to ensure public safety during all launch processing and flight, in accordance with 14 CFR Parts 417 and 420. Individual Security Plans that include motorized vehicular use or temporary structures or staging areas on the beach will require beach driving permits and/or Letters of Permission from the Georgia Coastal Resources Division (Official Code of Georgia Annotated [O.C.G.A.] 12-5-230, *Shore Protection Act*). Individual Security Plans developed between the County and launch operator must be submitted to the Georgia Coastal Resources Division to determine if any additional plan-specific authorizations are required prior to implementation (O.C.G.A. 12-5-320, *Coastal Management Act*). The Georgia Coastal Resources Division requests notification in writing of all launch operations that require public notification so that they may assist in alerting the affected public of upcoming closures.

The Spaceport Camden Security Plan would describe the procedures for securing a closure area, thus limiting unauthorized public access in the area on the day of a launch. The closure area would be expected to include areas around the access points to the launch site at the end of Harrietts Bluff Road (also referred to as Union Carbide Road) and the waterways surrounding the launch site, in addition to parts of Cumberland Island and Little Cumberland Island extending along the trajectory and out to sea. Exhibit ES-5 and Exhibit ES-6 show possible hazard and closure areas for a launch based on two representative trajectories (three trajectories were used in the analyses for this EIS: a northern [83°], a middle [100°] and a southern [115°]; Exhibit ES-5 and Exhibit ES-6 show hazard and closure areas for the northernmost and southernmost of these three trajectories).

Other trajectories proposed by launch operators would be assessed to determine the need for additional environmental impact analysis and documentation. Closure and hazard areas would be determined as part of the FAA launch approval process for each launch. Additional trajectories, all in a generally easterly direction, could be used for launches from this launch site; at roughly 4 miles from the launch site (the approximate distance to first possible crossing over any part of Cumberland Island), the altitude of the vehicle in a typical launch profile would be over 30,000 feet. Each launch would have an individually defined closure and hazard area, which is dependent upon the specific type of vehicle, the trajectory, and the mission.

As can be seen from Exhibit ES-5 and Exhibit ES-6, differences in the locations of the hazard areas could result in changes to the defined closure areas. If the closure area for a proposed launch would impact areas other than those described and analyzed in this EIS, additional or supplemental environmental review may be required. Camden County (as the launch site operator) and/or the launch operator would coordinate with the following entities (and possibly others) to develop and implement the Security Plan: Camden County, Glynn County and State of Georgia law enforcement agencies; the cities of Brunswick, St. Marys, Woodbine and Kingsland; the National Park Service (NPS); U.S. Navy; FAA; Crooked River State

1 Park; Jekyll Island State Park; the U.S. Fish and Wildlife Service (USFWS); the Georgia Department of
2 Transportation; and the U.S. Coast Guard (USCG).

3 In addition, consultation under Section 4(f) with the NPS regarding impacts from closures on the
4 Cumberland Island National Seashore would be conducted as part of the consideration of the issuance
5 of a launch license. Advanced planning work sessions with all stakeholders would occur to ensure every
6 organization's role and responsibilities were defined and understood and that a detailed (minute-by-
7 minute) launch checklist (count down and contingency plan) would be created. There may be dry runs of
8 the detailed launch checklist before the first few launches to make sure everyone is clear on how the
9 process would flow, and the detailed launch checklist would be updated as needed to account for
10 lessons learned. Appropriate cost recovery mechanisms would be put in place as needed for those
11 stakeholders that are a part of the process, and provisions for "authorized persons" would also be
12 determined and implemented (e.g., residents, vacation house owners and permit-holding campers, NPS
13 personnel). Should those persons wish to depart the area on Cumberland Island or Little Cumberland
14 Island for a launch, Spaceport Camden personnel may facilitate transportation for those individuals to
15 and from their houses or camp sites on the day of the launch.

16 Camden County proposes to limit public access during launches at a pre-defined checkpoint on Harrietts
17 Bluff Road/Union Carbide Road and up to two other locations on logging roads near the launch site to
18 ensure that unauthorized persons remain off the launch site, which would be entirely within the
19 anticipated closure area. These locations are shown as points X₁, X₂, and X₃ on Exhibit ES-5 and Exhibit
20 ES-6. The Camden County Sheriff department would be responsible for setting up these checkpoints.
21 Only approved government, Camden County, launch operator, and emergency personnel, and others
22 with appropriate credentials would be allowed on the launch site during a launch (or at other times).

23 The proposed closure area would be further developed in consultation with FAA, the USFWS, and the
24 NPS to ensure the Cumberland Island National Seashore and the Satilla River/Andrews
25 Sound/Cumberland River areas are properly secured, with minimal impact to activities and operations.

26 Closures could last up to 12 hours on a launch day, with 4 to 6 hours being the typical closure time for a
27 nominal launch. The 12-hour closure period allows for potential aborts and contingencies. A closure for
28 a wet dress rehearsal or static fire engine test would be shorter than for a launch, typically three hours
29 or less and would include only those areas within a 2-mile radius of the launch pad.

30 During a closure, monitoring would be done by vehicles (car/truck) along existing roads such as Harrietts
31 Bluff Road, as well as by video surveillance (e.g., high-definition video cameras with zoom lenses placed
32 well above ground level on the water tower and/or lightning towers). Camden County, the launch
33 operator, and/or law enforcement would monitor the area to the east of the checkpoints to ensure that
34 the area would remain clear. Except in case of an emergency, Camden County and/or the launch
35 operator would not conduct ground sweeps. Only if video surveillance is insufficient would other
36 monitoring methods be used, such as the following:

- 37 • Unmanned aerial surveillance (no more than two unmanned vehicles at the same time), with
38 unmanned vehicles abiding by airspace restrictions for the Cumberland Island National Seashore
39 and generally not overflying the wilderness area
- 40 • Manned aerial surveillance (one fixed-wing aircraft with flight time less than 30 minutes at an
41 altitude of less than 1,000 feet)
- 42 • Beach sweeps along the Atlantic coast beaches of Cumberland Island and Little Cumberland
43 Island (limited to the areas within the closure area) using ground vehicles suitable for beach
44 travel (e.g., all-terrain or sport utility vehicles) and approved for use on Cumberland Island and
45 Little Cumberland Island
- 46 • USCG vessel

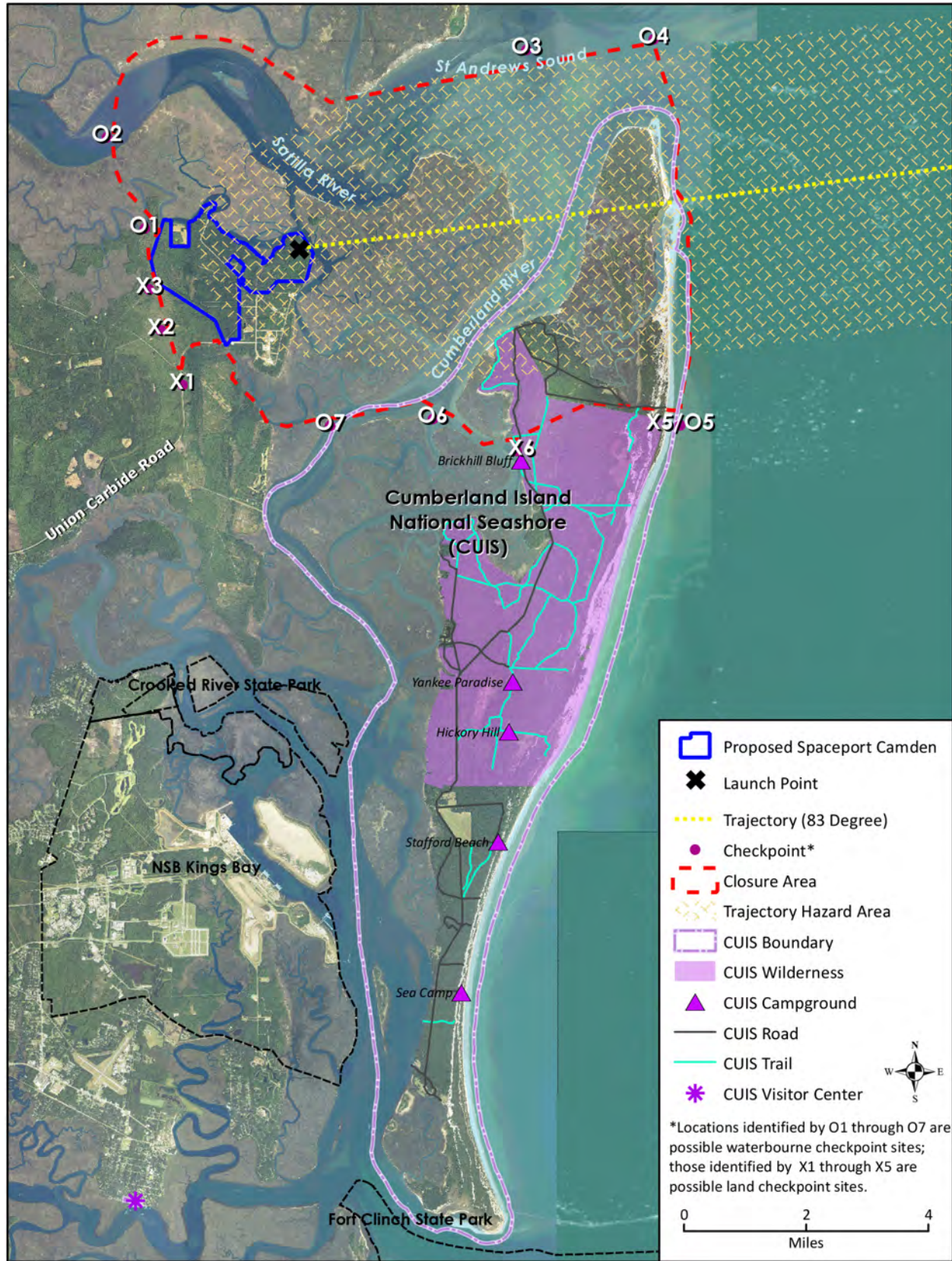


Exhibit ES-5. Representative Trajectory (83 Degree) with Hazard and Closure Areas

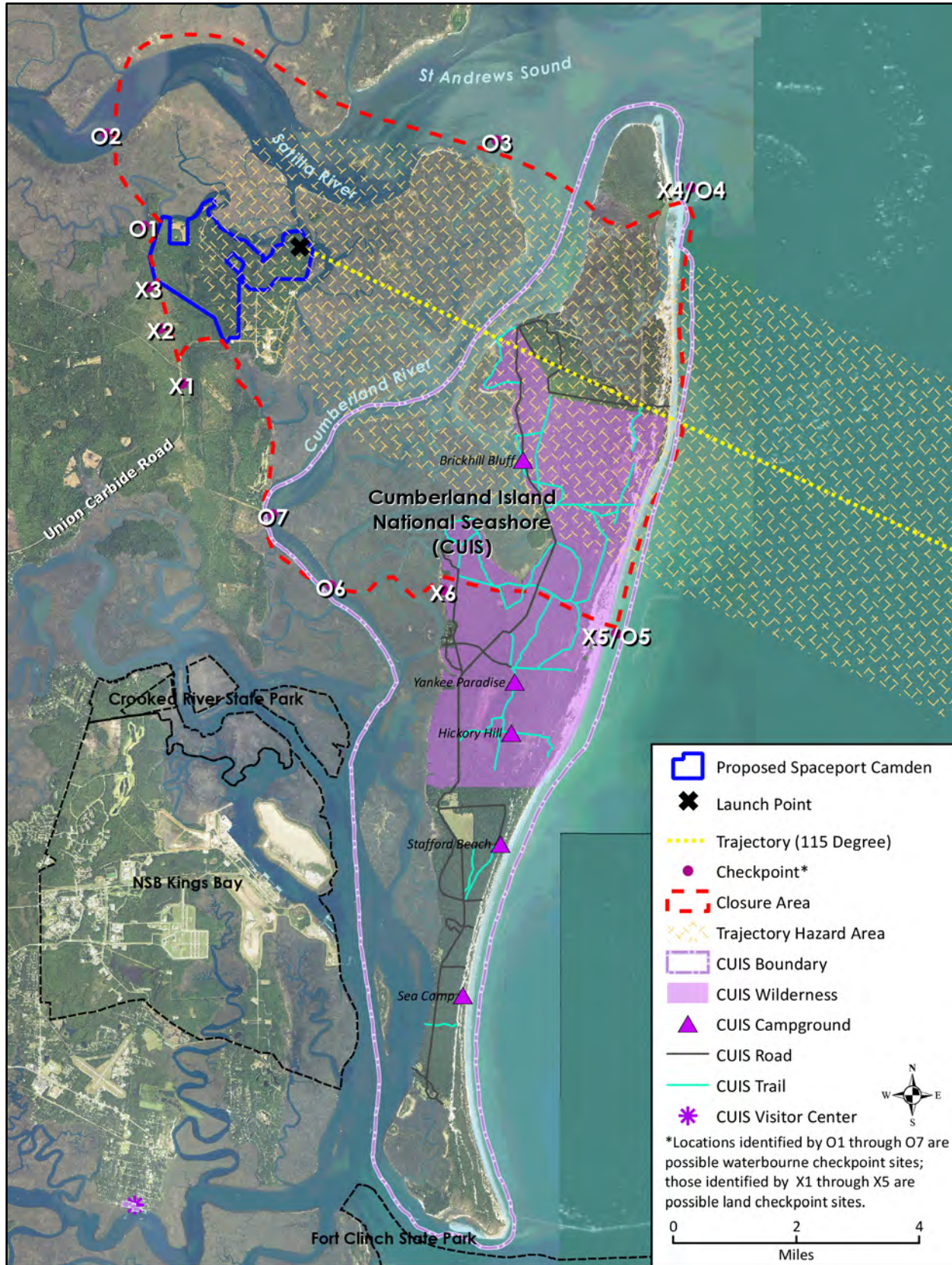


Exhibit ES-6. Representative Trajectory (115 Degree) with Hazard and Closure Areas

Specific closures for launch days are still to be determined. However, Exhibit ES-5 and Exhibit ES-6 note initially proposed check points.

The Security Plan would also include a process for clearing offshore areas. This process would include coordinating with the USCG, issuing a Notice to Mariners (NOTMAR), and clearing the offshore area in order to ensure public safety. The USCG could conduct a boat patrol to sweep the offshore area to make sure the area is clear; sweeps would continue until the launch operator is ready to load propellant to the vehicle (approximately three hours prior to launch). If necessary, a final sweep of the closure areas by manned fixed-wing aircraft or unmanned aerial vehicle could be implemented at this time to ensure the areas are clear.

After the launch (and landing at the launch site, if planned) operation is completed or postponed, Camden County and/or the launch operator and FAA would notify law enforcement that the area has been deemed safe, allowing them to reopen the closure areas. In the event that the launch would be postponed, closure and hazard areas would be reestablished for the rescheduled launch.

Staffing

Permanent staffing at the launch site under the Proposed Action would be approximately 77 full-time employees, with 27 of the employees being Camden County employees and 50 of the employees being launch operator employees. Depending on the launch operator and type of launch, onsite activities supporting a launch would be expected to begin up to four weeks before launch day. During launch operations, it is anticipated that the number of staff would increase to approximately 50 to 100 Camden County employees and 150 to 200 launch operator employees beginning about two weeks before the launch.

ES.4.2 Ocean-Landing Only Alternative (Environmentally Preferred Alternative)

Under the Ocean-Landing Only Alternative, which is the Environmentally Preferred Alternative, FAA would issue a Launch Site Operator License to the County. The license would allow the County to operate Spaceport Camden in a manner similar to that described under the Proposed Action, except that the recovery of a launch vehicle first stage would be limited to a landing on a barge approximately 200 to 300 miles off shore in the Atlantic Ocean and would not include the option to land the first stage of a launch vehicle at Spaceport Camden. This alternative is the Environmentally Preferred Alternative because it eliminates certain environmental issues associated with landings at the spaceport site. Particularly, there would be no landing-related noise or sonic booms as there would be with the Proposed Action. Additionally, there would be less ground disturbance because the Landing Zone would not be constructed.

The first stage of the launch vehicle could land in the Atlantic Ocean on a barge or could be dropped in the Atlantic Ocean and not recovered. A first stage that lands on a barge would be returned to Spaceport Camden. Three facilities and the related infrastructure improvements would be constructed under the Ocean-Landing Only Alternative: a Vertical Launch Facility, a Launch Control Center Complex and, an Alternate Control Center and Visitor Center. Since the Ocean-Landing Only Alternative does not include the potential for first-stage landings at Spaceport Camden, a Landing Zone Facility would not be constructed.

ES.4.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License to the Camden County Board of Commissioners. No activities related to constructing or operating a commercial spaceport would occur at the site. Camden County would not exercise its option to purchase the property, and the property would continue to be owned by the private landowner in accordance with its

1 current industrial zoning. The property, currently under private ownership with no public access, is not
2 being used. Under this No Action Alternative, it is assumed that the property would continue to be
3 unused. Therefore, for this EIS, FAA will consider impacts associated with the assumption that no
4 further development or change in the use of the property would occur.

5 **ES.5 Summary of Environmental Effects (Draft EIS Chapter 4)**

6 Fourteen resource areas were considered to provide a context for understanding and assessing the
7 potential environmental effects of the Proposed Action and alternatives including: air quality; biological
8 resources (including fish, wildlife, and plants); climate; coastal resources; Department of Transportation
9 Act, Section 4(f) properties; farmlands; hazardous materials, solid waste, and pollution prevention;
10 historical, architectural, archaeological, and cultural resources; land use (including wilderness); natural
11 resources and energy supply; noise and compatible land use; socioeconomics, environmental justice,
12 and children's environmental health and safety risks; visual effects (including light emissions); water
13 resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers); and
14 secondary (induced) impacts. Additional resource areas were also considered, including airspace, health
15 and safety, and ground traffic and transportation. For each resource area discussed in this EIS, the
16 Region of Influence (ROI) was determined. The ROI describes the area that could be affected by the
17 Proposed Action, Ocean-Landing Only Alternative, and the No Action Alternative. The environmental
18 consequences associated with the Proposed Action, Ocean-Landing Only Alternative, and the No Action
19 Alternative were analyzed for the appropriate ROI for each resource area. Table ES-1 provides a
20 summary of potential environmental impacts from the Proposed Action, Ocean-Landing Only
21 Alternative, and the No Action Alternative.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
Air Quality	There would be air emissions associated with construction activities resulting in short-term and temporary emissions during these activities. While emissions associated with operational activities would be temporary with respect to individual launches, they would continue for the term of the Launch Site Operator License or longer. However, launch-related emissions would be minimal compared to the regional baseline emissions. Based on air quality analysis the Proposed Action would not result in any significant adverse air quality impacts because emissions would not cause any pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS) for any of the time periods analyzed.	Air emissions would generally be the same as described for the Proposed Action. The construction emissions would be slightly lower, because the construction of the Landing Zone at the spaceport would not be required. Operational emissions would likely increase slightly due to increase vessel support and distance traveled. Overall, impacts to regional air quality would likely be less because there would be no emissions from landing zone construction, and offshore emissions would not be likely to disperse in such a manner as to appreciably contribute to pollutant concentrations on shore.	The No Action Alternative is, essentially, the baseline condition, and air quality impacts under the No Action Alternative would consist of those generated by ongoing activities within the region.
Biological Resources	There would be a loss of vegetation associated with land clearing activities, although the area affected is negligible when compared to the overall undeveloped land area associated with the spaceport site. Wildlife species could be affected due to habitat alteration and loss, disturbance or displacement resulting from human activities and noise, and direct physical impacts. While some number of individual species would experience adverse impacts, which could include injury or mortality, quantification is difficult. The Proposed Action would not result in an overall decrease in population diversity or abundance for any species. Pre-construction management actions would minimize the potential for physical strikes and habitat disturbance. Effects would generally consist of short-term behavioral reactions, such as a startle response, and would not be considered significant. FAA submitted a Biological Assessment (BA) to the USFWS and initiated consultation in accordance with Section 7 of the Endangered Species Act (ESA). FAA also conducted ESA	Impacts to vegetation and animal species would essentially be the same as those for the Proposed Action, except there would be no impacts (noise) from landing at the Landing Zone. The difference in the area of land cleared (and habitat lost) associated with no Landing Zone would be negligible. Disturbance and noise would be comparable to that associated with the Proposed Action, and the same wildlife species would be affected. From the standpoint of biological resources, there would be essentially no difference between the alternatives except a slightly higher potential for marine animal impacts due to increased ocean landings. No significant impacts on biological resources are expected.	The No Action Alternative would not change the existing conditions for biological resources and, therefore, would not result in impacts on biological resources.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	consultation with NMFS (see Appendix A, Public Involvement/Agency Coordination and Consultation). FAA determined the Proposed Action would either have “no effect” or “may affect but is not likely to adversely affect” ESA-listed species depending on the particular species and scope of associated activity. On February 12, 2019, the USFWS provided concurrence that the proposed action is not likely to adversely affect federally listed species provided that conservation measures identified in the consultation are implemented. FAA is still in consultation with NMFS regarding the effects determinations. The Final EIS will document the conclusion of the ESA consultations. The consultation documents provided in Appendix A outline conservation measures that would be implemented to avoid or minimize potential impacts. No significant impacts on biological resources are expected.		
Climate	The small amount of greenhouse gases resulting from construction and operation of the spaceport is not likely to have any impact on global climate change, sea level rise, or any potential impacts of climate change. However, sea level rise and other climatological changes such as increase in extreme weather events, may impact the spaceport in the coming years.	Climate-related impacts under this alternative would be the same as those for the Proposed Action.	The baseline climate of the area under the No Action Alternative would continue to change over time, affected by natural processes and ongoing activities within the region.
Coastal Resources	The Proposed Action is consistent with the Georgia Coastal Management Program; there would be no impacts to coastal barrier resources; no unacceptable risks to human safety or property; and no adverse impacts to the coastal environment that cannot be satisfactorily mitigated. Camden County submitted a coastal consistency certification to the Georgia Department of Natural Resources (GDNR) certifying the project is consistent with the state’s Coastal Management Program (see Appendix A, Public Involvement/Agency Coordination and Consultation). GDNR is currently reviewing the consistency certification. The final results of this	Impacts to coastal resources under this alternative would be the same as those for the Proposed Action, with the difference in the area of land cleared (and habitat lost) associated with no Landing Zone being negligible. Disturbance and noise would be comparable to that associated with the Proposed Action, and the same coastal resources would be affected. No significant impacts on coastal resources are expected.	The No Action Alternative would not change the existing conditions for coastal resources and, therefore, would not result in impacts on coastal resources.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	coordination will be included in the Final EIS. No significant impacts on coastal resources are expected.		
Dept. of Transportation Act, Section 4(f)	Upland portions of Cumberland Island National Seashore at a distance of about 3.5 miles from the closest construction (Vertical Launch Facility) would experience noise levels of approximately 43 A-weighted decibels (dBA) day-night average sound level (DNL) (see Section 4.11.1.1, Construction). The noise would not substantially limit the use or diminish the quality of any of the Section 4(f) properties, such that their value would be impaired. Additionally, there would be no direct impact to historic properties and vibration from construction (e.g., pile driving) would be far enough away that there would also be no indirect effects. Outside of the proposed Spaceport Camden boundary the Cumberland Island National Seashore historic properties and cultural landscape are also unlikely to experience audible or visual impacts related to construction activities. Therefore, the FAA has made a preliminary determination that construction activities would not constitute a constructive use of Section 4(f) properties. The potential for constructive use to occur as a result of closures or restricted access to parks and recreational areas was not evaluated because sufficient information about individual launches that may take place at the proposed launch site is not yet available. At the time when individual launch licenses are applied for, FAA will evaluate the potential for restrictions in access and closures for parks and recreational areas that qualify for protection under Section 4(f) to result in a constructive use of the properties. Further coordination with officials with jurisdiction over the properties will occur at that time in order to arrive at a constructive use determination. However, at this time the FAA has made the preliminary determination that the operations under the Proposed Action would not result in a constructive use of parks, recreation areas, or historic sites.	Potential Section 4(f) use under this alternative would be similar to that described under the Proposed Action. However, the potential for adverse noise effects on Section 4(f) properties would be less because sonic booms associated with landings would not occur on land.	Under the No Action Alternative there would be no “use” of Section 4(f) properties. Such properties would continue to be affected by ongoing and future activities within the region.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
Farmlands	No farmlands pastureland, cropland, and forest considered to be prime, unique, or of State or local importance have been identified within the project region of influence (ROI). Therefore, FAA has identified no impacts to farmlands under the Proposed Action.	Potential impacts to farmlands under this alternative are the same as those for the Proposed Action.	Because there are no farmlands considered prime, unique, or of State or local importance identified within the project ROI there would be no impact to farmlands under the No Action Alternative.
Hazardous Materials, Solid Waste, and Pollution Prevention	While hazardous materials would be utilized and hazardous and solid wastes generated during construction and operation, impacts would be minimal. No National Priorities List properties are involved in the project, and landfill capacities would not be exceeded. There is the potential for effects to historical contamination sites. Once the land is acquired by Camden County, these potentially contaminated sites would likely be managed under the Georgia Brownfields Program. In this case, the new owner (Camden County) would be responsible for soil and groundwater investigations and management of soil and source material that are above Georgia risk reduction standards. This would involve preparing a Corrective Action Plan, which would work like a contract for soil and source cleanup at these sites in accordance with State of Georgia requirements.	Impacts associated with hazardous materials and waste, solid waste, and pollution preventions under this alternative would be the same as those described for the Proposed Action, with slightly less construction-related solid waste associated with not constructing the Landing Zone.	Under the No Action Alternative no impacts from hazardous materials and wastes or contamination sites over those under current conditions would occur.
Historical, Architectural, Archaeological and Cultural Resources	Temporary effects to architectural historic properties, identified through the Section 106 process, could arise from the changes to the audible and visual environment during operation of the spaceport through introduction of elements inconsistent primarily with the historic properties' setting, but there would be no adverse effect. Within the project area but outside the construction zone, three National Register of Historic Places (NRHP)-eligible components of the Floyd's Fairfield and Bellevue Plantations/Union Carbide Property would experience no adverse effect from vibration related to noise from wet dress rehearsals, launch and	Potential impacts to historical, architectural, archaeological, and cultural resources associated with this alternative would be the same as those described for the Proposed Action, with the exception that there would be no noise/vibrational impacts associated with landings because those would occur off shore.	Under the No Action Alternative there would be no effect to historic properties, and thus no impact on cultural resources within the APE for direct effects and no impact on cultural resources within the APE for audible and visual effects. Cultural

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	spaceport landing of space vehicles. On Cumberland Island, there would be effects to the setting of the portion of the NRHP-listed High Point-Half Moon Bluff Historic District (including six contributing elements); to the NRHP-listed Main Road; and to the NRHP-eligible Cumberland Island Cultural Historic Landscape (a Historic Vernacular Landscape). Effects would be from vibration and noise from launches, landings at the project area, visual impacts from light from lightning poles and the water tower, and visual impacts from the launch and spaceport landings, and from the view of the launch facility as seen from some portions of the historic district, the Main Road, and the historic landscape. These temporary effects to historic properties' setting are unlikely to result in any adverse effect or significant impact to cultural resources. The same conditions hold true for the NRHP-eligible resources at the Dover Bluff Club Historic District, the Tabby Ruins associated with the Black Hammock Plantation, and the Cabin Bluff Cumberland River Retreat Historic District. Four archaeological sites that are potentially eligible for the NRHP are located within the construction footprint of the Vertical Launch Facility. If project activities cannot avoid these sites, a Phase II archaeology survey would be required. If Phase II testing determines that the sites are eligible for listing on the NRHP, they could be adversely affected by construction of the spaceport through direct disturbance related to construction activities and mitigations would be required. Georgia State Historic Preservation Officer (SHPO) has concurred with these determinations of eligibility and potential adverse effect (SHPO letter dated April 3, 2017) (see Appendix A, Public Involvement/Agency Coordination and Consultation). The requirements for any avoidance, Phase II testing requirements, and mitigations would be identified through consultation and a Section 106 agreement document, to be completed before the Final EIS.		resources within the APE may be affected by ongoing and future activities outside the scope of the Proposed Action.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	FAA is currently conducting consultation with the SHPO regarding its determination of no adverse effect; and with concerned federally recognized Native American tribes regarding cultural resources and TCPs. Correspondence with the SHPO and Native American tribes is found in Appendix A, Public Involvement/Agency Coordination and Consultation.		
Land Use	There would be no conflict with existing land use management plans, laws, or other policies and the site would remain within its current industrial land use designation. Adverse impacts on recreational use within the operational ROI would be short-term and temporary during launch operations and would not result in long-term preclusion of certain uses, prohibition or severe access limitations to certain areas, and/or severe alterations or diminished aesthetic recreational experiences (e.g., wilderness solitude). Long-term impacts to the solitude quality of the Cumberland Island Wilderness would result from the skyglow and visual intrusion of the spaceport towers/facilities, but only from west shoreline areas; implementation of a Light Management Plan and vegetative buffers will minimize these impacts. No substantial long-term annoyance (i.e., noise-compatible land use impacts) and/or permanent conflicts with landowners has been identified.	Potential impacts to land use under this alternative would be the same as those described for the Proposed Action.	The No Action Alternative would not result in any land use impacts beyond the scope of normal conditions and influences within the region.
Natural Resources and Energy Supply	While construction and operation of the spaceport would require the use of natural and energy resources, the Proposed Action would not have the potential to cause demand to exceed available or future supplies of applicable resources.	Potential impacts to natural resources and energy supply under this alternative would be the same as those for the Proposed Action, with slightly less need for natural resources due to lack of construction of the Landing Zone.	Under the No Action Alternative any changes to current energy usage or natural resource consumption at the property and surrounding areas would continue to be affected by ongoing and future activities associated with Union Carbide Corporation, Bayer CropScience, and other entities utilizing

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
			natural and energy resources throughout the region.
Noise and Noise-Compatible Land Use	Noise levels during launches, landings, and static fire events would be quite high in areas surrounding Spaceport Camden, but each event type would occur only up to 12 times per year and no land area outside of Spaceport Camden would have significant noise impacts (i.e., exposed to noise levels of 65 dBA DNL – average over a 24-hour period). Although individual noise events would temporarily alter the quiet setting that is a defining feature in surrounding areas (e.g., Cumberland Island), rocket noise events would be infrequent. Activities other than rocket launches (e.g., construction, loudspeaker announcements, etc.) would result in temporary localized noise level increases primarily affecting the area on and immediately surrounding Spaceport Camden. Because the sound environment in noise-sensitive locations near Spaceport Camden would be unchanged during the vast majority of the year, current land uses (e.g., recreation, residences, commercial, etc.) would remain compatible. The area exposed to greater than 115 dBA maximum A-weighted overall sound pressure level ($L_{A,max}$) is uninhabited, and because sonic boom overpressures experienced on land would be below 4 pounds per square foot (psf), the potential for noise induced hearing loss would be negligible. Structures in portions of unincorporated Camden County would be exposed to noise levels between 111 dB and 120 dB maximum decibel level (L_{max}), which have been associated with between one damage claim per 1,000 households affected and one damage claim per 100 households. Sonic booms of between 0.5 and 2 psf, which would occur on land as a result of first stage landings, would be associated with a very low risk of damage to structural elements including windows, particularly if the structure is not in good	Noise impacts under this alternative would essentially be the same as the Proposed Action, with the exception that sonic booms associated with first stage landings would not occur on land, as these landings would occur several hundred miles off shore.	Under the No Action Alternative no changes to existing noise levels would occur. Noise levels at the location would continue to be affected by ongoing activities unrelated to spaceport activities.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	repair. Tests have shown the risk of damage to glass, which is typically the most sensitive structural element, at between 1 in 1 billion and 1 in 1 million (depending on the condition of the glass) when exposed to 1 psf sonic booms. During launches, static fires, and landings, noise levels at two nearby noise-sensitive locations, the closest residence and the Settlement on Cumberland Island would be exposed to noise levels expected to disrupt normal speech (i.e., 66 dBA) for less than 132 seconds during each single noise event. In cumulative total, over the course of a year, these two locations would be exposed to noise levels exceeding 66 dBA for up to about half an hour. Subsonic and supersonic noise events would occur at Naval Submarine Base Kings Bay, but events would not be at an intensity that would be of concern. Noise at Cumberland Island National Seashore would be of particular concern because of the expectation among visitors of a completely natural soundscape. Because people's feelings about rockets can be expected to have a strong effect on their perception of rocket noise, previous research conducted on National Parks visitor's reactions to aircraft noise are not expected to be applicable to predicting the percentage of people highly annoyed by rocket noise. Although existing research does not support prediction of a specific percentage of visitors that would be highly annoyed by the noise of rocket operations, disruption of the natural soundscape, particularly in the designated Cumberland Island Wilderness Area could degrade the positive experiences of visitors to the island. Certain people exposed to elevated noise levels during launch, landing, and static fire events could become annoyed by the noise, and there would be a very low risk of damage to structures due to noise. However, the noise events would be infrequent and FAA does not expect operational activities to result in significant adverse impacts.		

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks	The Proposed Action may provide some economic benefits to the surrounding area through employment and income. There would be some inconveniences to local residences and recreational users during hazard area closures; however, advance notices would be provided by the County and these closures would be short-term and temporary. There are no identified disproportionate impacts to minorities and/or low-income populations, and no identified impacts that pose special risks to children.	Potential impacts to socioeconomics, environmental justice and children's environmental health and safety risks under this alternative are the same as those described under the Proposed Action, with the exception that under this alternative there would be less potential for noise-related adverse impacts to socioeconomics, environmental justice, or special risks to children with sonic booms associated with first stage landings occurring several hundred miles off shore instead of over land.	Under the No Action Alternative the baseline condition of socioeconomics, environmental justice, and special risks to children would continue to be influenced by ongoing activities within the region now and into the future
Visual Effects	Overall, the construction activities would have little effect on visual resources in the areas surrounding the proposed Spaceport Camden. The completed facilities would mostly be screened and not visible from most offsite locations. The tallest elements of the construction are situated at the Vertical Launch Facility and would rise above surrounding forest and vegetation. These elements would be visible from several locations and from open waterways. Notably, these elements would be visible but not dominant in the viewshed from the western shoreline of the wilderness areas on Cumberland Island National Seashore. Because these towers would have hazard lighting and markings, they could be highly annoying to some residents in closer proximity to the site. Lighting at the launch pad during a launch event would be highly noticeable at nighttime for about one or possibly two nights each month on average. The directed light would be highly noticeable from nearby locations and could cause glare depending on the exact position of the viewer, conflicting with activities such as driving and aviation.	Potential visual effects under this alternative are the same as those described under the Proposed Action, with the exception that the lack of a Landing Zone would result in less visible lighting impacts.	Under the No Action Alternative visual resources and light emissions would continue to be affected by ongoing baseline and future activities at or near the site.
Water Resources	Approximately 0.78 acre of wetland and 0.166 acres of waterways may be impacted from construction activities; this	Construction related wetland impacts would potentially be less than those	Under the No Action Alternative no impacts

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	would require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers and compensatory mitigation would be required for any unavoidable impacts to jurisdictional wetlands and waterways. The partial filling of wetlands and waterways would result in a loss of wetland and stream function. The amount of wetlands and waterways filled represents a small percentage of the total wetlands and waterways on site. The Vertical Launch Facility and Alternate Control Center and Visitor Center would be constructed in the 100 and 500-year flood zone. The Main Gate area of the project is also within the 500-year flood zone. Approximately 82 acres of proposed facilities would be constructed within flood zones (19 acres in the 100-year flood zone, and 63.1 acres in the 500-year flood zone). This represents 0.9 percent of the approximately 9,470 acres of flood zones within the ROI. The Vertical Launch Facility is considered a critical facility under Camden County's definition in the County's Unified Development Code (UDC) as the facility would store and use flammable and volatile chemicals. Construction in the floodplain would require an exemption to the County's UDC, which states that critical facilities shall not be constructed in a floodplain; the Vertical Launch Facility's storage areas would be developed so that the storage of flammable and volatile chemicals would be above the 500-year flood zone. Potential indirect impacts from proposed construction activities could result in additional sediment loads being transported to surface waters in the vicinity of proposed construction. Increases in sedimentation could alter stream and wetland functions and result in the loss of wildlife habitat. However, during construction a Storm Water Pollution Prevention Plan (SWPPP) and sediment and erosion control plan would be prepared in compliance with Georgia NPDES requirements and Georgia's Erosion and Sedimentation Act of 1975. The SWPPP and sediment and	described under the Proposed Action as no heavier road or heavier road alternate route would need to be constructed from the landing zone area. Similarly surface water impacts would be less than those described previously as no impacts would occur to the surface water areas within the landing zone or along the heavier roads from the landing zone area. Construction related impacts to floodplain and groundwater would be the same as those described previously under the Proposed Action. Operational impacts to wetlands, floodplains, and surface waters would be the same in type as those described in the Proposed Action but would be reduced in scale. There would be less impervious surfaces and less stormwater runoff decreasing potential indirect impacts associated with stormwater runoff. Groundwater withdrawal rates would effectively be the same as those described under the Proposed Action and impacts to groundwater would be the same as those previously described. There would be no impacts to wild and scenic rivers.	are anticipated to wetland, surface water and groundwater resources, or floodplains associated with spaceport development and operations as the property would remain in its current state. Water resources in the region would continue to be impacted by ongoing and future activities throughout the county and region.

Table ES-1. Environmental Impacts Summary by Alternative

Resource Area	Proposed Action	Ocean-Landing Only Alternative	No Action Alternative
	erosion control plan would implement the use of management practices to prevent erosion and sedimentation. Implementation of these management practices would minimize indirect impacts and no significant adverse impacts to surface waters would be anticipated. Surface waters and wetlands could be impacted by spills of fuels and other hazardous materials during construction and during operation of Spaceport Camden. Spills could result in the loss of vegetation and pollution of wetlands or surface waters resulting in a short-term loss of wildlife habitat. However, all hazardous materials use would be conducted in accordance with standard operating procedures that minimize the potential for spills. The operation of the spaceport would require an Industrial Stormwater Permit in accordance with Section 402 of the CWA to accommodate stormwater runoff and identify operational best practices to reduce the potential for onsite stormwater pollution. No adverse impacts to groundwater resources within the aquifers underlying the ROI have been identified and no wild and scenic rivers are within the project vicinity. No construction related impacts to the Satilla River are anticipated that would adversely impact this river system. The river is located more than 1 mile from proposed construction activities and the potential for the offsite migration of sediments would be low. Operational impacts to the Satilla River would primarily be related to noise and the possible impacts to recreational use of the river. These impacts are described in Section 4.14, Water Resources.		

ES.6 Cumulative Impacts (Draft EIS Chapter 5)

The CEQ regulations define a cumulative impact 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” (see 40 CFR §1508.7). Cumulative impacts can be viewed as the total combined impacts on the environment of a proposed action or alternative(s) and other known or reasonably foreseeable actions.

Past, present, and reasonably foreseeable future actions are considered in determining whether there are potential cumulative impacts. Actions can be initiated by any entity (i.e., other Federal agencies, State, tribal, or local governments, or private entities). In this EIS, FAA has made an effort to identify actions on or near the action areas associated with the Proposed Action that are under consideration and in the planning stage at this time. These actions are included in the cumulative analysis sections to the extent that details regarding such actions exist and the actions have a potential to interact with the Proposed Action and associated “shared” resources. Although the level of detail available for those future actions varies, this approach provides the decision maker with the most current information to evaluate the consequences of the alternatives.

The detailed cumulative impacts analysis can be found in Chapter 5 of this EIS.

ES.7 Mitigation (Draft EIS Chapter 6)

The EIS describes mitigation measures that may be implemented to avoid or minimize identified adverse impacts in the Draft EIS associated with the Proposed Action and alternative. Some of these mitigation measures may be associated with permitting requirements (and in some cases exact mitigations would be outlined during the permitting process), while others may be associated with consultation with the USFWS and Georgia State Historic Preservation Officer (SHPO) or recommended as part of impact analysis.

Mitigation measures to be implemented would be identified in the Record of Decision and incorporated into a Mitigation Plan that would indicate implementation and monitoring requirements, timelines for implementation, and roles and responsibilities with regards to mitigation measure implementation and monitoring. A detailed description of mitigation by resource can be found in Chapter 6 of this EIS.

ES.8 Unavoidable Adverse Impacts, Irreversible and Irretrievable Commitment of Resources, and Short-Term Uses and Long-Term Productivity (Draft EIS Chapter 7)

As required by 40 CFR §1502.16 of the CEQ regulations, FAA must identify any irreversible or irretrievable commitments of resources that would be involved in the Proposed Action or reasonable alternative(s), should they be implemented. An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed. Examples include permanent conversion of wetlands and loss of cultural resources, soils, wildlife, agricultural production, or socioeconomic conditions. Irreversible is a term that describes the loss of future options. It applies primarily to the impacts of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time. Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. For example, if farm land is used for a non-agricultural event, some or all of the agricultural production from an area of farm land is lost irretrievably while the area is temporarily used for another purpose. The production lost is irretrievable, but the action is not irreversible.

1 Implementing the Proposed Action or Ocean-Landing Only Alternative would require a commitment of
2 natural, physical, human, and fiscal resources. In all of these categories, irreversible and irretrievable
3 commitments of resources would occur, with these commitments similar in nature across both
4 alternatives. While the land area under consideration is currently designated as an industrial site, with a
5 closed landfill operating under a Resource Conservation and Recovery Act post-closure care permit and
6 Munitions and Explosives of Concern (MEC) areas on the Union Carbide Corporation property, land
7 required for new construction would be irreversibly committed during the functional life of the facilities.
8 In some cases land uses would change from unimproved/semi-improved to improved but for the most
9 part designation as an industrial site would remain. Although it is possible for land to revert to its
10 former state if the facilities were abandoned and destroyed, the likelihood of such an occurrence for
11 established facilities would be low.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition	Acronym	Definition
A-F	general agriculture-forestry		Noise
APE	area of potential effect	FMU	Fire Management Unit
APLIC	Avian Power Line Interaction Committee	FR	<i>Federal Register</i>
		GA	Georgia
ARTCC	Air Route Traffic Control Center	GDNR	Georgia Department of Natural Resources
ATV	all-terrain vehicle		
B.P.	before present	GHG	greenhouse gas
BEA	Bureau of Economic Analysis	HAPCs	habitat areas of particular concern
BLM	Bureau of Land Management	HAPs	hazardous air pollutants
BLS	Bureau of Labor Statistics	Hz	Hertz
BRRC	Blue Ridge Research and Consulting	ICP	Institutional Control Plan
BTEX	benzene, toluene, ethylbenzene and xylene	IDA	International Dark-Sky Association
		I-G	general industrial
°C	degrees Celsius	IPaC	Information for Planning and Consultation
C&D	construction and demolition		
CAA	Clean Air Act	KSC/CCAFS	Kennedy Space Center/Cape Canaveral Air Force Station
CAP	Corrective Action Plan		
CATEX	categorical exclusion	kV	kilovolt
CEQ	Council on Environmental Quality	kVA	kilovolt amps
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	kW	kilowatt
		L _{A,max}	maximum A-weighted overall sound pressure level
CESQG	conditionally exempt small quantity generator	LBP	lead-based paint
CFR	Code of Federal Regulations	LED	light-emitting diode
CO	carbon monoxide	LEED®	Leadership in Energy and Environmental Design
CO ₂ e	carbon dioxide equivalent	L _{max}	maximum decibel level
C-P	conservation preservation	µg/m ³	microgram per cubic meter
CS	orthochlorobenzalmalononitrile ("tear gas")	MBTA	Migratory Bird Treaty Act
		MCLV	Medium Class Launch Vehicle
CWA	Clean Water Act	MECs	Munitions and Explosives of Concern
CZMA	Coastal Zone Management Act	mm	millimeter
dB	decibels	MMH	monomethylhydrazine
dba	A-weighted decibels	MMPA	Marine Mammal Protection Act
DNL	day-night average sound level	MOVES	Motor Vehicle Emission Simulator
DOT	U.S. Department of Transportation	MPAs	marine protected areas
EFH	essential fish habitat	MRAs	munitions response areas
EIS	Environmental Impact Statement	MSA	Magnuson-Stevens Fishery Conservation and Management Act
EO	Executive Order		
EPCRA	Emergency Planning and Community Right-to-Know Act	MSATs	Mobile Source Air Toxics
		MSW	Municipal Solid Waste
ESA	Endangered Species Act	NAAQS	National Ambient Air Quality Standards
°F	degrees Fahrenheit	NASA	National Aeronautics and Space Administration
FAA	Federal Aviation Administration		
FEMA	Federal Emergency Management Agency	NEI	National Emissions Inventory
		NEPA	National Environmental Policy Act of 1969
FHWA	Federal Highway Administration		
FICAN	Federal Interagency Committee on Aviation Noise	NHPA	National Historic Preservation Act
		NIOSH	National Institute for Occupational Safety and Health
FICON	Federal Interagency Committee on		

Acronym	Definition
NMFS	National Marine Fisheries Service
NO ₂	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NTO	nitrogen tetroxide
O ₃	ozone
OASPL	overall sound pressure level
O.C.G.A.	Official Code of Georgia Annotated
OSHA	Occupational Safety and Health Administration
Pb	lead
PD	planned development
PEM	palustrine emergent
PFO	palustrine forested
pH	potential of hydrogen (acidity)
PM _{10/2.5}	particulate matter equal to or less than 10 or 2.5 microns
PSD	Prevention of Significant Deterioration
psf	pounds per square foot
PSHMP	Protected Species and Habitat Management Plan
PSS	palustrine scrub-shrub
PUB	palustrine unconsolidated bottom
PUD	planned unit development
RCRA	Resource Conservation and Recovery Act
RCW	red-cockaded woodpecker
ROI	region of influence
RP-1	rocket propellant-1
SEL	sound exposure level
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
U.S.	United States
U.S.C.	United States Code
UAV	unmanned aerial vehicle
UDC	Unified Development Code
UDMH	unsymmetrical dimethyl hydrazine
USACE	U.S. Army Corps of Engineers

Acronym	Definition
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOCs	volatile organic compounds
WRAP	Wetland Rapid Assessment Procedure

1 INTRODUCTION

The Camden County Board of Commissioners (the County) is proposing to construct and operate a commercial space launch site, called Spaceport Camden, on the Atlantic seaboard in Camden County, Georgia. The County could offer the commercial space launch site to vertical launch vehicle operators for the orbital and suborbital launch of small to medium-large, liquid propellant launch vehicles. Orbital launch vehicles are classified based on the maximum payload weight in pounds according to orbital inclination; at 90-degrees inclination: *small* is less than or equal to 3,300 pounds; *medium* is greater than 3,300 to less than or equal to 8,400 pounds; *medium-large* is greater than 8,400 to less than or equal to 15,000 pounds. Launch operations would include preparatory activities to ready and test launch vehicles and systems, including mission rehearsals and static tests, and for any first-stage landings on the space launch site or returns to the launch site after landing on a barge located about 200 to 300 miles off shore in the Atlantic Ocean.

The operation of commercial space launch sites are licensed by the Federal Aviation Administration (FAA) under Title 14 Code of Federal Regulations (CFR) Part 420, and the County intends to apply to FAA for a Launch Site Operator License. Because issuance of this license would be a major Federal action, this Environmental Impact Statement (EIS) has been prepared by FAA's Office of Commercial Space Transportation to assist in its decision-making process as required by the National Environmental Policy Act of 1969 (NEPA) as amended (42 United States Code [U.S.C.] §§4321 et seq.), Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500–1508), and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

This EIS evaluates the potential direct, indirect, and cumulative environmental impacts of construction and operation of the proposed launch site that would result from FAA's Proposed Action to issue a Launch Site Operator License to the County for Spaceport Camden. The launch vehicle operator would be required to obtain a license to launch the specific vehicle or class of vehicle from the launch site. Impacts evaluated in this EIS include those related to construction and operation of the proposed Spaceport Camden, including impacts that could result from the launches of a representative launch vehicle. Future proposed activities that are outside the scope of this EIS could require additional environmental analysis under NEPA. A supplemental environmental analysis could be required when one or more of the parameters of the proposed construction or launch activities fall outside what is analyzed in this EIS.

1.1 Background

While exploring opportunities to expand the Camden County and regional economies, the County identified the development and operation of a commercial launch site as a desirable means to support economic growth. Camden County's *Strategic Plan 2016, 2023, 2032*, which addresses its long-range planning, mission, and vision, identifies a launch site, or "spaceport," as one of four pillars of economic growth and sustainment (Camden County, 2015).¹ In developing its plan for a spaceport, the County undertook a search for a suitable location for a launch site and identified the property shown in Exhibit 1.1-1, a former industrial site that is currently used for tree-farming in discrete areas (Tetra Tech, 2013).

¹ See Chapter 10, References, for a bibliographical list of cited sources.



The site is located in an unincorporated area of Camden County, Georgia, approximately 11.5 miles east of the city of Woodbine, at the mouth of the Satilla and Crooked Rivers and just west of Cumberland River and Cumberland Island. The property, on which two plantations and a ship-building enterprise operated in the 1800s, was first redeveloped in 1927 as a hunting preserve. In the early 1940s, the property was used as a tree farm and source of fiber for a local paper mill. During the 1960s, the Thiokol Chemical Company produced and tested solid rocket motors for the National Aeronautics and Space Administration (NASA) (CH2MHill, 2015). When NASA decided to focus on liquid-fueled rockets, the site was converted to manufacture military hardware and supplies, including mortar ammunition, illuminating ordnance devices (trip flares), tear gas, and assorted chemicals.

On February 3, 1971, an explosion destroyed the magnesium trip-flare assembly building and started a fire that burned 200 acres. The explosion killed 29 workers and injured 50 others (Jackson, 2001; Scardino, 1986; Thiokol Memorial Project, Inc., 2015). From the mid-1970s to 2012, the property was the site of a pesticide manufacturing facility (Tetra Tech, 2013).

The entire project site is owned by two companies, the Union Carbide Corporation and Bayer CropScience. The County has entered into an option agreement² to purchase most of the Union Carbide Corporation property (about 4,000 acres) and is considering an option to purchase the Bayer CropScience property (an additional 7,800 acres). The site is a combination of uplands and marshlands. Camden County proposes to construct Spaceport Camden on approximately 100 noncontiguous acres of the approximately 11,800 acres of uplands on the Union Carbide property. The remainder of the property would be part of the spaceport boundary, although there are no plans for constructing supporting facilities in these areas at this time.

1.2 Federal Agency Roles

FAA, as the licensing agency, is the lead agency in the preparation of this *Spaceport Camden Environmental Impact Statement (Spaceport Camden EIS)*. NASA and the National Park Service (NPS) are cooperating agencies.

1.2.1 FAA Role

FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-Federal launch and reentry sites, as authorized by Executive Order (EO) 12465, Commercial Expendable Launch Vehicle Activities, and the Commercial Space Launch Act of 2015 (51 U.S.C. §§50901–50923) as amended by the U.S. Commercial Space Launch Competitiveness Act of 2015 (Public Law 114-90). 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, FAA is directed to encourage, facilitate, and promote commercial space launches and reentries.

The FAA license application review process for a commercial Launch Site Operator License includes four major applicant reviews as defined below (policy, safety, launch site location, and environmental):

- Policy Review (14 CFR §420.15[a][3]) – FAA reviews a license application to determine whether it presents any issues affecting U.S. national security or foreign policy interests or international obligations of the United States.

² An option to purchase is a formal agreement that provides one of the parties, for a specified time, the right to buy, sell, or obtain an asset at an agreed-upon price at some time in the future.

- Safety Review (14 CFR §§420.51–420.71) – FAA conducts a safety review to determine whether proposed operations can be conducted safely. Because the licensee is responsible for public safety, it is important that the applicant demonstrate an understanding of the hazards involved and discuss how the operations will be performed safely.
- Launch Site Location Review (14 CFR §§420.19–420.29) – FAA conducts a review of an applicant’s ability to demonstrate that, for each launch point proposed for the launch site, at least one type of expendable or reusable launch vehicle can be flown from the launch point safely.
- Environmental Review – NEPA requires Federal agencies to integrate environmental values into their decision-making processes. FAA considers the environmental impacts of proposed actions and reasonable alternatives to those actions in order to make decisions based on an understanding of environmental consequences. Because issuance of a Launch Site Operator License is a major Federal action under NEPA, FAA is preparing this *Spaceport Camden EIS* to identify the potential environmental impacts of the construction and operation of Spaceport Camden.

1.2.2 Cooperating Agency Role

A cooperating agency may be any Federal agency other than the lead agency that has jurisdiction by law or special expertise with respect to the environmental impacts expected to result from a proposal (40 CFR §1508.6). An agency has “jurisdiction by law” if it has the authority to approve, veto, or finance all or part of the proposal (40 CFR §1508.15). An agency has “special expertise” if it has statutory responsibility, agency mission, or related program experience with regard to a proposal (40 CFR §1508.26).

NASA is a cooperating agency for this *Spaceport Camden EIS* because the agency provides unique knowledge and special expertise regarding the potential impacts from launches and the operation of a launch site. NASA provides special expertise with respect to potential environmental impacts from space launches and the operation of a launch site. NASA also has special expertise and interest in the operation of reusable suborbital rockets through its programs, which are intended to help foster the development of the commercial reusable suborbital transportation industry. Additionally, NASA uses Space Act Agreements and contracts, as well as competitions to promote technology development and demonstration. NASA’s partnerships with commercial suppliers and private enterprises are expanding such that NASA may have a direct or indirect contribution to a commercial payload. For these reasons, NASA requested to be a cooperating agency in the development of this EIS.

Cumberland Island National Seashore is managed by the NPS and is located less than 5 miles east of the proposed Spaceport Camden site. Cumberland Island National Seashore contains a diversity of wildlife and plant species, a federally designated wilderness area, and several historic sites listed on the National Register of Historic Places (NRHP). The NPS is a cooperating agency for the *Spaceport Camden EIS* because it has special expertise with respect to environmental issues and wildlife and cultural and archaeological resources associated with Cumberland Island National Seashore and its wilderness area.

FAA entered into a Memorandum of Agreement with each of these cooperating agencies. The cooperating agencies are responsible for developing and verifying information, including portions of the EIS for which the cooperating agency has special expertise under 40 CFR §1506.1.

1.3 Purpose and Need

1.3.1 Camden County Board of Commissioners' Purpose and Need

The purpose of the County's proposal to construct and operate Spaceport Camden is to allow the County to offer a commercial space launch site to a growing number of small to medium-large lift-class, orbital and suborbital, vertical launch vehicle operators to conduct commercial launches from the east coast of the United States. A commercial space launch site may be able to more effectively respond to the scheduling needs of commercial launch providers than Federal facilities with national security priorities and logistical complexities.

The need for the proposed commercial space launch site is to further the goals of Camden County as established in the County's *Strategic Plan 2018, 2023, 2032* to create a strong regional economy with diverse job opportunities based on four major pillars of economic growth and sustainment, one of which is developing a world-class spaceport that would also attract businesses to support its operation. To be a successful commercial space launch site, the site needs to meet the safety requirements established by FAA for operation of a commercial space launch site and be able to accommodate the technical, logistical, and scheduling needs of commercial launch vehicle operators. These general requirements include a location that supports the necessary trajectories in an area that could meet the requirements of 14 CFR Part 420, License to Operate a Launch Site. Site-specific requirements and evaluation criteria are presented in Chapter 2, Section 2.4, *Alternatives Considered but Not Carried Forward*.

1.3.2 FAA's Purpose and Need

The purpose of FAA action in connection with the County's proposal is to fulfill FAA's responsibilities as authorized by EO 12465, Commercial Expendable Launch Vehicle Activities (49 *Federal Register* [FR] 7099, 3 CFR, 1984 Comp., p. 163), and the Commercial Space Launch Act of 2015 (51 U.S.C. §§50901–50923) as amended by the U.S. Commercial Space Launch Competitiveness Act of 2015 (Public Law 114-90) for oversight of commercial space launch activities, including issuing Launch Site Operator Licenses for the operation of commercial space launch sites, and launch licenses to operate expendable and reusable orbital and suborbital launch vehicles. The Proposed Action would be consistent with the objectives of the Commercial Space Launch Act, as amended. Further, FAA action is consistent with the finding of Congress, as expressed in the Act, that participation of State governments³ in encouraging and facilitating private sector involvement in space-related activity, particularly through space transportation-related infrastructure, is in the national interest and of significant public benefit.

The need for the FAA action of issuing a Launch Site Operator License and launch licenses results from the statutory direction from Congress under the Commercial Space Launch Act to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States and to encourage, facilitate, and promote commercial space launch and reentry activities by the private sector in order to strengthen and expand U.S. space transportation infrastructure.

1.4 Agency Involvement

This section identifies the licenses, permits, and approvals that would be required for construction and operation of Spaceport Camden.

³ Although Camden County is the applicant, the State of Georgia is participating.

1.4.1 FAA Licenses

Two FAA licenses would be required for commercial space launch operations at Spaceport Camden: a Launch Site Operator License and a launch license. The Launch Site Operator License would authorize Camden County to operate Spaceport Camden, and the launch license would authorize any launch operator proposing to launch a vehicle from the launch site. This EIS addresses FAA issuance of the Launch Site Operator License; issuance of launch licenses would require further environmental review to determine whether the launch parameters fall within the scope of this EIS. Additional environmental analysis would be required if the launch parameters do not fall within the scope of this EIS.

FAA is the Federal agency with the responsibility to regulate and license commercial space launch activities. These regulations are codified at 14 CFR Parts 400–450. Under the Proposed Action, the County would apply for a Launch Site Operator License (14 CFR Part 420) from FAA for the operation of Spaceport Camden. The Launch Site Operator License authorizes a licensee to operate a launch site in accordance with the conditions of the application and to offer its launch site to any launch operator for each launch point for the type and weight of launch vehicle identified in the license application. A Launch Site Operator License remains in effect for five years from the date of issuance and can be renewed by the licensee.

Launch operators proposing to launch from Spaceport Camden would be required to obtain an FAA launch license under 14 CFR Part 400. A launch operator could apply for either of two types of launch licenses. A Launch-Specific License authorizes a licensee to conduct one or more launches, having the same launch parameters, of one type of launch vehicle from one launch site. This license identifies, by name or mission, each launch authorized under the license. A licensee's authorization to launch terminates upon completion of all launches authorized by the license or the expiration date stated in the license, whichever comes first. A Launch Operator License authorizes a licensee to conduct launches from one launch site, within a range of launch parameters, of launch vehicles from the same family of vehicles transporting specified classes of payloads. A Launch Operator License remains in effect for five years from the date of issuance.

1.4.2 Other Licenses, Permits, and Approvals

Construction and operation of Spaceport Camden would require environmental permits and regulatory approvals for liquid discharges and airborne emissions from the facility, management of wastes, and storage of hazardous materials. Permits or approvals could also be required for withdrawal of groundwater, provision of drinking water, and management of sanitary wastes. The FAA has identified the following environmental permits and approvals for Spaceport Camden construction and operation, but others may be required pending completion of analyses and resource agency consultations.

Air Emissions. Air emissions would be permitted by the Georgia Department of Natural Resources (GDNR). It is not anticipated that Spaceport Camden would be a major source requiring a Title V Permit.

Biological Resources. Consultation under Section 7 of the Endangered Species Act (ESA) for impacts to threatened and endangered species is required and has been completed with the U.S. Fish and Wildlife Service (USFWS) and is in progress with the National Marine Fisheries Services (NMFS). FAA is seeking concurrence on “no effect” and “may affect but not likely to adversely affect” determinations for several federally listed species under the ESA; FAA submitted the NMFS consultation on September 7, 2017, and the USFWS consultation on October 31, 2017. On February 12, 2018, the USFWS provided concurrence that the Proposed Action is not likely to adversely affect federally listed species, provided that conservation measures identified in the consultation are implemented. The agencies' opinions may identify special terms and conditions for impact avoidance and mitigation measures that would be required to be implemented as part of the Proposed Action and/or alternatives and will be included in

1 the Final EIS. The consultation documents and correspondence are provided in Appendix A, *Public*
2 *Involvement/Agency Coordination and Consultation*.

3 **Coastal Resources.** A Federal Consistency Certification is required for projects such as Spaceport
4 Camden that are federally licensed when they are located in coastal areas. A Coastal Consistency
5 Determination has been prepared in accordance with the Coastal Zone Management Act (CZMA) and
6 submitted to GDNR for review (see Appendix A). No in-water improvements or modifications to the
7 Floyd Creek dock are planned at this time. However, use of this dock or any work on the dock, including
8 maintenance, must be coordinated with the Georgia Coastal Resources Division and the U.S. Army Corps
9 of Engineers (USACE) to obtain applicable permits/permissions (Official Code of Georgia Annotated
10 [O.C.G.A.] 12-5-280, *Coastal Marshlands Protection Act*, and O.C.G.A. 50-16-61, *Administrative*
11 *Procedures Act/Revocable License Program*), to include a USACE Section 404 and Section 10 permit, and
12 Coastal Marshlands Protection Committee permit. Additionally, the dock is currently permitted for
13 recreational use and Camden County would be required to coordinate permitting for other uses with
14 GDNR. Any launch/landing vehicle debris landing in tidally-influenced marsh or State waters out to
15 3 miles must be recovered when feasible and may require authorization from the Georgia Coastal
16 Resources Division (O.C.G.A. 12-5-230, *Shore Protection Act*, and/or O.C.G.A. 12-5-280, *Coastal*
17 *Marshlands Protection Act*, and/or O.C.G.A. 50-16-61, *Administrative Procedures Act/Revocable License*
18 *Program*).

19 **Historic and Cultural Resources.** A Section 106 consultation with the Georgia State Historic Preservation
20 Officer (SHPO) under the National Historic Preservation Act (NHPA) is required to identify and evaluate
21 archaeological and architectural resources protected by the NHPA that could be affected by the
22 construction or operation of Spaceport Camden. FAA has initiated consultation by providing the SHPO
23 with information on historic resources associated with the Proposed Action, as well as a qualified finding
24 of *no adverse effect* for historic properties based on impact analysis. Consultation documentation is
25 provided in Appendix A. FAA seeks concurrence on this effect determination, as well as input on any
26 mitigation measures required to avoid or minimize impact on identified resources. Final disposition of
27 resources and associated mitigation or management measures would be identified in a Programmatic
28 Agreement between consulting parties prior to any Record of Decision regarding this proposed project
29 and will be included in the Final EIS.

30 **Wetlands.** Section 404 of the Clean Water Act (CWA) and Section 10 (Rivers and Harbors Act) permits
31 are issued by USACE for dredging or filling wetlands or other waters of the United States. Less than
32 1 acre of wetlands would be impacted by the proposed construction activities. Unless final design plans
33 can further avoid wetland impacts, a Section 404 permit will be required prior to construction activities.

34 **Wastewater Discharges.** If there are any point source discharges from Spaceport Camden facilities, a
35 National Pollutant Discharge Elimination System (NPDES) permit would be required. GDNR is authorized
36 to administer this program.

37 **Stormwater Discharges.** During construction, a Storm Water Pollution Prevention Plan (SWPPP) and
38 sediment and erosion control plan would be required in compliance with Georgia NPDES requirements
39 and Georgia's Erosion and Sedimentation Act of 1975. Operational stormwater discharges would be
40 permitted under NPDES Industrial Stormwater General Permit Number GAR050000. The County would
41 be required to submit a notice of intent to discharge under this permit no less than seven days before
42 commencing to discharge.

43 **Sanitary Waste.** Several septic systems have been proposed for Spaceport Camden. Septic systems are
44 regulated and permitted by the Georgia Department of Public Health and Camden County Department
45 of Health.

Hazardous Materials and Waste. A hazardous waste generator operating permit from the Georgia Environmental Protection Division would be required for operations at the site.

Safety. The Georgia Coastal Resources Division requests notification in writing of all launch operations that require public notification, so that they may assist in alerting the affected public of upcoming closures. Operational activities involving closures may require a Marine Event Permit, in coordination with GDNr. Marine Event Permits must be applied for 30 to 60 days in advance, depending on the number of spectators anticipated, prior to each closure (O.C.G.A. 52-7-19, *Boat Safety Act*). Individual Security Plans that include motorized vehicular use or temporary structures or staging areas on the beach will require beach driving permits and/or Letters of Permission from the Georgia Coastal Resources Division (O.C.G.A. 12-5-230, *Shore Protection Act*). Individual Security Plans developed between the County and launch operator must be submitted to the Georgia Coastal Resources Division to determine if any additional plan-specific authorizations are required prior to implementation (O.C.G.A. 12-5-320, *Coastal Management Act*).

1.5 Public Involvement

FAA gathered input from the public during the scoping process, which is an early and open process for determining the range of issues to be addressed in the EIS. FAA also is providing the Draft EIS to the public for review and comment. FAA considers all comments on the Draft EIS and responds to substantive comments in the Final EIS.

1.5.1 Scoping Process

Scoping provides an opportunity for the general public, government agencies, and interested groups to learn about the purpose and need, the Proposed Action, and alternatives for implementing the Proposed Action. The scoping process also provides an opportunity for the public to help define the scope of the Draft EIS, the alternatives, and the analyses by suggesting alternative approaches that meet the purpose and need and raising concerns and issues. During the public scoping comment period for this *Spaceport Camden EIS*, FAA requested input from government agencies, Native American tribes, organizations, interest groups, and the public on issues of concern and alternatives to be analyzed.

Scoping for this *Spaceport Camden EIS* began with the publication in the *Federal Register* of the Notice of Intent (NOI) to prepare an EIS, open a public scoping period, and hold a public scoping meeting in Camden County, Georgia, on November 6, 2015 (80 FR 68893). The NOI provided the date and time for the public scoping meeting and a summary of the Proposed Action; invited interested agencies, organizations, Native American tribes, and members of the public to submit comments; and formally initiated the public scoping comment period. FAA also notified, by postcard or e-mail, individuals; Federal, State, and local agencies; elected officials; and various groups that were likely to be interested in the Proposed Action and the scoping process. The NOI was also posted on FAA's *Spaceport Camden EIS* website: http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/camden_spaceport. Appendix A, *Public Involvement/Agency Coordination and Consultation*, contains materials and information from the scoping process. Specifically, Appendix A includes the *Scoping Summary Report* and associated appendices and the posters, fact sheets, FAA's presentation, and the transcript from the public scoping meeting.

The public scoping comment period was originally scheduled to close on January 4, 2016, but in response to public requests, it was extended to January 18, 2016. The extension was announced by issuing a notice of extension of public scoping comment period in the *Federal Register* on January 11, 2016 (81 FR 1280), posting a notice on FAA's *Spaceport Camden EIS* website, and sending e-mail notifications to those on FAA's Spaceport Camden mailing list.

The Brunswick News and the *Tribune & Georgian* are newspapers that provide service to the potentially affected communities in proximity to the proposed project. Table 1.5-1 identifies the advertisements announcing the public scoping meeting that were placed in these newspapers in the two weeks preceding the public scoping meeting. The advertisements summarized the Proposed Action; provided the time, date, and location of the public scoping meeting; and described the methods for submitting scoping comments.

Table 1.5-1. Scoping Meeting Notices—Publication Dates for Newspapers

Newspaper	Publication Date	Page Number
<i>The Brunswick News</i>	November 28, 2015	2A
	December 5, 2015	4A
<i>Tribune & Georgian</i>	November 26, 2015	5A
	December 3, 2015	6A

Although not an official part of the scoping process as defined by NEPA and FAA, the following additional outreach activities were conducted. In December 2015, FAA mailed letters to the leaders of the following Native American tribes, initiating formal government-to-government consultation: Chickasaw Nation, Choctaw Nation of Oklahoma, Muscogee (Creek) Nation, Poarch Band of Creek Indians, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and Thlopthlocco Tribal Town. In January 2016, FAA mailed NHPA Section 106 consultation letters to the Georgia SHPO, the Tribal Historic Preservation Officers of the aforementioned tribes, and the Cherokee of Georgia Tribal Council, Georgia Tribe of Eastern Cherokee, and the Lower Muskogee Creek Tribe. FAA also e-mailed a NHPA Section 106 consultation letter to the Chair of the Gullah Geechee Commission.

1.5.1.1 Scoping Meetings

Two scoping meetings were held for the *Spaceport Camden EIS*, one for the public and one for agencies with an interest or involvement in the project.

Public Scoping Meeting

The public scoping meeting was held on Monday, December 7, 2015, from 5:00 p.m. to 8:00 p.m. at the Camden County Public Services Authority Recreation Center located at 1050 Wildcat Drive in Kingsland, Camden County, Georgia. Attendees were welcomed at the entrance of the Recreation Center and were asked to fill out scoping meeting sign-in cards. Members of the public who wished to speak during the public comment portion indicated their intention to speak when they registered. The public scoping meeting began with an open-house poster session from 5:00 p.m. to 6:00 p.m., during which members of the public could speak to FAA representatives and view posters about the proposed project, the *Spaceport Camden EIS*, and the NEPA process. Posters and handouts provided information on the NEPA process and environmental impact categories (or resource areas); an overview of the Proposed Action, activities, and facilities; FAA licensing and permitting process; and the public involvement process.

Comment forms and pens were available during the poster session and during and after the formal meeting for attendees to fill out and submit comments. Comments could be submitted at the public scoping meeting, or the forms could be taken home and mailed to FAA after the meeting. A court reporter was present during the open house to record oral comments for those who did not wish to speak publicly at the meeting and to record the public comment session.

After the open house, FAA began the formal meeting with a brief presentation about the proposed project and the licensing and NEPA processes, followed by the public comment session. Speakers were called during the comment session in the order in which they signed up to speak. The transcript of the public comment session is included in Appendix A, *Public Involvement/Agency Coordination and*

1 *Consultation*, and also available on FAA's *Spaceport Camden EIS* website, the link for which is provided in
2 Section 1.5.1, *Scoping Process*.

3 A total of 460 individuals signed in at the public scoping meeting. Attendees included members of the
4 public, representatives of Federal and State elected officials, city government agencies, community
5 groups, and the media. There were 53 oral commenters at the public scoping meeting: 51 spoke during
6 the comment session and 2 spoke privately to the court reporter.

7 **Public Comments**

8 Five methods were available to the public for providing comments:

- 9 • Submitting written comments at the public scoping meeting
- 10 • Providing oral comments during the public scoping meeting
- 11 • Providing oral comments privately to the court reporter during the open house preceding the
12 comment portion of the public scoping meeting
- 13 • Submitting comments electronically to FAACamdenSpaceportEIS@Leidos.com
- 14 • Sending written comments by U.S. mail to Ms. Stacey M. Zee, FAA Environmental Specialist for
15 the *Spaceport Camden EIS*

16 A total of 909 comment submissions were received. This total includes 770 comment submissions
17 received during the time the public scoping comment period was officially open (November 6, 2015, to
18 January 18, 2016). Of these 770 comment submissions, 355 comment submissions were provided as
19 part of a campaign by the National Parks Conservation Association. Prior to the initiation of the public
20 scoping comment period, 125 comment submissions were received, 124 of which were from a campaign
21 by the Wild Cumberland Organization. After the close of the public scoping comment period, another
22 14 comment submissions were received, 10 of which were additional National Parks Conservation
23 Association campaign letters. Comment submissions are posted on FAA's *Spaceport Camden EIS*
24 website, the link for which is provided in Section 1.5.1, *Scoping Process*. Table 1.5-2 identifies the
25 number of comment submissions and the method by which they were received.

26 **Table 1.5-2. Comment Submission Method Summary**

Method of Submitting Comments ¹	Number of Comment Submissions Received
Written comments at scoping meeting	45
Oral comments at scoping meeting	53
Electronic (e-mail) ²	770
U.S. mail	41
Total	909

Notes:

¹ Duplicate comment submissions provided via different methods were only counted once.

² A total of 125 comment submissions were received prior to the scoping comment period, and
14 comment submissions were received after the conclusion of the scoping comment period.

27 Concerns raised by commenters about the Proposed Action included the following:

- 28 • Disturbance of the natural habitat and visitor experience on Cumberland Island National
29 Seashore
- 30 • Conflict between the Proposed Action and the wilderness designation of portions of the
31 Cumberland Island National Seashore under the Wilderness Act

- Decreases in tourism and ecotourism, Cumberland Island visitation, and other local outdoor commerce
- Impacts on the public and threatened and endangered species from noise, vibration, chemical use and release, and lighting
- Potential for hazards to the public, land, and wildlife from accidents or failed launches
- Impacts on Naval Submarine Base Kings Bay, especially from a failed launch or accident
- The effectiveness of emergency response and preparedness in the event of an accident, including the suitability of the existing road network and water evacuation routes
- A lack of specific information about the Proposed Action (trajectories, frequency, duration, and vehicle specifications)
- Safety issues with, and lack of precedent for, launches over populated areas and the failure rates of commercial rockets at other launch sites
- Impacts of evacuations and land and water closures (including closure of the Intracoastal Waterway) on local residents
- Lowered property values and increased insurance rates
- Overall reduction in local quality of life
- Financial liability of Camden County and its residents
- Impacts on cultural and historic sites from noise and vibration, including those listed on the NRHP
- Potential for vibrations to cause the release of residual hazardous materials from onsite soils
- Degradation of air quality and the potential for release of toxic fumes during launches
- Degradation or contamination of groundwater and surface waters
- Impacts on salt marshes, barrier islands, tidal areas, and other coastal resources
- De-confliction of both military and commercial airspace

Positive impacts of the Proposed Action cited by commenters included the following:

- Ideal setting of site (prior land use, location, isolation, natural buffers)
- Creation of new jobs/high-paying jobs
- Regional economic stimulus
- Increased tourism
- Increased educational opportunities and the retention of graduates with technical degrees

All comments received during the scoping period have been given equal consideration in the preparation of this *Spaceport Camden EIS*. The potential impacts from the Proposed Action and alternatives on the environmental impact categories (or resource areas) listed in Paragraph 4-1 of FAA Order 1050.1F are analyzed as part of the Draft EIS. These environmental impact categories are:

- Air quality
- Biological resources (including fish, wildlife, and plants)

Spaceport Camden

- Climate
- Coastal resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous materials, solid waste, and pollution prevention
- Historical, architectural, archaeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and compatible land use
- Socioeconomics, environmental justice, and children's environmental health and safety risks
- Visual effects (including light emissions)
- Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

Additional resource areas recommended by commenters that are not listed in FAA Order 1050.1F, Paragraph 4-1 (e.g., airspace, geology and soils, health and safety, transportation) are analyzed and presented in appendices to this Draft EIS.

Agency Scoping Meeting

The agency scoping meeting was held on December 8, 2015, from 9:30 a.m. to 12:00 p.m. at the Camden County Emergency Operations Center, located at 131 North Lee Street, Kingsland, Georgia. Representatives from NASA, NPS, NMFS, USACE, USFWS, U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (USEPA), U.S. Marine Corps, U.S. Navy, GDNR, Georgia Department of Community Affairs, Camden County Board of Commissioners, and Camden County Joint Development Authority participated either in person or by telephone.

The meeting began with FAA making the presentation it had given at the public scoping meeting during the previous evening. After the presentation, meeting participants introduced themselves and indicated their agency and interest in, or area of responsibility for, the proposed project. Introductions were followed by a discussion of issues and concerns. In general, agencies requested details about the proposed spaceport and launch activities; potential closure areas, evacuation zones, and restrictions; potential effects on Cumberland Island National Seashore, wildlife, and habitats; and coordination and de-confliction with Naval Submarine Base Kings Bay and Marine Corps Air Station Beaufort. Attendees discussed agency consultation, coordination, and the roles and responsibilities of each of the agencies in attendance, including those required by Section 7 of the ESA, Department of Transportation Act Section 4(f), and Section 106 of the NHPA.

The meeting was followed by a tour of the proposed Spaceport Camden site. Agency representatives were able to view the site, comment on the potential for impacts on their respective areas of concern, and discuss any analyses or regulatory activities that might be required.

1.5.2 Public Involvement on the Draft EIS

In accordance with 40 CFR §1506.6 and §1503.4, FAA must provide the public and interested agencies with an opportunity to review and comment on this Draft EIS and must formally respond to those public

1 comments in the Final EIS. The Draft EIS review and comment period was initiated with the publication
2 of the USEPA's Notice of Availability (NOA) in the *Federal Register* on March 16, 2018. In addition, FAA
3 published a NOA in the *Federal Register* on March 16, 2018, indicating that the Draft EIS was available
4 for review online at [https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental](https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/camden_spaceport/)
5 [/nepa_docs/review/documents_progress/camden_spaceport/](https://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/camden_spaceport/) and in hard copy format at the following
6 local libraries:

- 7 • Camden County Public Library, 1410 Georgia Highway 40, Kingsland, Georgia 31548
- 8 • St. Marys Public Library, 100 Herb Bauer Drive, St. Marys, Georgia 31558
- 9 • Brunswick-Glynn County Library, 208 Gloucester Street, Brunswick, Georgia 31520
- 10 • St. Simons Island Public Library, 530A Beachview Drive, St. Simons Island, Georgia 31522

11 FAA sent notification of the publication of the Draft EIS to members of Congress; Federal, State, and
12 local elected and appointed government officials and other agencies; Native American tribal officials;
13 and libraries. FAA sent notification of the publication of the Draft EIS to media outlets; special interest
14 groups; organizations; affected landowners; and interested members of the public who requested to be
15 notified of the Draft EIS, as listed in Appendix A, *Public Involvement/Agency Coordination and*
16 *Consultation*. FAA provided e-mail notification of the availability of the Draft EIS and the website
17 location to everyone on the distribution list who had a valid e-mail address; those persons without valid
18 e-mail addresses who provided a mailing address were notified via postcard. Notifications were also
19 placed in local newspapers indicating the availability of the Draft EIS in the "Georgia" insert of the
20 *Florida Times Union* (March 11 and April 8, 2018), the *Tribune & Georgian* (March 8 and April 5, 2018),
21 and the *Brunswick News* (March 10 and April 7, 2018). The NOA, local newspaper advertisements, Draft
22 EIS distribution letters, and the website also provided notification of public hearings occurring to gather
23 public input on the Draft EIS. The public hearings are scheduled to take place on April 11 and 12, 2018,
24 at the Camden County Public Services Authority Recreation Center located at 1050 Wildcat Drive in
25 Kingsland, Camden County, Georgia. Hearings are scheduled to start at 5:30 p.m. with an open house
26 and poster session, with a formal presentation running from 6:30 p.m. to 6:50 p.m. and a formal
27 commenting period from 7:00 p.m. to 8:30 p.m. Regional notification of the Draft EIS availability was
28 also provided by placing NOAs on March 11, 2018, in the following newspapers: *The Island Packet*
29 (Hilton Head, South Carolina); *Savannah Morning News* (Savannah, Georgia); main section of the *Florida*
30 *Times-Union* (Jacksonville, Florida); and the *St. Augustine Record* (St. Augustine, Florida).

31 In providing comments on the Draft EIS, FAA requests that comments be substantive in nature.
32 Generally, substantive comments are regarded as specific comments that: challenge the analysis,
33 methodologies, or information in the Draft EIS as being factually inaccurate or analytically inadequate;
34 identify impacts not analyzed; develop and evaluate reasonable alternatives or feasible mitigation
35 measures not considered by FAA; offer specific information that may have a bearing on the decision,
36 such as differences in interpretations of significance, scientific, or technical conclusions; or cause
37 changes or revisions in the Proposed Action. Nonsubstantive comments, which do not require an FAA
38 response, are generally considered those comments that: are nonspecific; express a conclusion or
39 opinion about the Proposed Action; agree or disagree with the proposals; vote for or against the
40 proposal itself or some aspect of it; state a position for or against a particular alternative; or otherwise
41 state a personal preference or opinion.

42 The Draft EIS public comment period lasts for 45 days, from March 16, 2018, to May 7, 2018. Persons or
43 agencies wishing to have their comments considered for the Final EIS are encouraged to provide their
44 comments no later than May 7, 2018. In accordance with 40 CFR §1503.4, FAA will assess and consider
45 comments, both individually and collectively, and will respond to all substantive comments in the Final
46 EIS.

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2 PROPOSED ACTION AND ALTERNATIVES

This *Spaceport Camden EIS* evaluates three alternatives: the Proposed Action, the Ocean-Landing Only Alternative, and the No Action Alternative. Under the Proposed Action, FAA would issue a Launch Site Operator License (14 CFR Part 420) to the Camden County Board of Commissioners (the County) that would allow the County to offer the commercial space launch site, Spaceport Camden, to commercial launch operators. Under the Proposed Action, the County would construct Spaceport Camden on the proposed site and operate it as a location for the integration, test, and launch of liquid-fueled, small to medium-large lift-class, orbital and suborbital vertical launch vehicles. The Proposed Action includes possible recovery of the first stage of the launch vehicle either by landing the first stage at Spaceport Camden or landing the first stage on a barge approximately 200 to 300 miles off shore in the Atlantic Ocean and returning it to Spaceport Camden.

Any commercial launch operator would be required to obtain a launch license (14 CFR Part 415) from FAA for operation of their vehicle(s) from Spaceport Camden. This EIS addresses issuance of a Launch Site Operator License; FAA's issuance of such launch licenses will require discrete environmental reviews. The Proposed Action is described in Section 2.1, *Proposed Action*.

Section 2.2, provides discussion of the *Ocean-Landing Only Alternative*. Under this alternative, as in the Proposed Action, FAA would issue a Launch Site Operator License to the County that would allow the County to offer the commercial space launch site, Spaceport Camden, to commercial launch operators. Under this alternative, the County would construct Spaceport Camden on the proposed site and operate it as a location for the integration, test, and launch of liquid-fueled, small to medium-large lift-class, orbital and suborbital vertical launch vehicles. However, under this alternative, the recovery of a launch vehicle first stage would be limited to landing on a barge in the Atlantic Ocean and returning it to Spaceport Camden. This alternative does not include the option included within the Proposed Action to land the first stage of a launch vehicle at Spaceport Camden.

Section 2.3, *No Action Alternative*, describes the No Action Alternative. Under the No Action Alternative, FAA would not issue a Launch Site Operator License to the County. Therefore, Spaceport Camden would not be constructed on the proposed launch site, and no activities requiring licensing or oversight by FAA would occur. Camden County could decide to purchase the property for other purposes not related to spaceport operation or not exercise its option to purchase the property.

Section 2.4, *Alternatives Considered but Not Carried Forward*, describes alternatives considered but not carried forward for detailed analysis. These alternatives include locations in Camden County other than the proposed site that were considered as candidate sites for Spaceport Camden and alternative locations on the proposed Spaceport Camden site for the placement of the Vertical Launch Facility. This section includes the criteria developed by the County to assess these launch sites and Vertical Launch Facility locations and a discussion of why these other alternatives were not carried forward for analysis.

2.1 Proposed Action

Under the Proposed Action, which is the Preferred Alternative, FAA would issue a Launch Site Operator License to the County. The Proposed Action is the County's Preferred Alternative because it provides future launch vehicle operators with the most flexibility in terms of landing options (both land and sea), and it is logistically the most practical. The license would allow the County to offer the commercial space launch site, Spaceport Camden, to commercial launch operators to conduct launches of liquid-fueled, small to medium-large lift-class, orbital and suborbital vertical launch vehicles. The proposed launch site

would be constructed, in Camden County, Georgia, in the extreme southeastern part of the state, approximately 11.5 miles due east of the city of Woodbine.

The proposed launch site would be constructed within an existing 11,800-acre industrial site, consisting of property currently owned by the Union Carbide Corporation and Bayer CropScience, shown in Exhibit 2.1-1. The County has signed an option agreement⁴ with the Union Carbide Corporation to purchase its portion of this industrial site (approximately 4,000 acres) on which to construct the spaceport. The Union Carbide site consists of 1,200 acres of upland and 2,800 acres of marshland. The spaceport (the boundary is outlined in blue in Exhibit 2.1-1) would be constructed on the uplands portion of this site. The County is also considering purchasing approximately another 7,800 acres of adjoining property, currently owned by Bayer CropScience, in the same industrial complex. The total 11,800 acres of these two properties would provide an appropriate buffer⁵ to ensure the safety of the public.

The facilities of the proposed Spaceport Camden would encompass less than 100 noncontiguous acres as shown in Exhibit 2.1-2 and Exhibit 2.1-3. Related existing infrastructure (e.g., roads and utilities) would also be improved within the existing industrial site. The facilities and infrastructure improvements are further described in Section 2.1.1, *Construction – Activities and Facility Descriptions*.

Each of the launch site facilities and the western boundary of the site would be fenced to provide security and control access. The Spaceport Camden boundary, which is fully within the uplands portion of the property, is shown in dark blue on Exhibit 2.1-2. (Note that the location of one of the facilities, the Alternate Control Center and Visitor Center, is located outside of the Spaceport Camden site boundary on what is currently Bayer CropScience property⁶.) The remainder of the property, much of which is marshland, would be used as buffer.

There is an existing dock with deep water access (on the Bayer CropScience portion of the property) that may be utilized during construction and operation of the spaceport, given that repairs are performed and updated permitting by Georgia authorities is provided.

The industrial site consists of the approximately 11,800 acres that includes both the property that Camden County has an option to purchase and the property Camden County might purchase.

The Spaceport Camden property would consist of 4,000 acres within the industrial site. Camden County currently has an option to purchase these 4,000 acres from the property owners, the Union Carbide Corporation. Camden County is also considering purchasing (but does not have an option to purchase) the additional 7,800 acres of property within the industrial site currently owned by Bayer CropScience. If Camden County purchases both properties, the County would own the entire 11,800 acres of the industrial site. If the County does not purchase the additional 7,800 acres it would remain in its current state as utilized by Bayer CropScience.

The proposed Spaceport Camden site (spaceport site, or site) would be fully within a 1,200-acre upland portion of the 4,000-acre Spaceport Camden property. The uplands area is the area of the property above tidal water flows and does not include the portion of the property that is marshland. (All marshland within the property would be used as a buffer.)

The four facilities that would be built to support spaceport operations would occupy less than 100 acres and would be constructed on uplands portions of the industrial site, three within the launch site and one on what is currently Bayer CropScience property.

⁴ An option to purchase is a formal agreement that provides one of the parties, for a specified time, the right but not the obligation to buy, sell, or obtain an asset at an agreed-upon price at some time in the future, usually with certain conditions.

⁵ Camden County has defined the buffer as the area that exists between the launch point and the launch site boundary, to satisfy 14 CFR 420.21, Table 2, and any other additional lands, water, and/or marsh around the launch point determined to be needed to ensure the safety of the public. This buffer area would not be constructed upon and would be left in its current condition.

⁶ Bayer CropScience has indicated a willingness to sell the property to Camden County, should the County pursue the purchase. However, should the County not purchase the property nor reach an agreement to build on Bayer CropScience property, this facility would have to be relocated. Alternative locations for the facility would be assessed to determine the need for additional environmental impact analysis and documentation.



Exhibit 2.1-1. Proposed Spaceport Camden Regional Location

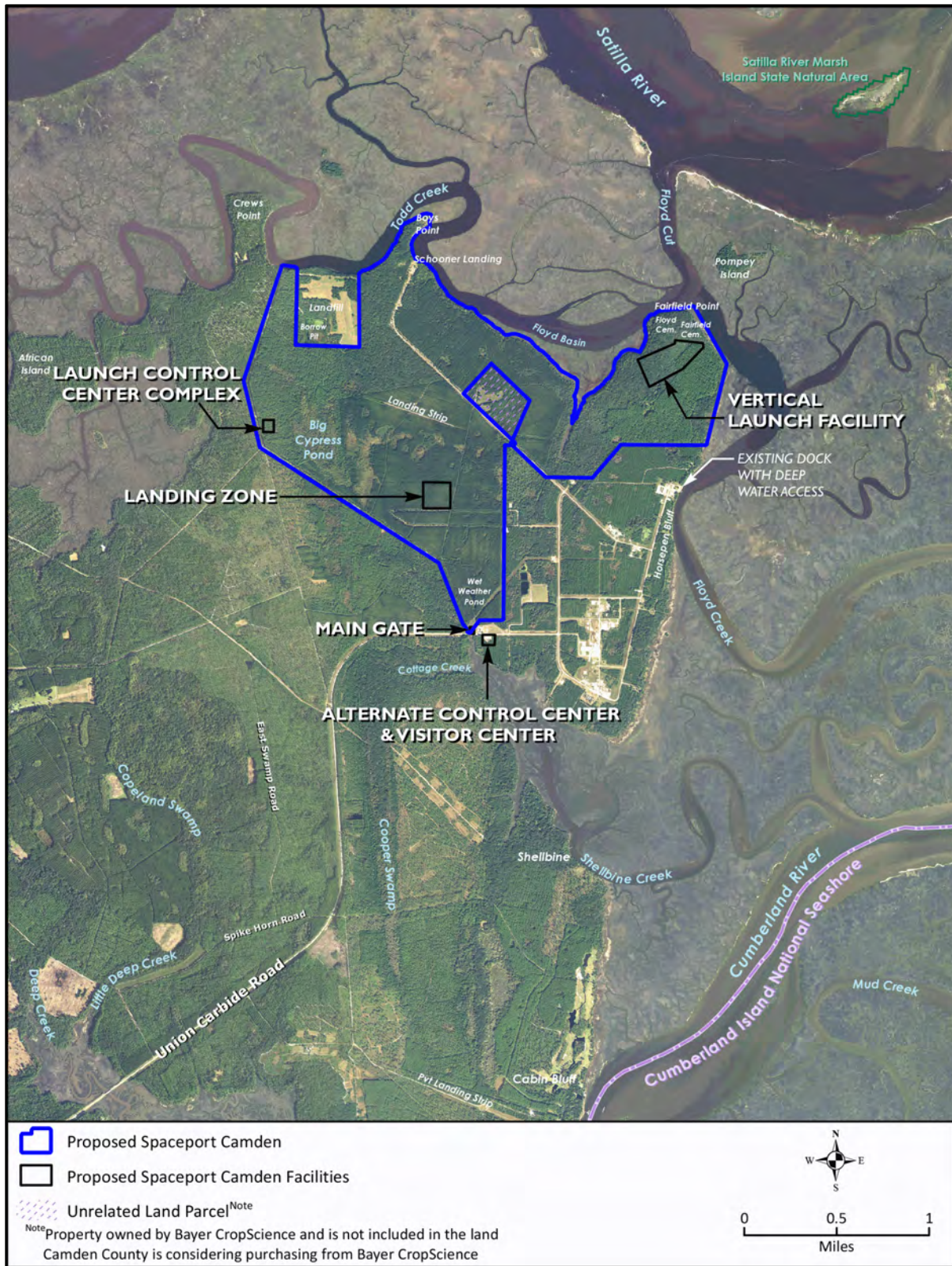


Exhibit 2.1-2. Proposed Spaceport Camden Site Plan⁷

⁷ The parcel of land identified in the exhibit as “not part of proposed Spaceport Camden” is property owned and utilized by Bayer CropScience and is not included in the land Camden County is considering purchasing from Bayer CropScience.



Exhibit 2.1-3. Proposed Spaceport Camden Site Plan – Aerial View

Spaceport Camden could accommodate up to 12 vertical launches and up to 12 associated launch vehicle first-stage landings per year. All vehicles would launch generally to the east over the Intracoastal Waterway, Cumberland Island National Seashore, Little Cumberland Island, and the Atlantic Ocean. Any first-stage landings would return to the launch site from the east. In addition, in support of the launches there would be up to 12 wet dress rehearsals and up to 12 static fire engine tests per year.⁸ Operational activities are described in Section 2.1.2, *Representative Launch Vehicle and Operational Activities*.

For purposes of this analysis, FAA is considering a range of launch trajectories ranging from 83 to 115 degrees from true north (both launches and landings would occur within the same 83 to 115 degree trajectory range). This range is depicted in Exhibit 2.1-4.

The launch trajectories used for any launch would be specific to each particular launch operator's mission. As part of the launch license evaluation process, FAA conducts a policy review, payload⁹ review, financial determination, and safety review. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, trajectory specific hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements¹⁰.

2.1.1 Construction – Activities and Facility Descriptions

This section describes the facilities and construction activities proposed for Spaceport Camden under the Proposed Action. Construction activities would include the construction of four facilities; including a Vertical Launch Facility, Launch Control Center Complex, an Alternate Control Center and Visitor Center, and Landing Zone; and associated infrastructure.

2.1.1.1 Launch Site Construction Activities

There are no existing structures that could be converted to support launch site operations and very little infrastructure (i.e., there are some roadways but no water, electricity, or communications systems) available on the Union Carbide Corporation property. Therefore, all of the facilities and most of the onsite infrastructure proposed for Spaceport Camden would be new. Onsite infrastructure improvements would include improvements to existing internal roads, construction of new roadways, and new electrical distribution, water distribution, and septic systems on the launch site.

However, electricity and water are available on the adjoining Bayer CropScience property, and there is an acceptable access road to the launch site. No improvements to the offsite infrastructure would be needed to support Spaceport Camden.

During construction, temporary laydown areas (i.e., staging areas for construction equipment and materials) for each facility would be included within the facility fenced perimeter (see Exhibit 2.1-5 through Exhibit 2.1-8). Typically these laydown areas would be located in areas that would ultimately be used as parking lots (or in the case of the Vertical Launch Facility, the launcher track) and other areas within the fenced perimeter that would be open space after construction is completed. If needed, existing unused roadways may also be used as laydown areas. Construction of the facilities and infrastructure for Spaceport Camden would result in the clearing of approximately 122 acres.

⁸ Wet dress rehearsals are launch rehearsals that include loading of propellants but do not include ignition of the first-stage engines. Static fire engine tests are short (two- to seven-second) tests that include firing of the first-stage engines with the rocket held down. These are further detailed in Section 2.1.2.5, *Pre-Launch Activities*.

⁹ Payload includes everything that the launch vehicle is launching, including the cargo (such as a satellite or experimental equipment) and other material such as propellants and payload engines.

¹⁰ Any proposed trajectories, launch vehicles, and/or propellant types identified during the licensing process that are outside the scope of those addressed in this EIS would require additional environmental review.

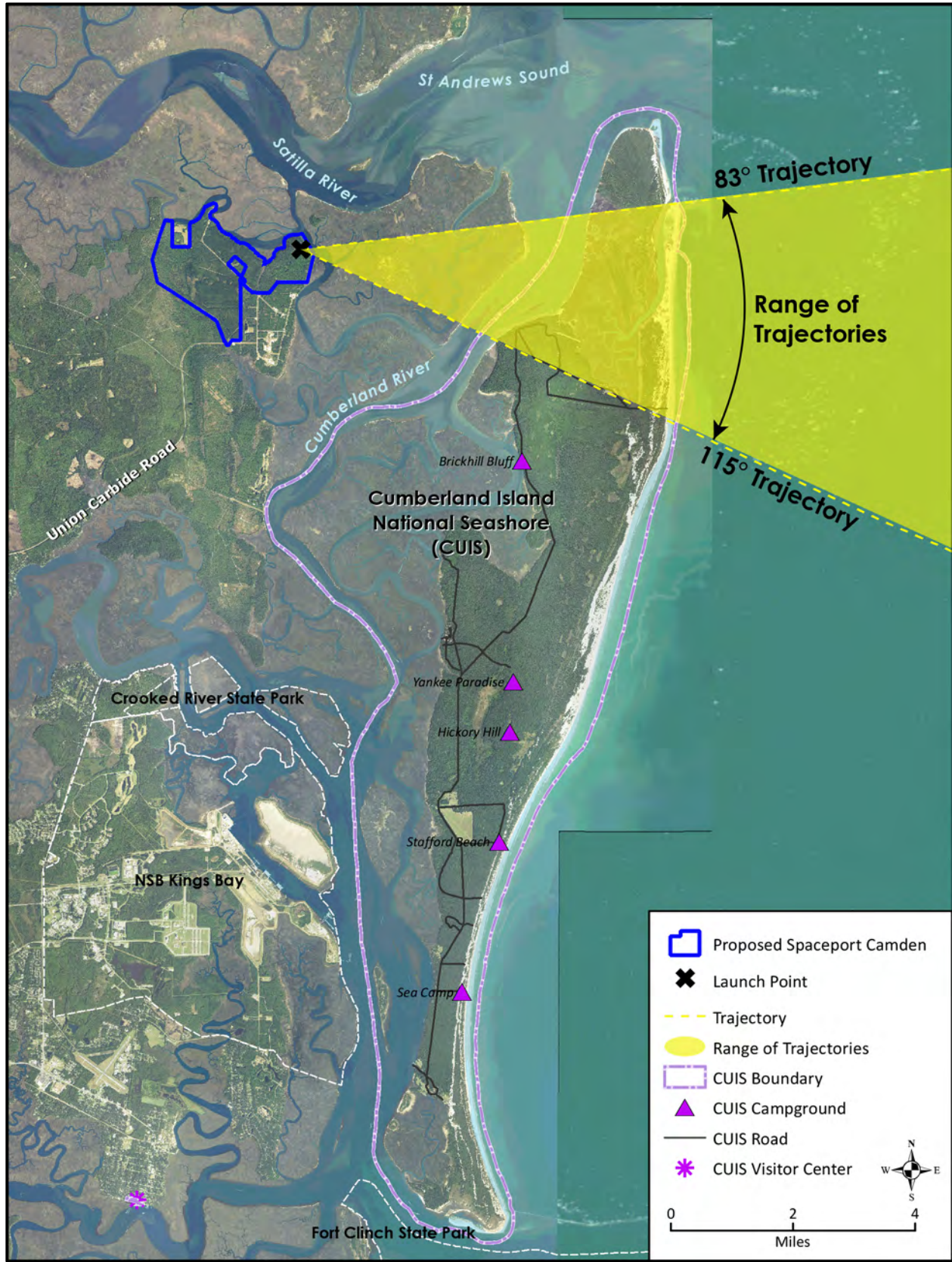


Exhibit 2.1-4. Spaceport Camden Range of Launch Trajectories

Table 2.1-1 shows the estimated construction timeframe for Spaceport Camden facilities. Construction of the facilities and infrastructure would occur concurrently and last approximately 15 months, the length of time needed for construction of the Vertical Launch Facility. Construction activities would occur during daylight hours, five days per week. It is anticipated that about 40 to 50 construction workers would be required for the construction of the facilities and about 20 additional construction workers would be required for the construction of new infrastructure (water, sewer, drainage, and roads). Launch site construction activities would not commence until after the NEPA process, including issuance of a Record of Decision, has been completed and any required permits or approvals have been granted.

Table 2.1-1. Estimated Construction Duration

Facility	Construction Duration
Vertical Launch Facility	15 months
Launch Control Center Complex	12 months
Alternate Control Center and Visitor Center	12 months
Landing Zone	9–10 months
Infrastructure ¹	6–7 months

Note: ¹ Includes water, sewer, drainage, electric, and roads.

2.1.1.2 Vertical Launch Facility

Exhibit 2.1-5 includes an artist's rendering of the Vertical Launch Facility and a schematic of the facility. The Vertical Launch Facility would be approximately 29 acres¹¹ in size and, as indicated in Exhibit 2.1-2, would be located in the northeastern portion of the spaceport.

The Vertical Launch Facility would include a launch pad and its associated structures, storage tanks, and handling areas; vehicle and payload integration facilities; a lightning protection system; deluge water systems and associated water capture tank; water tower; and other launch-related facilities and systems including shops, office facilities, and stormwater retention ponds (also referred to as retention ponds).

The launch pad would be a pile-supported concrete platform with a steel gantry framing. A concrete launcher track (supported by 3-foot-diameter piers), a flame trench, and a water retention tank would be the principal supporting features for launch activities. Four lightning towers about 250 feet tall each would be the major components of the lightning protection system.

Liquid oxygen and rocket propellant-1 (RP-1) would be stored in dedicated propellant storage areas at the Vertical Launch Facility. Liquid oxygen tanks would store 50,000 to 100,000 gallons each and would be approximately 14 feet in diameter and 50 to 100 feet long. RP-1 tanks could be up to 50,000-gallon capacity each, approximately 12 feet in diameter and 60 feet long. Depending on the size of the tanks, up to six tanks for liquid oxygen and up to four tanks for RP-1 would be installed at the Vertical Launch Facility. Additional storage tanks would be provided for helium and nitrogen (both gaseous and liquified), which are used as purge gases and tank pressurants. A total of approximately 10,000 to 15,000 gallons of helium would be stored in high-pressure tube banks, and a total of 25,000 to 50,000 gallons of nitrogen would be stored in up to two liquified nitrogen storage tanks and four gaseous nitrogen storage tanks, each up to approximately 10 feet in diameter and 44 feet long. In addition to these materials, ordnance may be stored at this facility for a short time before being inserted into the launch vehicle. Launch vehicles use ordnance as part of the flight termination system (see Section 2.1.2.1, *Representative Launch Vehicle*) and often use explosive bolts to ensure that components would separate when needed. The ordnance supplies the explosive force for these bolts.

The Vehicle Integration Building would be used for the inspection and assembly of the component parts (e.g., first stage, second stage) of the launch vehicle and payload mating (attachment of the payload to the launch vehicle) and would house a machine shop and storage facilities.

¹¹ Facility areas include the area within the fenced perimeter (which encloses all of the facility structures) and the 25-foot grassy (cleared) area outside the fenced perimeter and, for this facility, the two retention ponds located outside of the fenced perimeter.



There is 25 ft of grass outside the perimeter fence and along retention ponds.

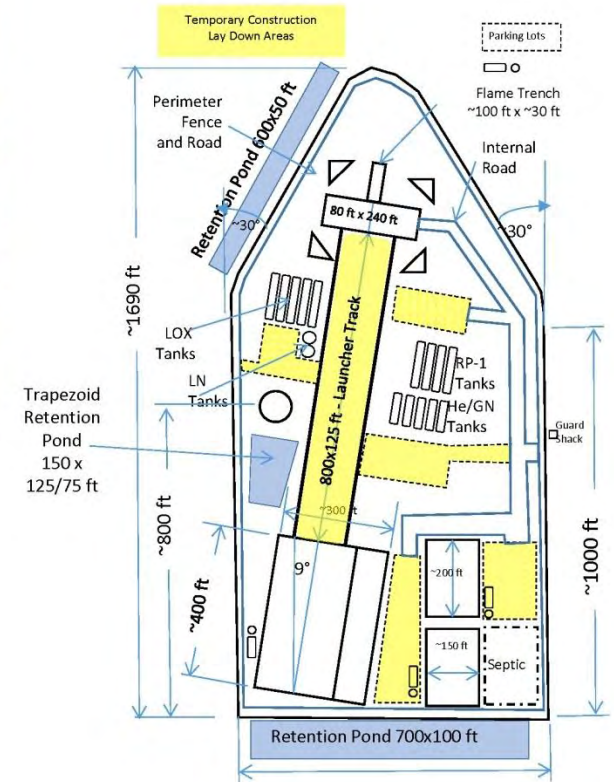


Exhibit 2.1-5. Vertical Launch Facility

1
2

1 If a launch operator arranged for the first stage to return to Spaceport Camden, either by landing at the
2 spaceport or after landing on a barge in the Atlantic Ocean, some refurbishment of the first stage could
3 occur in the Vehicle Integration Building. This building would be certified to meet National Fire
4 Protection Association requirements for electrical systems and equipment. This structure would be a
5 65-foot-tall, pre-engineered metal building on a concrete foundation with a metal roof and siding. The
6 Vehicle Integration Building would include a high bay and a multistory work area and would contain
7 overhead bridge and jib cranes for operational support. Two support buildings housing machine shops,
8 offices, integration facilities, and a warehouse would be either pre-engineered metal buildings or cinder
9 block masonry buildings on concrete foundations with metal roofs and interior offices and work areas.
10 Like the Vehicle Integration Building, the building housing machine shops and a warehouse would have a
11 high bay. These support buildings would be approximately 45 feet tall.

12 A 250-foot tall water tower would be constructed at the vertical launch area to feed a deluge water
13 system to provide sound and vibration suppression during an actual launch. The deluge water would be
14 injected into the rocket exhaust plume and flame trench and sprayed on the launch pad deck. During an
15 actual launch, the water tower would discharge up to 250,000 gallons of water.

16 Other Vertical Launch Facility features would include associated roads, a parking lot, a perimeter road
17 and fencing, gates, a guard shack, a diesel generator system (including fuel storage tanks)¹² a septic
18 system, and area lighting. These features are described in Section 2.1.1.6, *Infrastructure*. As shown in
19 Exhibit 2.1-5, three retention ponds for stormwater runoff control would be installed at the Vertical
20 Launch Facility. Each pond would be 8 feet deep, and the ponds would have a combined surface area of
21 115,000 square feet and total retention volume of 920,000 cubic feet.

22 Site preparation and construction of the Vertical Launch Facility is anticipated to take about 15 months.

23 **2.1.1.3 Launch Control Center Complex**

24 The Launch Control Center Complex would be constructed on approximately 2.4 acres (see Exhibit
25 2.1-6). As indicated on Exhibit 2.1-2, the Launch Control Center would be located on an uplands area in
26 the extreme western portion of the property approximately 2.3 miles from the launch pad at the
27 Vertical Launch Facility and approximately 1 mile from the Landing Zone.

28 The Launch Control Center Complex would include a Launch Control Center Building housing a control
29 room and related equipment and a Payload Processing Building. The Launch Control Center Building
30 would be the control hub for launches and related operations. The Payload Processing Building would
31 be the location for satellite¹³ and other related payload processing activities prior to integration onto
32 launch vehicles. A first responder facility would be located within the Launch Control Center Building or
33 the Payload Processing Building.

34 In addition to these two structures, the Launch Control Center Complex would include two small storage
35 buildings for payload propellants (satellite and special fuels¹⁴) and miscellaneous maintenance
36 equipment. Additional space for approximately 1,000 cubic feet of helium storage and 3,000 cubic feet
37 of nitrogen storage would be provided at the Launch Control Center Complex. Typically, these gases
38 would be stored in six to eight tube banks or tanks, the tanks being approximately 2 feet in diameter
39 and 40 feet long. In addition to these materials, ordnance may be stored at this facility for a short time
40 before being installed on the vehicle or transferred to the Vertical Launch Facility.

¹² There may be a total of up to seven diesel fuel storage tanks on the Spaceport Camden property, located at the Launch Control Center Complex, Vertical Launch Facility, and Alternate Control Center and Visitor Center.

¹³ A satellite is the portion of the payload consisting of an object placed in orbit around the earth.

¹⁴ Satellite and special fuels include hydrazine and monomethylhydrazine (MMH) or unsymmetrical dimethyl hydrazine (UDMH) used with nitrogen tetroxide (NTO).



There is 25 ft of grass outside the perimeter fence and along retention ponds.

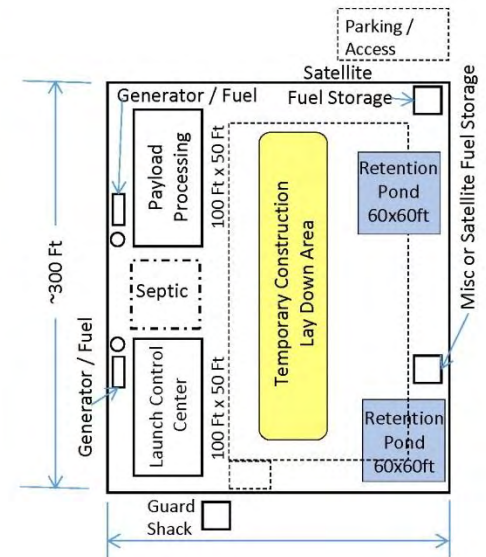


Exhibit 2.1-6. Launch Control Center Complex

The Launch Control Center Building and Payload Processing Building (the main buildings in this complex) would be approximately 150 feet by 50 feet and 40 to 45 feet tall, with a high bay and/or a second floor for offices and conference spaces. The smaller storage buildings (20 feet by 20 feet and 15 feet tall), if used for storage of hazardous materials such as hydrazine (used sometimes as satellite fuel), would have appropriate environmental and safety equipment. The main buildings would be of environmentally controlled, pre-engineered metal construction on concrete foundations with footers. The smaller storage buildings would be of pre-engineered metal or cinder block construction.

Both main buildings would be served by a backup generator with a fuel source (fuel storage tanks, up to 5,000 gallons each). Other features at the Launch Control Center Complex would include a parking lot, fencing, guard shack, gates, a septic system, and area lighting. These features are described in Section 2.1.1.6, *Infrastructure*. Two retention ponds for stormwater runoff control would be installed at the Launch Control Center Complex. Each pond would be 8 feet deep, and the ponds would have a combined surface area of 7,200 square feet and total retention volume of 58,000 cubic feet.

Site preparation and construction of the Launch Control Center Complex is anticipated to take about 12 months.

2.1.1.4 Alternate Control Center and Visitor Center

Exhibit 2.1-7 shows an artist concept for the Alternate Control Center and Visitor Center and the footprint for this facility. This facility would be similar in size and design to the Launch Control Center Complex and would serve as administration and conference headquarters for Spaceport Camden. It would be constructed on the south side of the spaceport site, as indicated in Exhibit 2.1-2, near the main entrance to the property. The Alternate Control Center would mirror the Launch Control Center in facility construction and would provide a backup launch control capability. This facility would also include a Visitor Center that would house informational displays for visitors and have accommodations for viewing launches.

The Alternate Control Center and Visitor Center buildings would be 40 to 45 feet tall. The two main buildings would be environmentally controlled, pre-engineered metal construction on concrete foundations with footers. The building would have a high-bay capability and/or second floor with offices and conference spaces. The storage buildings would be pre-engineered metal building or cinder block construction.

In addition to the buildings, the facility would include a parking lot, fencing, a septic system, area lighting and a guard shack. These features are described in Section 2.1.1.6, *Infrastructure*. The complex would have backup generators with a fuel source (fuel storage tanks, up to 5,000 gallons each) and two 20-foot by 20-foot storage buildings. Two retention ponds for stormwater runoff control would be installed at the Alternate Control Center and Visitor Center. Each would be 8 feet deep, and the ponds would have a combined surface area of 7,200 square feet and total retention volume of 58,000 cubic feet.

Construction of the Alternate Control Center, including facility site preparation, is anticipated to take about 12 months.

If the Bayer CropScience property becomes unavailable and the Alternate Control Facility is required to be redesigned for any reason, additional environmental review may be required if design, construction, or operational parameters fall outside the scope of this EIS.



There is 25 ft of grass outside the perimeter fence and along retention ponds.

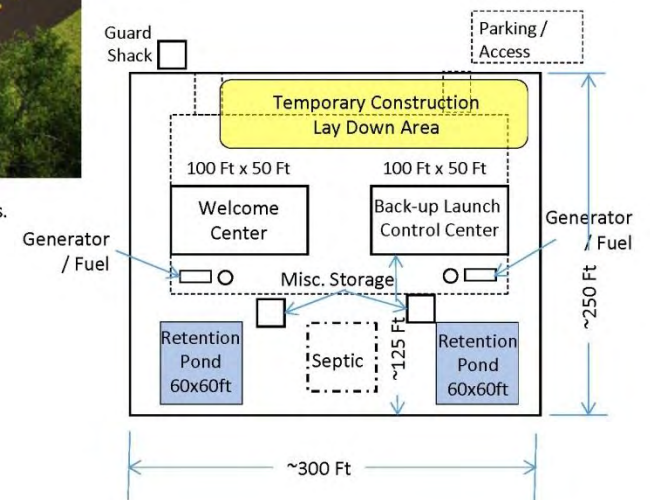


Exhibit 2.1-7. Alternate Control Center and Visitor Center

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2.1.1.5 Landing Zone

Exhibit 2.1-8 is an artist's rendering of the Landing Zone and a schematic of it. The Landing Zone would be used to land the first stage of some launch vehicles. It would occupy approximately 13 acres located in the center of the uplands portion of the spaceport, as indicated in Exhibit 2.1-2. The Landing Zone would primarily be a concrete pad located roughly in the center of the area. The Landing Zone would also have a building for operations and storage, and fuel and oxidizer "offload" tanks.

The 400-foot by 400-foot concrete landing pad would be supported by 3-foot-diameter concrete piers driven into the ground. There would be 100-foot-wide concrete side wings (concrete pads similar to the landing pad but not designed to support the landing of a first stage) for parking and storage of mobile offload propellant tanks and other support equipment such as mobile cranes or forklifts. The Landing Zone would have a building for operations and storage (50 feet by 50 feet by 20 feet tall) housing office space and storage areas.

The building for operations and storage would be constructed of either pre-engineered metal or cinder block and would be environmentally controlled. The Landing Zone would be fenced for security, have a septic system, and have a guard shack at the entrance. These features are described in Section 2.1.1.6, *Infrastructure*. Two retention ponds for storm water runoff control would be installed at the Landing Zone. Each would be 8 feet deep and would have a combined surface area of 46,000 square feet and total retention volume of 370,000 cubic feet.

Site preparation and construction of the Landing Zone is anticipated to take about 9 to 10 months.

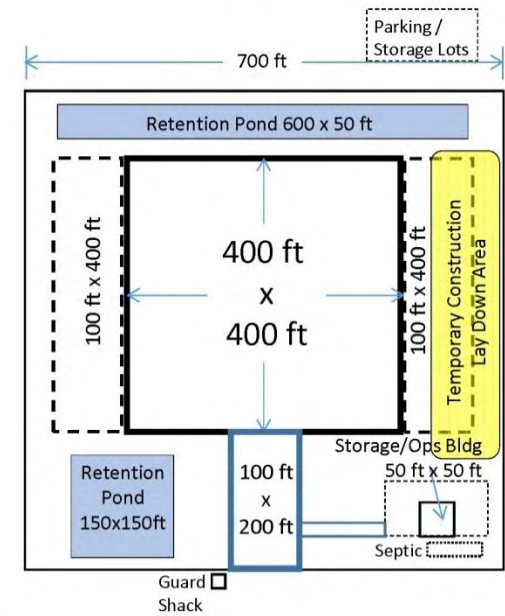
2.1.1.6 Infrastructure

New infrastructure or improvements to existing infrastructure would be required to support Spaceport Camden operations. Spaceport Camden would need water, electricity, and sewage treatment systems. The launch site road system would need to be expanded and upgraded. New security systems that include facility and improved launch site perimeter fencing, guard facilities, and gates would be required. Each facility would also need parking areas to accommodate launch site workers and visitors. The County has stated that new infrastructure and improvements would be limited to onsite improvements or, in the case of improved roadways, within the industrial property. The County does not anticipate improvements or expansions required for the access road to the spaceport site (Harrietts Bluff Road/Union Carbide Road) or the utilities that bring electricity and communications to the external boundary of the industrial property.

Expansion and improvement of the internal roadway system would be required for construction activities and to accommodate the new facilities and activities. Exhibit 2.1-9 shows the proposed roadway modifications, including modifications to roads on the spaceport site and on the Bayer CropScience property. Most of the launch site roadwork would involve upgrading existing roadbeds. It is anticipated that two grades of roads would be required onsite: regular roads, primarily for automotive traffic, and heavy roads to accommodate construction and transport of heavier equipment, including large and oversize components. Much of the road system to be upgraded for heavier use is located on the Bayer CropScience portion of the industrial property. It is estimated that 21,300 linear feet of regular road (8,800 feet of internal roads and a 12,500-foot launch site perimeter road) and 16,500 linear feet of heavier road would be required. Within the Vertical Launch Facility and Landing Zone, parking lots, internal roads, and the perimeter road would be constructed of concrete. All other roads (facility internal and perimeter roads and the site perimeter road) and parking lots would be constructed of asphalt.



There is 25 ft of grass outside the perimeter fence and along retention ponds.



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Exhibit 2.1-8. Landing Zone

As shown in Exhibit 2.1-9, one of the road upgrades is an upgrade to a heavier road to the existing dock. The dock area, which is part of Bayer CropScience property and would be included in the purchase option, could be used during construction or for the return of a first stage after a launch should the first stage be landed on a barge in the Atlantic Ocean. Existing infrastructure exists at the docks for use during construction and operation activities. The County has no plans at this time to make any modifications to the dock itself, as a land-based mobile crane would be used for transferring equipment between barge and truck, nor is there an anticipated need to dredge the channel for spaceport-related activities. The County recognizes that use of this dock or any work on the dock, including maintenance, must be coordinated with the Georgia Coastal Resources Division and USACE to obtain applicable permits/permissions (O.C.G.A. 12-5-280, *Coastal Marshlands Protection Act*, and O.C.G.A. 50-16-61, *Administrative Procedures Act/Revocable License Program*), to include a USACE Section 404 and Section 10 permit and a Coastal Marshlands Protection Committee permit. Permitting and coordination with both the Georgia Coastal Resources Division and USACE would determine the need for any bathymetric surveys of dredging.

There is no electrical power or water available within the proposed Spaceport Camden site. The Bayer CropScience property includes electrical and communications lines as well as two deep water wells; however, these utilities do not extend onto the Spaceport Camden site. Electric power, communications, and water are available at the main gate building to the two properties (Union Carbide Corporation and Bayer CropScience), but this guard facility is part of the Bayer CropScience side of the property. (This main gate building is located at the main gate location identified in Exhibit 2.1-2.) Power, communications, and water would be provided by extending the existing services available at the main gate for the two properties to the spaceport site and from there to each of the proposed new facilities.

Electrical power would be provided on the project site by installing approximately 3 miles of above-ground lines (mounted on wooden poles) located along launch site roadways to each facility and connected to existing offsite transmission lines. At each facility, the power lines would then be run underground. Transformers would be installed on the launch site as necessary. Annual power requirements during launch site operation are estimated to be approximately 31 million kilowatt (kW) hours per year. This is based on a nominal power demand of 6,400 kilovolt amps (kVA) per day¹⁵ (during operation, with a maximum demand of approximately 7,500 kVA per day). Power requirements during construction would be much less, nominally a little over 500 kVA per day.

There are two existing deep wells on the Bayer CropScience property that would be used to provide water for Spaceport Camden operations. Twelve-inch water lines would be run underground alongside the launch site roadways to provide water to each facility. The site is authorized to withdraw 1.7 million gallons of water daily from the two existing deep wells. Annual water usage during launch site operation is estimated to be 16.3 million gallons of water. This is based on a nominal water usage of 11,500 gallons per day with peak usage of approximately 405,000 gallons per day. (Peak usage would be dominated by the activation of the water deluge system, which could use up to 250,000 gallons per launch.)

Septic systems would be constructed at each of the four facilities to manage sanitary sewage. Commercial grade onsite sewage disposal (septic) systems would be utilized to treat the wastewater generated at each facility. Septic systems are sized based on the anticipated daily sewage flow. The anticipated flow for the launch site would be nearly 60,000 gallons per day (12,500 at the Launch Control Center Complex, 25,000 at the Alternate Control Center and Visitor Center, 2,500 at the Landing

¹⁵ kVA, kilovolt-ampere, is a measure of electrical power for an AC power system, it is the AC power equivalent to watts in a DC power system.

Zone, and 19,000 at the Vertical Launch Facility). Septic systems are regulated and permitted by the Georgia Department of Public Health and Camden County Department of Health.

Security fencing, and possibly video surveillance, would be installed around each of the four individual facilities and along the western border of the Camden launch site¹⁶. A main gate with controlled access would be installed near the Alternate Control Center and Visitor Center. The County has proposed that its perimeter fencing would be designed in accordance with FAA guidelines for security fencing in accordance with FAA-AC 150/5630-13 (as amended) and AC 150/5370-10 (as amended). The security fencing would consist of a chainlink fabric installed to a height of 8 feet (2.5 meters) and topped with a three-strand barbed wire overhang. Fence posts could be installed at no greater than 10-foot (3-meter) intervals. An area between 10 feet to 20 feet (3 meters to 6 meters) wide immediately outside of the perimeter fencing would be cleared.

Each of the facilities would have controlled access and guard shacks provided at the entrance to the facility. All the guard shacks for the four individual internal facilities (Vertical Launch Facility, Launch Control Center Complex, Landing Zone, and Alternate Control Center and Visitor Center) would be small one- to two-person enclosures. They would have power, an environmental control system, communications, lighting, water and a bathroom that connects to the facility's septic system.

The County has stated that its lighting systems would be designed and operated using best practices for wildlife, navigation, safety, and security. Area lighting would be provided for the four facilities but is not anticipated for the entire property or roads. Area lighting would consist of perimeter/security lighting, general illumination for parking lots, and walkway lighting for staff and visitor areas. All external lighting would be light-emitting diode (LED) lighting.

Typical (non-launch weekday) operations would dictate that external lighting would be turned on until about 9 p.m. then go into an automatic dim mode. Security lighting would be on trip sensors after 9 p.m. and would only be activated and on when triggered by a security alert. For launch operations, external lighting may be active from dusk until dawn due to the potential for three-shift operations at all four facilities.

2.1.1.7 Structure Summary

The previous sections provided information about the features of each of the four facilities and the infrastructure proposed for Spaceport Camden. Table 2.1-2 provides a summary of the permanent vertical structures that would be located at each of the Spaceport Camden facilities, their sizes, and type of construction. The facility size identified for each facility includes the area within a fenced perimeter plus a 25-foot cleared grassy area outside of the perimeter. Table 2.1-3 provides summary information for all facilities (total area, occupancy, and construction duration). The Vertical Launch Facility retention ponds would be located outside of the fenced perimeter; this area is included in the Vertical Launch Facility total area. Table 2.1-4 provides the facility final construction proposed footprint with the contribution from each of the structures at the facility (buildings, roads, parking areas, supporting foundations (pads), retention ponds). As noted in each of the previous sections, the County has stated that areas temporarily affected by construction (laydown areas) would all be within the fenced perimeter of the facilities. For the construction of these structures, the County has stated that all excavated material (an estimated 126,000 cubic yards) would be reused onsite, primarily as backfill.

Note that within the Landing Zone and Vertical Launch Facility all pads, parking lots, and roads would be concrete, all others would be asphalt.

¹⁶ No perimeter fencing would be installed at the launch site borders abutting marshland or water. Regular security patrols would be established to maintain access control for the site perimeter without fencing.

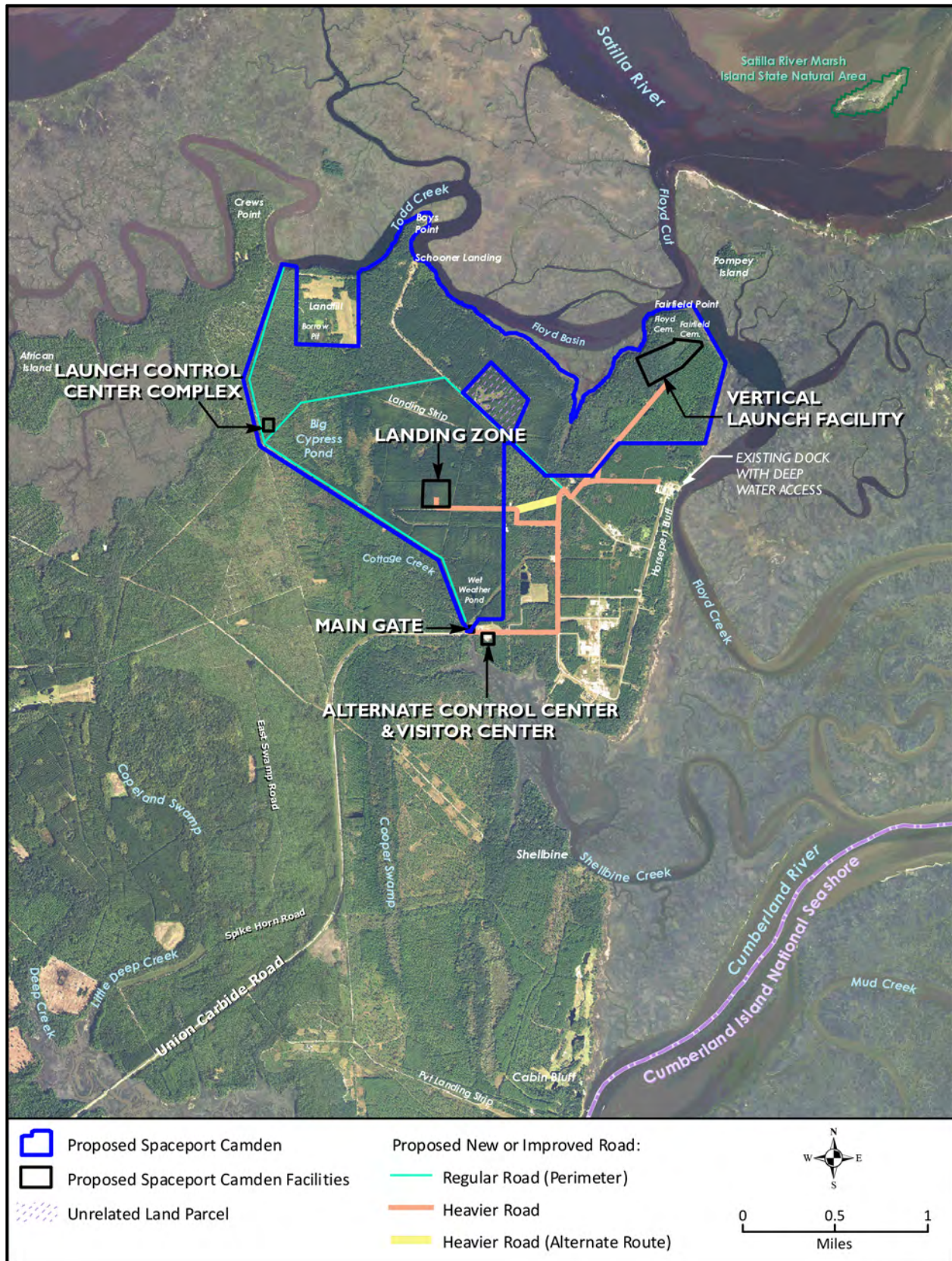


Exhibit 2.1-9. Proposed Launch Site Roads Improvements

Table 2.1-2. Proposed Action Permanent Vertical Structures

Facility	Structure	Height (feet)	Footprint(feet) ^a	Construction
Launch Control Complex (facility size: 300ft x 250ft)	Launch Control Center	40–45	100 x 50	Pre-engineered metal on concrete foundation
	Payload Processing Building	40–45	100 x 50	Pre-engineered metal on concrete foundation
	Storage building	1 story	20 x 20	Pre-engineered metal or cinder block on concrete foundation
	Storage building	1 story	20 x 20	Pre-engineered metal or cinder block on concrete foundation
	Guard shack	1 story	10 x 10	
Alternate Control Center and Visitor Center (facility size: 300ft x 250ft)	Alternate Control Center	40–45	100 x 50	Pre-engineered metal on concrete foundation
	Visitor Center	40–45	100 x 50	Pre-engineered metal on concrete foundation
	Storage building	1 story	20 x 20	Pre-engineered metal or cinder block on concrete foundation
	Storage building	1 story	20 x 20	Pre-engineered metal or cinder block on concrete foundation
	Guard shack	1 story	10 x 10	
Landing Zone (facility size: 700ft x 700ft)	Storage/operations building	20	50 x 50	Pre-engineered metal or cinder block on concrete foundation
	Guard shack	1 story	10 x 10	
Vertical Launch Facility (facility size: 1,690 x 800 ^c)	Vehicle Integration Building	65	300 x 400	Pre-engineered metal on concrete foundation with metal roof and siding
	Office building	45	150 x 200	Pre-engineered metal or cinder block on concrete foundation with metal roof
	Warehouse/storage/shop building	45	150 x 200	Pre-engineered metal or cinder block on concrete foundation with metal roof
	Guard shack	1 story	10 x 10	
	Water tower	250		Metal frame
	Lightning towers ^a (four)	250	60 x 60 x 85	Metal frame
	Chemical storage tanks ^b			
	Liquid oxygen	14	150 x 135	
	Rocket Propellant-1	12	135 x 135	
	Helium/nitrogen	10	80 x 160	

Notes: ^a Footprint dimensions are for the concrete pads for these structures.

^b Tank diameters were used for structure height; footprint dimensions are for the concrete pads for these structures.

^c Facility is not rectangular, the fenced perimeter consists of an 800-foot x 1,000-foot rectangular area and an area that is roughly triangular with an 800 foot base and a height of 690 feet.

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Table 2.1-3. Proposed Action Facility Summary

Facility	Total Acreage ^a (square feet/acres)	Occupants (normal/surge)	Construction Duration (months)
Launch Control Center Complex	105,000 / 2.4	25 / 100	12
Alternate Control Center and Visitor Center	105,000 / 2.4	10/50 15/150 (visitors)	12
Landing Zone	563,000 / 12.9	2/20 1 (visitor)	9–10
Vertical Launch Facility	1,270,000 / 29.2	40/150	15
Infrastructure ^a	924,000 / 21.2	N/A	6–7

Note: ^a Total acreage includes area for roads. (Water, drainage, and electric would be placed within the cleared areas along the roads. The sewer system is included in the acreage of its associated facility.) Construction duration is for all components of the infrastructure: water, sewer, drainage, electric, and roads.

Table 2.1-4. Spaceport Facilities Component Footprints

Vertical Launch Facility Components	Component Footprint (square feet)	Launch Control Center Components	Component Footprint (square feet)
Vehicle Integration Building	120,000	Launch Control Center Building	5,000
Office building	30,000	Payload Processing Building	5,000
Warehouse/storage/shop building	30,000	Guard shack	100
Water tower	0	Storage buildings (two)	800
Guard house	100	Parking area	22,500 ^a
Launch pad	19,200	Access drive	600
Launcher track	100,000	Retention ponds (two)	7,200
Flame trench	3,000	Total footprint (structures/pavement)	33,900 ^b
Lightning tower pads (four)	7,200	Alternate Control Center and Visitor Center Components	Component Footprint (square feet)
Parking lots (five)	132,000	Alternate Control Center Building	5,000
Chemical storage tank pads		Visitor Center	5,000
Liquid oxygen	20,300	Guard shack	100
Rocket Propellant-1	18,200	Storage buildings (two)	800
Helium/nitrogen	12,800	Parking area	22,500 ^a
Interior roads	56,800	Access drive (two)	1,200
Facility perimeter road	48,900	Retention ponds (two)	7,200
Retention ponds (two)	100,000	Total footprint (structures/pavement)	34,500 ^b
Total footprint ^d (Structures/Pavement)	598,000 ^b	Landing Zone Components	Component Footprint (square feet)
Launch Site Roads^e	Component Footprint (square feet)	Storage/operations building	2,500
Launch site perimeter road (west side of site)	150,000	Landing pad	160,000
Interior regular roads	312,000	Side wings (two)	80,000
Interior heavy use roads	462,000	Access road	20,000
Total road footprint	924,000	Parking lot	9,500 ^c
		Retention ponds (two)	31,500
		Total footprint (structures/pavement)	272,000 ^b

Notes: ^a Paved area of parking lot encompasses the two larger buildings. Paved area excludes area associated with the buildings.

^b Total does not include retention pond area.

^c Paved area of parking lot encompasses the storage/operations building. Paved area excludes area associated with the building.

^d Facility would not be rectangular; the fenced perimeter consists of an 800-foot x 1,000-foot rectangular area and an area that is roughly triangular with an 800-foot base and a height of 690 feet.

^e The perimeter road would be one lane all others two lanes. Lanes on regular use roads would be 12 feet wide and 14 feet wide on heavy use roads. An additional 6 feet of grassy area would be provided on each side of the roads. Construction duration is for all utilities (road, electric distribution, and water distribution).

2.1.2 Representative Launch Vehicle and Operational Activities

Operations¹⁷ would consist of up to 12 launches and up to 12 associated launch vehicle first-stage landings per year. Other operations, including up to 12 static fire engine tests and up to 12 wet dress rehearsals per year, are also proposed for the launch site. One of the 12 launches could be a night launch. All vehicles would launch to the east, from between 83 degrees (slightly north of due east) and 115 degrees (approximately east southeast), over the Intracoastal Waterway, Cumberland Island National Seashore and/or Little Cumberland Island, and the Atlantic Ocean. The first stage of the launch vehicle could land at Spaceport Camden, land on a barge about 200 to 300 miles off shore in the Atlantic Ocean, or drop into the Atlantic and not be recovered¹⁸. This section describes a typical medium-large lift-class launch vehicle and a description of typical operational activities.

Because the launch vehicles that would operate from the launch site would launch within a few days to several weeks after the arrival of the payload, minimal vehicle assembly and processing would be expected to occur at the launch site. Fabrication of the major components of the launch vehicle would occur at other facilities run by the launch operator (the launch service provider licensed to operate at Spaceport Camden). Launch vehicles would be delivered to the launch site in preassembled segments (e.g., first stage, second stage), and integration of these vehicle segments would occur at Spaceport Camden.

Permanent staffing at the launch site under the Proposed Action would be approximately 77 full-time employees, with 27 of the employees being Camden County employees and 50 of the employees being launch operator employees. Depending on the launch operator and type of launch, onsite activities supporting a launch would be expected to begin up to four weeks before launch day. During launch operations, it is anticipated that the number of staff would increase to approximately 50 to 100 Camden County employees and 150 to 200 launch operator employees beginning about two weeks before the launch. The additional Camden County employees are expected to be from the local work force; however, the launch operator employees would most likely be permanent launch operator employees temporarily assigned to Spaceport Camden. These additional employees would be needed to support the additional activities associated with payload processing, launch vehicle preparation, payload and launch vehicle integration, and launch support activities during launch preparation.

2.1.2.1 Representative Launch Vehicle

Spaceport Camden would be available to a range of launch operators, each of which offers various launch vehicles. While these vehicles would include small to medium-large lift class and use liquid propellants, they would have different design and operating specifications. Since a specific launch vehicle cannot be identified until a launch operator is identified and a variety of launch vehicles would be candidates to be launched from the launch site, a representative launch vehicle is used in this EIS to

¹⁷ Launch is defined as an attempt to place a launch vehicle or reentry vehicle and any payload from Earth in a suborbital trajectory, in Earth orbit in outer space, or otherwise in outer space.

Launch operations consist of the launch and pre- and post-flight ground operations, beginning with the arrival of the launch vehicle and payload/satellite at Spaceport Camden and continuing until all activities associated with the return of any portion of the launch vehicle to the ground in a safe condition are completed.

The FAA regulatory definition of *launch* includes both launches and launch operations.

¹⁸ Any proposed trajectories, launch vehicles, and/or fuel types or changes to the maximum number or timing of launches identified during the licensing process that are outside the scope of those addressed in this EIS would require additional environmental review.

1 evaluate the potential environmental impacts of launches from the launch site.¹⁹ The design features
2 identified for the launch vehicle described in the following paragraphs were selected as representative
3 for a medium-large lift-class launch vehicle. While not the only parameters that determine
4 environmental impacts, the size of the vehicle, the type of fuel used by the launch vehicle, fuel capacity,
5 (total amount of propellant carried on the vehicle), and thrust are important parameters in the analysis
6 of environmental impacts.

7 A medium-large lift-class launch vehicle may have a gross liftoff weight of approximately 750,000 to
8 1,500,000 pounds with an approximate length of 200 to 250 feet. The representative launch vehicle
9 considered for purposes of this EIS uses liquid oxygen and a special grade of kerosene known as RP-1 as
10 propellants.

11 **First Stage**

12 The first stage would be approximately 10 to 14 feet in diameter and between 125 to 175 feet long and
13 may include one or two large engines or as many as nine smaller engines. For purposes of this analysis,
14 it is assumed that the representative launch vehicle uses multiple engines producing approximately
15 1,800,000 pounds of thrust. It is further assumed the representative launch vehicle uses liquid oxygen
16 and RP-1 as its main propellants, and those propellants are stored onboard in two internal aluminum
17 tanks: one of approximately 60,000 to 65,000 gallons for liquid oxygen and one of 35,000 to
18 40,000 gallons for RP-1. The first stage of the launch vehicle could land at the launch site (recovered), in
19 the Atlantic Ocean on a barge (recovered), or in the water (unrecovered).

20 **Second Stage**

21 The second stage would be similar in diameter to the first stage and between 35 and 50 feet long, not
22 including the fairing (the top portion of the vehicle where the payload is enclosed) and payload. The
23 typical second stage would use one or two engines, one engine being more typical. It is assumed that a
24 single second-stage engine would be used to provide approximately 150,000 pounds of thrust. The
25 fairing would be between 12 and 18 feet in diameter by 30 to 40 feet long, although smaller versions
26 may also be used. The second stage is assumed to use approximately 15,000 gallons of liquid oxygen
27 and 9,000 gallons of RP-1 stored onboard in one aluminum tank each. Typically the second stage
28 achieves an orbit that decays relatively quickly, in about two to six months. The second stage typically
29 burns up upon reentry, but there have been instances where parts have impacted the earth. If possible,
30 if enough fuel remains in the second stage, the operator could perform a controlled reentry that would
31 ensure that any parts surviving reentry would land in the ocean. However, the potential location of
32 where the second stage would land would not be known until near the time of reentry.

33 **Common Subsystems in Stages 1 and 2**

34 Most medium-large lift-class launch vehicles use high-pressure helium as purge gas (to clear
35 components of residual fluids, such as propellants) or pressurants for propellant tanks (pressurants
36 maintain pressure in the tanks as the propellant is used). Therefore, it is assumed that both stages of
37 the representative vehicle use helium gas stored in high-pressure cylinders to pressurize the propellant
38 tanks for both stages. It is further assumed that both stages include radio frequency transmitters to
39 receive control signals and send monitoring and status data. Electronic control systems are used to
40 control valves and monitor equipment on the vehicles.

¹⁹ The determination of the applicability of the analysis performed using the representative launch vehicle to a specific launch vehicle would be made by FAA. Should a launch operator's launch vehicle differ from the representative launch vehicle, the need for additional NEPA documentation would be evaluated.

Flight Termination System

Launch vehicles are equipped with safety systems, called flight termination systems, intended to cause the destruction of the launch vehicle in the event that the vehicle does not perform as intended and subsequently strays from the intended trajectory. Activation of the system would be intended to limit the location of a vehicle (or vehicle debris) impact to the identified Hazard Area. (Hazard Areas are discussed in Section 2.1.2.5, *Pre-Launch Activities*, and representative Hazard Areas are shown in exhibits in that section.)

Vehicle Assembly

The first and second stages would typically arrive separately by oversized truck with two security escorts and would be placed in the Vehicle Integration Building at the Vertical Launch Facility. Once there, the stages and engines would be checked and prepared for mating. During vehicle operations, vehicle integration, and checkouts information on vehicle status (transmitted on radio frequency channels) would typically occur.

Ground transportation support for the delivery of the launch vehicle, payload, and the return of a recovered first stage would be minimal. This ground transportation support would consist of a truck to deliver a crane and four or five delivery trucks for delivery of the first stage, second stage, the interstage (a structure located between the first stage and second stage that houses the first stage release and stage separation systems), and any miscellaneous items. (The payload would be delivered separately from the delivery of the launch vehicle.) Additionally, should the first stage be recovered, this ground transportation support would also include a truck to deliver a crane and one to transport the recovered first stage back to the launch operator manufacturing facility. During transport of these launch vehicle components, the truck carrying the components would be accompanied by one or two escort vehicles.

2.1.2.2 Propellant, Gas, Fuel, Oil, and Solvent Storage

As discussed in Section 2.1.1.2, *Vertical Launch Facility*, liquid oxygen and RP-1 would be stored onsite to fuel launch vehicles. As much as 350,000 gallons of liquid oxygen and 200,000 gallons of RP-1 would be stored in tanks in dedicated propellant storage areas at the Vertical Launch Facility.

Payload fuels, such as unsymmetrical dimethyl hydrazine (UDMH), monomethylhydrazine (MMH), and nitrogen tetroxide (NTO), would be stored on a single-mission basis. In total, up to 5,500 pounds of UDMH, MMH, and NTO could be stored at the Launch Control Center Complex.²⁰ A typical storage tank for these types of propellants would hold 50 gallons, though some may also use up to 250 gallons per container in some cases. These propellants would be stored in aboveground storage tanks in the approximate 20-foot by 20-foot fuels storage area in the payload processing area of the Launch Control Center Complex. In addition, up to 2,000 gallons of hydrazine, used as a satellite propellant, could be stored at the fuel storage area of the Launch Control Center Complex.

Helium and nitrogen would be used as a pressurant for the propellant tanks during flight. They may also be used as a purge during fueling operations and at engine start. Helium and nitrogen would be obtained from commercial sources and delivered by tanker truck and would be stored in aboveground high-pressure storage tanks. Approximately 10,000 to 15,000 gallons of helium and 25,000 to 50,000 gallons of nitrogen would typically be stored at the Vertical Launch Facility. An additional 1,000 cubic feet of helium and 3,000 cubic feet of nitrogen would be stored at the Launch Control Center Complex.

²⁰ The ratio of the required fuels is payload specific. Typically, this amount is equivalent to less than 600 gallons of payload fuels.

Launch operators would arrange for the delivery of propellants and other necessary fluids and gases (e.g., the associated helium and nitrogen) needed for each launch. A total of approximately six to eight trucks would make monthly deliveries of propellant, helium, and nitrogen, as needed.

Approximately 100 gallons of isopropyl alcohol would be needed for each launch operation for additional cleaning operations, and approximately 20 gallons would be required for various cleaning operations during preparation activities. Solvent flushes would be performed during operation of the launch vehicle programs, requiring storage of limited quantities of various solvents in the shop areas. Less than 300 gallons of heavy gear oil and hydraulic oil, less than 5 gallons of cutting oil, and limited supplies of adhesives would be stored in the shop area in the Vehicle Integration Building or at the launch pad for general use in the maintenance of ground equipment. Welding equipment would be maintained onsite for occasional use. An oxygen/acetylene or other torch with its associated gases (carbon dioxide and argon) may also be used on a limited basis. Welding gases and supplies would be stored in 10 K-bottles (cylindrical tanks roughly 10 inches in diameter and 5 feet long each). Approximately 35,000 gallons of generator fuel (diesel or gasoline) would be stored at the launch site for backup generator usage.

Table 2.1-5 provides a representative list of these materials proposed to be stored onsite. When no quantity is listed, only minimal amounts would be stored.

Table 2.1-5. Material Storage

Material	Quantity Stored Onsite
Launch Vehicle Fuels/Propellants/Pressurants	
RP-1	200,000 gallons
Liquid oxygen	350,000 gallons
Helium	10,000 to 15,000 gallons at Vertical Launch Facility 1,000 cubic feet at Launch Control Center Complex
Nitrogen	25,000 to 50,000 gallons at Vertical Launch Facility 3,000 cubic feet at Launch Control Center Complex
Payload fuel (UDMH, MMH, NTO)	5,500 pounds (600 gallons ^a)
Hydrazine	2,000 gallons
Chemicals, Solvents, Lubricants	
Ammonia	^b
Chlorine Bleach	^b
Degreaser	^b
Grease	^b
Isopropyl Alcohol	^b
Machining lubricants	Less than 300 gallons
Gasoline	^b
Diesel fuel	35,000 gallons ^c
Welding gases (carbon dioxide and argon)	^b

Notes: MMH = monomethylhydrazine; NTO = nitrogen tetroxide; RP-1 = rocket propellant 1; UDMH = unsymmetrical dimethyl hydrazine.

^a Volume stored is dependent upon ratio of propellants stored. Quantity is based on typical ratio of propellants needed for payload.

^b Minimal quantities of this chemical would be stored onsite.

^c At Vertical Launch Facility, Launch Control Center Complex, and Alternate Control Center and Visitor Center, up to seven diesel fuel storage tanks may be used.

2.1.2.3 Representative Launch

Launch operations begin with the onsite delivery of the launch vehicle to the Vehicle Integration Building at the Vertical Launch Facility and the payload to the Payload Processing Building at the Launch Control Center Complex. Payload processing and launch vehicle checkout and assembly would occur concurrently. When ready for integration, the payload would be brought to the Vehicle Integration Building to be mated to the launch vehicle. Prelaunch tests (including dry and wet rehearsals and static engine tests) would be performed in the days leading to launch (see Section 2.1.2.5, *Pre-Launch Activities*). Notifications announcing the launch and identifying the closure area would also be made during this pre-launch period. Notifications could be made as much as a month in advance of the launch, although shorter notifications of two weeks or less are possible, depending upon launch specific turnaround times or possible launch delays. The closure area would be established, checkpoints manned, and access restrictions enforced hours before the launch (and continue for an hour after a nominal launch). After a final check, the integrated launch vehicle would be launched. For launches where the first stage would be recovered, the return of the first stage (either landing at the Landing Zone or returned by vessel after landing on a barge in the Atlantic Ocean) and first-stage refurbishment would complete the launch operations.

2.1.2.4 Payload and Payload Processing

Launches from the launch site would be expected to have payloads such as satellites and experiments. At this time, no launches with humans onboard are anticipated. Most payloads are expected to be commercial; however, payloads could also be from the Federal government or have a Federal contribution to a commercial payload. Primary commercial payload processing would be expected to occur at the Payload Processing Building at the Launch Control Center Complex. Typically, the payload would be delivered to the Payload Processing Building by the launch operator or a payload manufacturer up to four weeks before the scheduled launch.

Primary payload processing would include the following activities:

- Payload checkout, a visual checkout and functional inspection of the payload to ensure no damage has occurred during transit to the launch site and storage and the payload is functioning nominally.
- Payload/satellite propellant loading; payloads (including the satellite) are shipped without propellants. Propellants identified in the following paragraphs would be added to the payload/satellite at the Payload Processing Building.
- Payload encapsulation, placing the payload within the launch vehicle's payload fairing. The payload fairing provides protection from atmospheric impacts to the payload during launch and improves the aerodynamics of the launch vehicle.

Most payloads would include some additional propellants onboard, either for orbit maintenance or orbital insertion. Payload propellants may include fuels such as UDMH, MMH, and NTO, as well as pressurized gases including helium and nitrogen or solid propellants. Quantities would vary but could be as much as 5,000 pounds for combined weight of MMH and NTO for the representative launch vehicle. The MMH/NTO propellant weight for a representative capsule is approximately 3,000 pounds. Total payload weight (dry weight plus propellant weights) could be up to 18,000 pounds for the representative launch vehicle. Payloads would typically be fueled in the Payload Processing Building at the Launch Control Center Complex or at the Vertical Launch Facility. Any residual propellants would be returned to the Payload Processing Building storage facility.

At the launch site, UDMH, MMH, and NTO would be stored in a fuels storage area in the Launch Control Center Complex. Helium and nitrogen gases would be required at both the Vertical Launch Facility and Launch Control Center Complex. A small amount of ordnance, such as small explosive bolts and onboard batteries, would also typically be used and stored in the Payload Processing Building in the Launch Control Center Complex. This facility would be certified to meet National Fire Protection Association requirements for electrical systems and equipment and any Federal, State, or local laws and regulations concerning the storage of hazardous materials.

Spaceport Camden would have procedures, equipment, launch site staff, and local first responders trained in emergency response for materials and activities at the launch site. Launch operators would also be required to develop a Hazardous Materials Emergency Response Plan and establish an emergency response team for any hazardous or toxic propellants and materials. Spills would be contained and cleaned up in accordance with the procedures identified in the Hazardous Materials Emergency Response Plan.

After any necessary primary payload processing would be completed, the payload would be delivered to the Vehicle Integration Building. The payload would then be attached to the fully assembled launch vehicle, which would then be loaded on the transporter-erector. The Vehicle Integration Building and immediate vicinity would be used for unloading, storage, and any necessary final payload processing. Approved safety procedures, to accommodate both nonhazardous and hazardous payload processing, such as ordnance installation and loading of liquid propellants onto the second stage, would be in place. The Vehicle Integration Building would be certified to meet National Fire Protection Association requirements for electrical systems and equipment, including crane consoles.

2.1.2.5 Pre-Launch Activities

Pre-launch activities would include mission rehearsals, static fire engine tests, and coordination with governmental agencies and media outlets to provide notification of these launch operation activities and establish secure areas in the vicinity of the vertical launch area. A Security Plan, developed by Camden County in cooperation with the launch operator, would outline a process (e.g., the establishment of closure areas) to prevent the public and other nonauthorized personnel from accessing the area during hazardous operations in accordance with 14 CFR Parts 417 and 420.

Mission Dress Rehearsals

Mission rehearsals are performed to verify that all vehicle and ground systems are functioning properly and that all procedures are properly written. After final systems checkout, there would typically be two mission rehearsals. These rehearsals would allow for team training and coordination of activities between the mission-specific launch operator crew and other operations personnel. One dry dress rehearsal (a launch rehearsal performed without loading propellants on board the launch vehicle) and one wet dress rehearsal (a launch rehearsal performed with vehicle propellant loading²¹) would be performed to verify full launch readiness. During a wet dress rehearsal, the launch procedures would be followed up to a pre-programmed abort just prior to first stage engine ignition. Following each rehearsal, the integrated launch vehicle would be returned from the launch pad to the Vehicle Integration Building. All propellants loaded during the wet dress rehearsal would be removed from the launch vehicle and returned to their storage tanks at the Vertical Launch Facility at the conclusion of the rehearsal.

²¹ Propellants loaded onto the launch vehicle include the main engine fuel (RP-1), liquid oxygen, and any other fuels (such as hydrazine).

Static Fire Engine Tests

Static fire engine tests are performed to verify engine control and performance as well as launch pad systems performance. Static fire engine tests include all of the activities associated with a wet dress rehearsal, with the additional action of igniting the first stage engines. The deluge water system is also tested during a static fire engine test. Conservatively, all 250,000 gallons of water stored in the water tower could be used (sprayed into the engine exhaust plume) during a test, although typically less than 100,000 gallons would be used. During a static fire engine test, the launch vehicle engines would typically be ignited for approximately two seconds but could be ignited for up to seven seconds, then shut down. The launch vehicle would be held in place during the test to prevent launch. The launch vehicle would be defueled of propellants not consumed during the static fire test, and those propellants would be returned to their storage tanks at the Vertical Launch Facility at the conclusion of the test.

Public Notification of Launch Operations

Public access in the vicinity of the launch site would be restricted during launches, wet dress rehearsals, and static fire engine tests. Closures would involve securing both land and water areas (referred to as closure areas, the sizes of which would vary for each operation). Public notification would be required prior to establishing the closure areas.

Typically, for a commercial launch of a medium-large launcher and its primary payload(s), an estimated launch window can be established as far as 6 to 12 months out from launch and is usually publicly published. A specific target date(s) for the actual launch, wet dress rehearsal, and/or static fire engine test and associated hazard area closures is typically identified at least one to three months in advance and would be made available to county officials (including police, fire and rescue personnel) and the public for planning purposes. Notification would include intended date, time, and location of closure areas and best viewing areas, the expected closure dimensions, times, and backup closure dates and times. Camden County and/or the launch operator would post written notices of the date, time, and the proposed closure area at several locations in the area as well as an advertisement in local newspapers. Camden County and/or the launch operator would also coordinate with local government agencies with regard to launch operations requiring public notification.

Camden County would coordinate with Glynn County, State of Georgia law enforcement agencies, the USCG, the U.S. Navy at Naval Submarine Base Kings Bay, the Marine Corps Air Station Beaufort, and the appropriate regional Air Route Traffic Control Center (ARTCC). Notices would be put out through local media and through the use of Notices to Mariners (NOTMARs) and Notices to Airmen (NOTAMs). Camden County and/or the launch operator would also notify the City of Brunswick, the NPS, Crooked River State Park, the USFWS, and other appropriate agencies of the launch operation and associated closures.

The actual date for anticipated activity (to include hazard area closures) would be re-confirmed about two weeks in advance and notification would once again be made to officials and the public. Changes in the estimated, target and/or actual dates could occur any time prior to the planned activity due to weather, technical issues, or other mission critical parameters; in such cases the officials and public would be notified of any cancellation or changes in target date of the activity and any associated hazard area closures. In an atypical scenario for a medium-large launcher and its primary payload (e.g., a rush launch to replace a critical asset that has failed on orbit), this timeline could potentially be condensed to under one month, but this would be very unusual. The Georgia Coastal Resources Division recommends avoiding or minimizing launch operations that require closure areas on weekends, holidays, and during organized fishing tournaments in the vicinity, as well as posting closure dates/times at all public access points within 10 miles of proposed closure areas, including public boat ramps, 30 days in advance (O.C.G.A. 12-5-320, *Coastal Management Act*).

Security and Safety Zones

As part of the licensing process, Camden County and the launch operator would jointly develop a Security Plan that defines the process for ensuring that any unauthorized persons or occupied vessels, trains, aircraft, cars, trucks, all-terrain vehicles, or other vehicles are not within FAA-approved hazard area or, if they are, that they conform to criteria in 14 CFR Parts 417 and 420. (The hazard area encompasses areas that could potentially be affected by debris from a launch accident. In the event of a launch accident, only some portions of the hazard area would be impacted.) The Security Plan would include safety and security personnel for each launch operation activity and roadblocks and other security checkpoints to ensure the public remains clear of the area. Camden County and/or the launch operator also would develop and implement agreements and plans with local authorities whose support is needed to ensure public safety during all launch processing and flight, in accordance with 14 CFR Parts 417 and 420. Individual Security Plans that include motorized vehicular use or temporary structures or staging areas on the beach will require beach driving permits and/or Letters of Permission from the Georgia Coastal Resources Division (O.C.G.A. 12-5-230, *Shore Protection Act*). Individual Security Plans developed between the County and launch operator must be submitted to the Georgia Coastal Resources Division to determine if any additional plan-specific authorizations are required prior to implementation (O.C.G.A. 12-5-320, *Coastal Management Act*). The Georgia Coastal Resources Division requests notification in writing of all launch operations that require public notification so that they may assist in alerting the affected public of upcoming closures.

The Spaceport Camden Security Plan would describe the procedures for securing a closure area, thus limiting unauthorized public access in the area on the day of a launch. The closure area would be expected to include areas around the access points to the launch site at the end of Harrietts Bluff Road (also referred to as Union Carbide Road) and the waterways surrounding the launch site, in addition to parts of Cumberland Island and Little Cumberland Island extending along the trajectory and out to sea. Exhibit 2.1-10 and Exhibit 2.1-11 show possible hazard and closure areas for a launch based on two representative trajectories.²² Additional trajectories, all in a generally easterly direction, could be used for launches from this launch site; at roughly 4 miles from the launch site (the approximate distance to first possible crossing over any part of Cumberland Island), the altitude of the vehicle in a typical launch profile would be over 30,000 feet. Each launch would have an individually defined closure and hazard area, which is dependent upon the specific type of vehicle, the trajectory, and the mission.

As can be seen from Exhibit 2.1-10 and Exhibit 2.1-11, differences in the locations of the hazard areas could result in changes to the defined closure areas. If the closure area for a proposed launch would impact areas other than those described and analyzed in this EIS, additional or supplemental environmental review may be required. Camden County (as the launch site operator) and/or the launch operator would coordinate with the following entities (and possibly others) to develop and implement the Security Plan: Camden County, Glynn County and State of Georgia law enforcement agencies; the cities of Brunswick, St. Marys, Woodbine and Kingsland; the NPS; U.S. Navy; FAA; Crooked River State Park; Jekyll Island State Park; the USFWS; the Georgia Department of Transportation; and the USCG.

²²Three trajectories were used in the analyses for this EIS: a northern (83°), a middle (100°) and a southern (115°). Exhibit 2.1-10 and Exhibit 2.1-11 show hazard and closure areas for the northernmost and southernmost of these three trajectories. Other trajectories proposed by launch operators would be assessed to determine the need for additional environmental impact analysis and documentation. Closure and hazard areas would be determined as part of the FAA launch approval process for each launch.

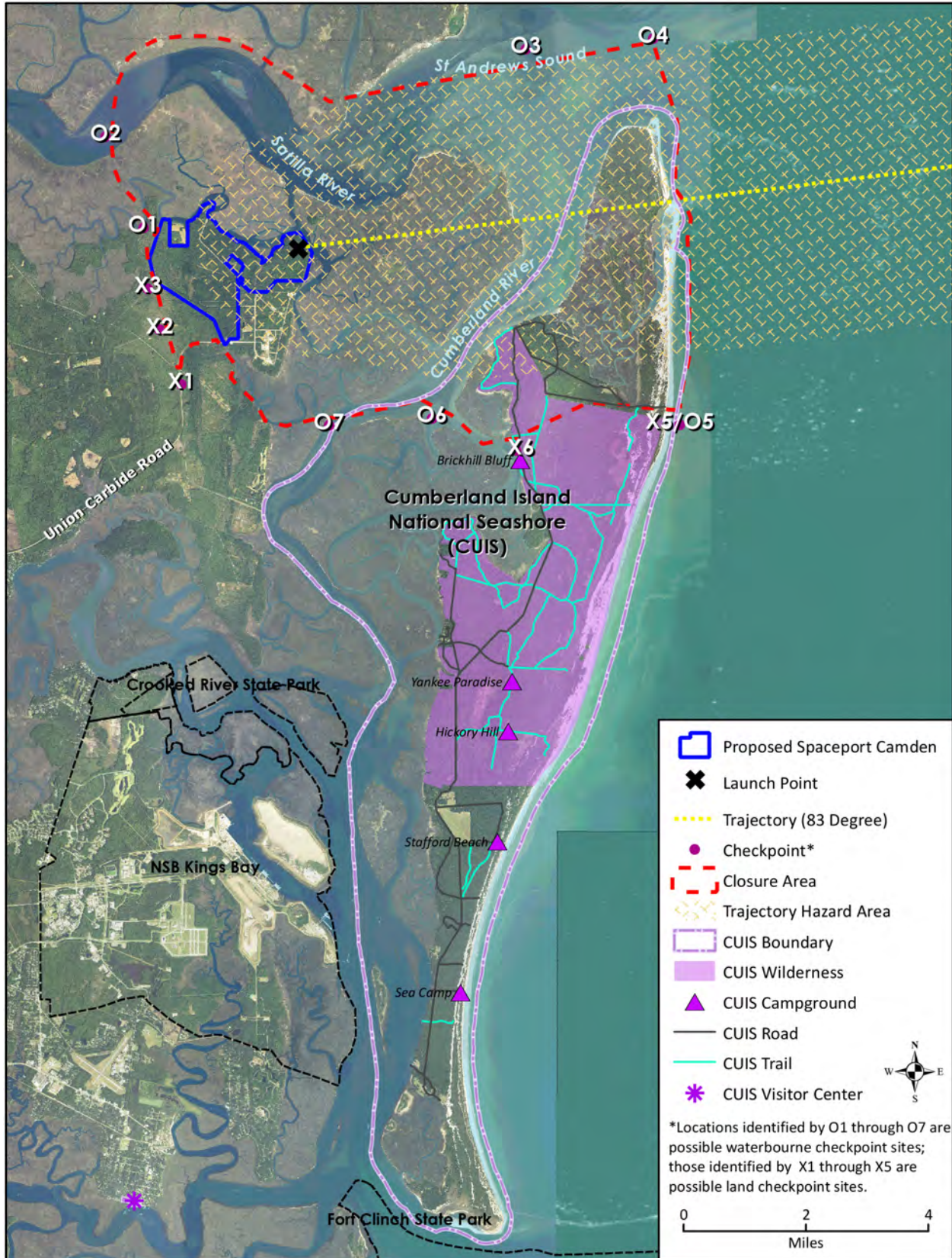


Exhibit 2.1-10. Representative Trajectory (83 Degree) with Hazard and Closure Areas

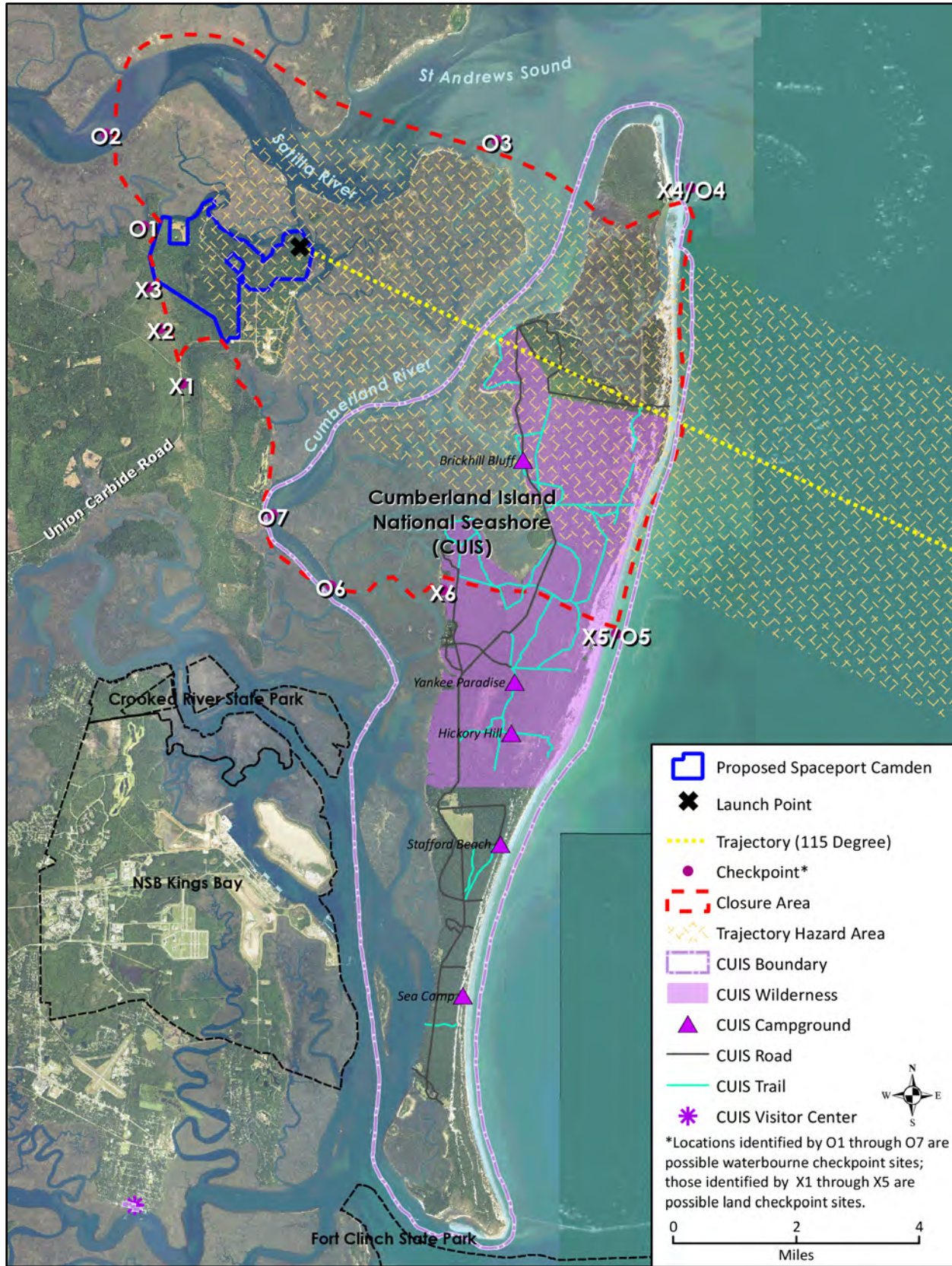


Exhibit 2.1-11. Representative Trajectory (115 Degree) with Hazard and Closure Areas

1 In addition, consultation under Section 4(f) with the NPS regarding impacts from closures on the
2 Cumberland Island National Seashore would be conducted as part of the consideration of the issuance
3 of a launch license. Advanced planning work sessions with all stakeholders would occur to ensure every
4 organization's role and responsibilities were defined and understood and that a detailed (minute-by-
5 minute) launch checklist (count down and contingency plan) would be created. There may be dry runs of
6 the detailed launch checklist before the first few launches to make sure everyone is clear on how the
7 process would flow, and the detailed launch checklist would be updated as needed to account for
8 lessons learned. Appropriate cost recovery mechanisms would be put in place as needed for those
9 stakeholders that are a part of the process, and provisions for "authorized persons" would also be
10 determined and implemented (e.g., residents, vacation house owners and permit-holding campers, NPS
11 personnel). Should those persons wish to depart the area on Cumberland Island or Little Cumberland
12 Island for a launch, Spaceport Camden personnel may facilitate transportation for those individuals to
13 and from their houses or camp sites on the day of the launch.

14 Camden County proposes to limit public access during launches at a pre-defined checkpoint on Harrietts
15 Bluff Road/Union Carbide Road and up to two other locations on logging roads near the launch site to
16 ensure that unauthorized persons remain off the launch site, which would be entirely within the
17 anticipated closure area. These locations are shown as points X₁, X₂, and X₃ on Exhibit 2.1-10 and Exhibit
18 2.1-11. The Camden County Sheriff Department would be responsible for setting up these checkpoints.
19 Only approved government, Camden County, launch operator, and emergency personnel, and others
20 with appropriate credentials would be allowed on the launch site during a launch (or at other times).

21 During the launch sequence, the Camden County Sheriff Department would set up additional
22 waterborne and land security checkpoints to ensure controlled access to the entire closure area. As
23 shown in Exhibit 2.1-10 and Exhibit 2.1-11 for the northernmost and southernmost trajectories
24 considered for this EIS, the waterborne checkpoints could be located along the Satilla River/St. Andrews
25 Sound area (O₁, O₂, and O₃ on Exhibit 2.1-10 and Exhibit 2.1-11), the Atlantic Ocean (O₄ and O₅), and the
26 Cumberland River (O₆ and O₇). Camden County Sheriff Department vehicles (boats) would be used to
27 secure the river, streams, and ocean checkpoints. Additional land security checkpoints could be
28 implemented on Cumberland Island near Brickhall Bluff or Plum Orchard (X₆) and on the Atlantic beach
29 (X₄ and X₅) to ensure controlled access.

30 The proposed closure area would be further developed in consultation with FAA, the USFWS, and the
31 NPS to ensure the Cumberland Island National Seashore and the Satilla River/Andrews
32 Sound/Cumberland River areas are properly secured, with minimal impact to activities and operations.

33 Closures could last up to 12 hours on a launch day, with 4 to 6 hours being the typical closure time for a
34 nominal launch. The 12-hour closure period allows for potential aborts and contingencies. A closure for
35 a wet dress rehearsal or static fire engine test would be shorter than for a launch, typically three hours
36 or less and would include only those areas within a 2-mile radius of the launch pad.

37 During a closure, monitoring would be done by vehicles (car/truck) along existing roads such as Harrietts
38 Bluff Road, as well as by video surveillance (e.g., high-definition video cameras with zoom lenses placed
39 well above ground level on the water tower and/or lightning towers). Camden County, the launch
40 operator, and/or law enforcement would monitor the area to the east of the checkpoints to ensure that
41 the area would remain clear. Except in case of an emergency, Camden County and/or the launch
42 operator would not conduct ground sweeps. Only if video surveillance is insufficient would other
43 monitoring methods be used, such as the following:

- 44 • Unmanned aerial surveillance (no more than two unmanned vehicles at the same time), with
45 unmanned vehicles abiding by airspace restrictions for the Cumberland Island National Seashore
46 and generally not overflying the wilderness area

Spaceport Camden

- Manned aerial surveillance (one fixed-wing aircraft with flight time less than 30 minutes at an altitude of less than 1,000 feet)
- Beach sweeps along the Atlantic coast beaches of Cumberland Island and Little Cumberland Island (limited to the areas within the closure area), using ground vehicles suitable for beach travel (e.g., all-terrain or sport utility vehicles) and approved for use on Cumberland Island and Little Cumberland Island
- USCG vessel

Table 2.1-6 lists actions that would be conducted to ensure the closure and security of the area prior to an actual launch. The same actions and activities would occur for other launch operations requiring a closure (i.e., wet dress rehearsal and static fire engine test), but the start time, area size, and durations would be different since these other launch operations are not expected to last as long or impact as large an area as an actual launch. Specific closures for launch days are still to be determined. However, Exhibit 2.1-10 and Exhibit 2.1-11 note initially proposed check points.

Table 2.1-6. Representative Security Activities on Day of Launch

Action	Purpose	Start Time	End Time
Establish check points and take down check points	Set up for launch and remove after launch. Commence monitoring of traffic flow.	T ¹ – 6 to 12 hours	T + 5 to 30 minutes
Establish hard checkpoints	Restrict access to only authorized persons (property owners, permitted campers, NPS personnel, etc.) in closure areas.	T – 3 hours	T + 5 to 30 minutes
USCG/other waterborne law enforcement on station	USCG and/or other local waterborne law enforcement sweep areas and restrict boating access.	T – 3 hours	T + 5 to 30 minutes
Security sweeps	Security sweeps responsible areas (e.g., beach, island Main Road, logging roads near launch site, rivers and creeks). Verify by video, UAV, or ATV as needed.	T – 2 hours	T – 1 hour 40 minutes
Trajectory sweep	Verify with visual and/or airborne sweep.	T – 1 hour	T – 40 minutes
Final sweep	Check land and water checkpoints for activity, review video one last time.	T – 1 hour	T – 40 minutes
Close airspace	In accordance with agreed procedure, FAA Air Traffic closes appropriate commercial airspace. Airspace closures potentially affecting Special Use Airspace would be coordinated with the appropriate using agency (e.g., U.S. Navy at Naval Submarine Base Kings Bay, Marine Corps Air Station Beaufort).	T – 15 minutes	T + 5 to 30 minutes

Notes: ATV = all-terrain vehicle; NPS = National Park Service; UAV = unmanned aerial vehicle; USCG = U.S. Coast Guard.

¹ “T” implies the anticipated time of engine firing, with start and end times measured before (minus x hours or minutes) or after (plus x hours or minutes). End times dependent on whether a first-stage landing is planned.

The Security Plan would also include a process for clearing offshore areas. This process would include coordinating with the USCG, issuing a NOTMAR, and clearing the offshore area in order to ensure public safety. The USCG could conduct a boat patrol to sweep the offshore area to make sure the area is clear; sweeps would continue until the launch operator is ready to load propellant to the vehicle (approximately three hours prior to launch). If necessary, a final sweep of the closure areas by manned fixed-wing aircraft or unmanned aerial vehicle could be implemented at this time to ensure the areas are clear.

After the launch (and landing at the launch site, if planned) operation is completed or postponed, Camden County and/or the launch operator and FAA would notify law enforcement that the area has

been deemed safe, allowing them to reopen the closure areas. In the event that the launch would be postponed, closure and hazard areas would be reestablished for the rescheduled launch.

2.1.2.6 Launch Day Activities

Within the 24 hours before a launch, the launch vehicle on the transporter erector would be moved to the launch pad from the Vehicle Integration Building and connected to the launch stand. A wheeled vehicle such as a small tug or other road equipment would be used to pull the launch vehicle and transporter erector to the launch pad, where the launch vehicle would be erected and final system checks completed. Launch vehicles may be erected and de-erected several times prior to launch. Approximately three hours before engine ignition the vehicle would be loaded with propellant. Just before engine ignition, the transporter erector would be retracted from the vehicle. The transporter erector would be moved into the Vehicle Integration Building after the launch.

One water tower would be constructed at the Vertical Launch Facility as a part of a deluge water system for sound and vibration suppression during an actual launch. The deluge water would be injected into the engine exhaust plume and flame trench and sprayed on the launch pad deck. Between 100,000 to 250,000 gallons of water from the tower would be required during a launch; much of this water would be vaporized, as depicted in Exhibit 2.1-12; the remainder drains to the water retention tank.



Source: NASA

Exhibit 2.1-12. Vapor Cloud from the Launch of a Medium Lift-Class Launch Vehicle from the NASA Wallops Flight Facility

2.1.2.7 First-Stage Landing

The incorporation of a landing zone at Spaceport Camden would allow for the landing of the launch vehicle first stage after it has successfully separated from the upper stages of the vehicle. Up to

12 launch vehicle first-stage landings per year could be made. Security and safety zones from the vehicle launch would be maintained for the return of this portion of the launch vehicle. (The first-stage return trajectory would be along the same path as the launch vehicle ascent trajectory and would not require an expansion of the security and safety zones.) First-stage landings would occur approximately 10 minutes after launch and, therefore, would not appreciably extend the length of time security, and safety zones would need to be maintained.

Not all launches would involve landing the first stage at the launch site. First stages may drop in the Atlantic Ocean or land on a barge in the Atlantic Ocean.²³ During a landing (either at the spaceport or on a barge at sea), the first-stage engines would be used to control the descent of the vehicle. In the event of a landing on a barge, the first stage could be returned to the launch site, utilizing the existing dock on Floyd Creek shown in Exhibit 2.1-2.

Whether the first stage lands at the launch site or is returned by vessel, the activities associated with refurbishing the first stage would be expected to be similar. The first stage would be defueled at the landing pad or on the barge (residual propellant would initially be transferred to mobile storage tanks within the Landing Zone or on the barge and then returned to propellant storage tanks at the Vertical Launch Facility). After being defueled, the first stage would be loaded onto a transport vehicle using a land-based mobile crane at the dock area, returned to the Vehicle Integration Building, cleaned, and prepared for transport back to launch service provider facilities.

2.1.2.8 Launch Failures

Failures are possible, with launch failure probabilities for launch vehicles of the type being considered for the proposed Spaceport Camden assessed to be in the range of 2.5 to 6 percent (NASA, 2014; Glaser, 2017). While a failure can occur at any point in the launch, historically, failures are typically at the pad, soon after ignition/lift off and over the launch site or much later in the flight (which in this case would be well out to sea) (NASA, 2014). Launch failures would occur either on the launch pad or during flight (launch vehicle ascent). For launches with a first stage landing, failures could also occur during the return flight of the first stage or at the landing pad/barge; to date all of the failures associated with return of the first stage have occurred at the landing pad. Failures on the launch pad would be expected to result in the complete destruction of the launch vehicle and payload. The ensuing explosion would consume most, if not all, of the propellants carried on the vehicle. Because FAA regulations (14 CFR §420.21) require launch pads to be at least 10,600 feet (for medium-lift-class to large-lift-class launch vehicles) from the launch site boundary, vehicle debris from the explosion would be expected to be confined to the launch site. Failures at the landing pad or on the landing barge would be expected to result in the destruction of the first stage. The explosion would consume most, if not all, of the propellants remaining on the first stage. First stage debris from a failure at the landing pad would be expected to be confined to the launch site.

Failures in flight could result in the destruction of the vehicle either due to the failure itself or as the result of a destruct signal generated by a flight termination system. The flight termination system is designed to destroy the vehicle in the event that the vehicle veers from the planned flight trajectory. This system is employed to ensure that any debris from the destruction of the vehicle would land within the FAA-approved trajectory specific hazard area. Most propellants are expected to be consumed during the destruction of the vehicle, but some may escape and be released into the atmosphere. Although this process is intended for the vehicle to be totally destroyed, some of the vehicle

²³ In the event that the first stage is dropped into the Atlantic Ocean, the first stage would not be recovered and would sink in the Atlantic Ocean hundreds of miles off shore.

components could survive relatively intact. Any debris or surviving components would be expected to impact within the launch site boundary, or on land or in water within the hazard area. Components and debris impacting water could sink intact or break up into smaller pieces before sinking. Should any propellant tanks survive a water impact relatively intact, the propellant would, if not recovered, eventually leak out of the tanks and into the water.

2.2 Ocean-Landing Only Alternative

Under the Ocean-Landing Only Alternative, which is the Environmentally Preferred Alternative, FAA would issue a Launch Site Operator License to the County. The license would allow the County to offer the commercial space launch site, Spaceport Camden, to commercial launch operators to conduct launches of liquid-fueled, small to medium-large lift-class, orbital and suborbital vertical launch vehicles. Under this alternative, the recovery of a launch vehicle first stage would be limited to a landing on a barge approximately 200 to 300 miles off shore in the Atlantic Ocean and would not include the option to land the first stage of a launch vehicle at Spaceport Camden. This alternative is the Environmentally Preferred Alternative because it eliminates certain environmental issues associated with landings at the spaceport site. Particularly, there would be no landing-related noise issues or sonic booms as there would be with the Proposed Action. Additionally, there would be less ground disturbance because the Landing Zone would not be constructed.

As in the Proposed Action, the proposed launch site would be constructed in Camden County, Georgia, in the extreme southeastern part of the state, approximately 11.5 miles due east of the city of Woodbine. The proposed launch site would be constructed within an existing 11,800-acre industrial site, consisting of property currently owned by the Union Carbide Corporation and Bayer CropScience, shown in Exhibit 2.1-1.

The first stage of the launch vehicle could land in the Atlantic Ocean on a barge or could be dropped in the Atlantic Ocean and not recovered. A first stage that lands on a barge would be returned to Spaceport Camden. Three facilities and the related infrastructure improvements would be constructed under the Ocean-Landing Only Alternative: a Vertical Launch Facility, a Launch Control Center Complex and, an Alternate Control Center and Visitor Center. Since the Ocean-Landing Only Alternative does not include the potential for first-stage landings at Spaceport Camden, a Landing Zone Facility would not be constructed.

Table 2.2-1 summarizes the major components of the Proposed Action and Ocean-Landing Only Alternatives.

Table 2.2-1. Construction and Operations Activities Under the Proposed Action and Ocean-Landing Only Alternatives

Proposed Action	Ocean-Landing Only Alternative
Construction	
Vertical Launch Facility	Vertical Launch Facility
Launch Control Center Complex	Launch Control Center Complex
Alternate Control Center and Visitor Center	Alternate Control Center and Visitor Center
Landing Zone	
Infrastructure	Infrastructure
New and improved roads	New and improved roads
Electrical distribution system	Electrical distribution system
Septic systems	Septic systems
Water distribution system	Water distribution system
Operations	
Up to 12 static test fires	Up to 12 static test fires

Table 2.2-1. Construction and Operations Activities Under the Proposed Action and Ocean-Landing Only Alternatives

Proposed Action	Ocean-Landing Only Alternative
Up to 12 dry dress rehearsals	Up to 12 dry dress rehearsals
Up to 12 wet dress rehearsals	Up to 12 wet dress rehearsals
Up to 12 launches	Up to 12 launches
Up to 12 launch vehicle landings at the launch site or on a barge (with first stage return to the launch site)	Up to 12 launch vehicle landings on a barge (with first stage return to the launch site)

2.2.1 Construction – Activities and Facility Descriptions

This section highlights the differences between the construction activities for the Ocean-Landing Only Alternative compared with those required for the Proposed Action. Construction activities include the construction of three facilities (Vertical Launch Facility, Launch Control Center, and Alternate Control Center and Visitor Center) and associated infrastructure.

2.2.1.1 Launch Site Construction Activities

Under the Ocean-Landing Only Alternative, three of the four facilities identified for the Proposed Action and their associated infrastructure would be built. However, there would be no Landing Zone Facility and its associated laydown areas and infrastructure would not be required. The information provided in Section 2.1.1.1, *Launch Site Construction Activities*, that is not specific to the Landing Zone or its infrastructure is otherwise applicable to this alternative.

2.2.1.2 Vertical Launch Facility

Construction activities associated with the Vertical Launch Facility and the structures located within the facility are the same as those described in Section 2.1.1.2, *Vertical Launch Facility*, for the Proposed Action.

2.2.1.3 Launch Control Center Complex

Construction activities associated with the Launch Control Center Complex and the structures located within the facility are the same as those described in Section 2.1.1.3, *Launch Control Center Complex*, for the Proposed Action.

2.2.1.4 Alternate Control Center and Visitor Center

Construction activities associated with the Alternate Control Center and Visitor Center and the structures located within the facility are the same as those described in Section 2.1.1.4, *Alternate Control Center and Visitor Center*, for the Proposed Action.

2.2.1.5 Landing Zone

The Landing Zone would not be constructed under the Ocean-Landing Only Alternative. The landing pad and the associated structures would not be constructed, and no additional infrastructure would be constructed to support a Landing Zone Facility.

2.2.1.6 Infrastructure

New infrastructure or improvements to existing infrastructure would be required to support Spaceport Camden operations. Spaceport Camden would need water, electricity, and sewage treatment systems. The launch site road system would need to be expanded and upgraded. New security systems that include facility and improved launch site perimeter fencing, guard facilities, and gates would be required. Each facility would also need parking areas to accommodate launch site workers and visitors. New infrastructure and improvements would be limited to onsite improvements. There are no anticipated improvements or expansions required for the access road to the spaceport site (Harrietts Bluff Road/Union Carbide Road) or the utilities that bring electricity and communications to the industrial property.

Changes to the infrastructure requirements for the Ocean-Landing Only Alternative compared with those for the Proposed Action are related to the lack of a Landing Zone in the Ocean-Landing Only Alternative. Except as noted below, the infrastructure requirements for the Ocean-Landing Only Alternative are the same as those for the Proposed Action as described in Section 2.1.1.6, *Infrastructure*.

Expansion and improvement of the internal roadway system would be required for construction activities and to accommodate the new facilities and activities. Exhibit 2.1-9 shows the proposed roadway modifications for the Proposed Action. For the Ocean-Landing Only Alternative, the heavy road extending to the Landing Zone would not be required, but all other road improvements identified in Section 2.1.1.6, *Infrastructure*, would be required. The upgrade of the road to the existing dock to heavy road would be required under this alternative, but this road would only be used for the delivery of heavy equipment during construction. By not constructing a Landing Zone, this alternative reduces the length of heavier road to 11,250 linear feet.

The Ocean-Landing Only Alternative would not require the extension of electric power to a Landing Zone, reducing the length of power transmission lines by about a mile. Four miles of aboveground power lines would need to be installed onsite. Overall power requirements are not expected to change from that identified for the Proposed Action (Section 2.1.1.6, *Infrastructure*).

The Ocean-Landing Only Alternative would not require the extension of the water distribution system to a Landing Zone, reducing the length of water lines by about a mile. However, the total water needs for the launch site would not change between alternatives. Annual and peak water system usage would be the same as described in Section 2.1.1.6, *Infrastructure*.

There would be no septic system, security fencing and guard shack, or lighting systems associated with a Landing Zone. However, the total capacity of the launch site septic systems, compared to that needed for the Proposed Action (Section 2.1.1.6, *Infrastructure*), would not change since the number of people assumed to be onsite would be essentially the same as for the Proposed Action.

2.2.1.7 Structure Summary

The previous sections provided information about the features of each of the three facilities and the infrastructure for Spaceport Camden. Table 2.1-2 summarizes the permanent vertical structures located at each of the Spaceport Camden facilities, their sizes, and type of construction for the Proposed Action. All structures identified in that table would be constructed under the Ocean-Landing Only Alternative except for the two structures associated with the Landing Zone, a storage/operations building and the guard shack. Table 2.1-3 provides information for all facilities (total area, occupancy, and construction duration). The information provided in that table for the Vertical Launch Facility, Control Center Complex, and Alternate Control Center and Visitor Center would be applicable to the Ocean-Landing Only Alternative. The facility information provided for the Landing Zone is not applicable to this

alternative. The facility final construction footprint is provided in Table 2.1-4 along with the contribution from each of structures at the facility (buildings, roads, supporting foundations [pads], retention ponds). As noted in each of the previous sections, areas temporarily affected by construction (laydown areas) are all within the fenced perimeter of the facilities. With the exception of the information associated with the Landing Zone, this Table 2.1-4 facility information is applicable to the Ocean-Landing Only Alternative. With the elimination of the construction of the Landing Zone in the Ocean-Landing Only Alternative, the road to the Landing Zone proposed for the Proposed Action would not be required, resulting in the construction of 1 mile less of heavier road. The reduced road footprint for the Ocean-Landing Only Alternative is provided in Table 2.2-2. For the construction of these structures, all excavated material (an estimated 89,000 cubic yards) would be reused onsite, primarily as backfill.

Table 2.2-2. Ocean-Landing Only Alternative Facility Summary

Launch Site Roads ¹	Component Footprint (square feet)
Launch site perimeter road (west side of site)	150,000
Interior regular roads	312,000
Interior heavy use roads	315,000
Total road area	777,000

Note: ¹ The perimeter road would be one lane, and all others would be two lanes. Lanes on regular-use roads would be 12 feet wide and on heavy-use roads 14 feet wide. An additional 6 feet of grassy area would be provided on each side of the roads.

2.2.2 Operations – Operational Activities

This section highlights the differences between operational activities associated with the Proposed Action and Ocean-Landing Only Alternatives. Information that is expected to be the same for both alternatives has been presented in Section 2.1.2, *Representative Launch Vehicle and Operational Activities*.

Operations would consist of up to 12 launches and up to 12 associated launch vehicle first-stage ocean landings per year. Other operations, including up to 12 static fire engine tests and up to 12 wet dress rehearsals per year are also proposed for the launch site. One of the 12 launches could be a night launch. All vehicles would launch to the east, from between 83° (slightly north of due east) and 115° (approximately east southeast), over the Intracoastal Waterway, Cumberland Island National Seashore and/or Little Cumberland Island, and the Atlantic Ocean. The first stage of the launch vehicle could land on a barge in the Atlantic Ocean or drop into the Atlantic and not be recovered.

Permanent staffing at the launch site would be approximately the same under the Ocean-Landing Only Alternative as for the Proposed Action: 75 full-time employees, with 25 of the employees being Camden County employees and 50 of the employees being launch operator employees. Depending on the launch operator and type of launch, onsite activities supporting a launch would be expected to begin up to four weeks before launch day. During launch operations, it is anticipated that the number of staff would increase to approximately 50 to 100 Camden County employees and 150 to 200 launch operator employees beginning about two weeks before the launch. The additional Camden County employees are expected to be from the local work force; however, the launch operator employees would most likely be permanent launch operator employees temporarily assigned to the launch site. These additional employees would be needed to support the additional activities associated with payload processing, launch vehicle preparation, payload and launch vehicle integration, and launch site launch support activities during launch preparation.

2.2.2.1 Representative Launch Vehicle

The typical medium-large lift-class launch vehicle would be the same as that described for the Proposed Action in Section 2.1.2.1, *Representative Launch Vehicle*.

2.2.2.2 Propellant, Gas, Fuel, Oil, and Solvent Storage

Propellant, gas, fuel, oil, and solvent storage would be the same as described for the Proposed Action in Section 2.1.2.2, *Propellant, Gas, Fuel, Oil, and Solvent Storage*.

2.2.2.3 Representative Launch

The representative launch would be the same as that described for the Proposed Action in Section 2.1.2.3, *Representative Launch*.

2.2.2.4 Payload and Payload Processing

Payload and payload processing would be the same as that described for the Proposed Action in Section 2.1.2.4, *Payload and Payload Processing*.

2.2.2.5 Pre-Launch Activities

Pre-launch activities would be the same as that described for the Proposed Action in Section 2.1.2.5, *Pre-Launch Activities*.

2.2.2.6 Launch Day Activities

Launch day activities would be the same as that described for the Proposed Action in Section 2.1.2.6, *Launch Day Activities*.

2.2.2.7 First Stage Landing

First stages may drop in the Atlantic Ocean or land on a barge in the Atlantic Ocean. During a landing on a barge at sea, the first-stage engines would be used to control the descent of the vehicle. In the event of a landing on a barge, the first stage could be returned to the launch site, utilizing the existing dock on Floyd Creek shown in Exhibit 2.1-2. No launches would involve landing the first stage at the launch site.

Because there would be no landings of the launch vehicle first stage at the launch site, security and safety zones from the vehicle launch would not need to be maintained for the return of this portion of the launch vehicle. The extended duration for maintaining the security and safety zones identified in Section 2.1.2.7, *First-Stage Landing*, would not be required.

In the event of a barge landing, the first stage would be defueled on the barge (residual propellant would initially be transferred to storage tanks on the barge and then returned to propellant storage tanks at the Vertical Launch Facility), returned to the Vehicle Integration Building, cleaned, and prepared for transport back to launch service provider facilities.

2.2.2.8 Launch Failures

The discussion of launch failures would be the same as that provided for the Proposed Action in Section 2.1.2.8, *Launch Failures*.

2.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License to the Camden County Board of Commissioners. No activities related to constructing or operating a commercial spaceport would occur at the site. Camden County would not exercise its option to purchase the property, and the property would continue to be owned by the private landowner in accordance with its current industrial zoning. The property, currently under private ownership with no public access, is not being used. Under this No Action Alternative, it is assumed that the property would continue to be unused. Therefore, for this EIS, FAA will consider impacts associated with the assumption that no further development or change in the use of the property would occur.

2.4 Alternatives Considered but Not Carried Forward

Several possible locations within Camden County were preliminarily evaluated as candidates for the Spaceport Camden site. Because the Proposed Action is a Camden County initiative, only locations within Camden County were considered. In addition to evaluating other locations to site a spaceport, alternative locations on the proposed site for the location of the Vertical Launch Facility were considered before selecting the proposed location. This section describes the launch site selection criteria used to assess the viability of these alternate locations for both the spaceport site and the Vertical Launch Facility location within the launch site and discusses the ability of each site and location to meet the selection criteria.

2.4.1 Offsite Alternatives

In addition to the site selected for the Proposed Action, four potential locations within Camden County were considered for the location of Spaceport Camden. Each of these locations was assessed against siting criteria important for safety, environmental, logistical, and economic reasons. The siting is influenced by many factors, including FAA regulations contained in 14 CFR Parts 400–499 and their appendices, topography of the location, and the condition of the land under consideration. The following paragraphs discuss the siting criteria and the siting options considered.

2.4.1.1 Launch Site Selection Criteria

The siting criteria for the location of a spaceport in Camden County have evolved over the course of several years. Initially, Camden County officials received initial high-level launch site requirements for launch operations from launch services companies through the Georgia Economic Development Department, and Camden County representatives identified potential sites based upon their location in Camden County. The criteria included relatively low population density near the sites, proximity to ocean trajectories (for vertical launch), utility access, other available infrastructure (e.g., roads and runways for horizontal launch sites), and size of site. In response to interest shown by commercial space companies, additional high-level requirements were identified, including larger buffer areas where a vertical launch could be safely performed in accordance with 14 CFR Parts 420 and 415 requirements and site access requirements, such as dockage.

The siting criteria for the location of a spaceport in Camden County evolved to include eight primary criteria and two secondary criteria that could be applied to five potential sites identified by county officials. Failure of a site to meet any one of the primary criteria was sufficient to eliminate the site from further consideration as a spaceport site.

Primary Criteria

- The site must be located in Camden County, Georgia.
- The site must be zoned or have the potential to be either zoned or otherwise permitted for use as a launch complex.
- The site must be large enough, approximately 100 acres of usable upland with sufficient on-property or adjacent government-owned buffer lands/wetlands, to accommodate one vertical launch pad; the necessary facilities and infrastructure to support the launch of liquid-fueled, medium-large lift-class, orbital and suborbital vertical launch vehicles; the landing of the vehicles' first stage; a control center/payload integration facility; an alternate control center, visitor center, visitor viewing area for up to 1,000 visitors; and necessary parking for up to 250 cars.
- The site must have the clear potential to satisfy FAA regulations, 14 CFR Part 420.
- The site must be located in an area with either existing or reasonable potential access for required launch infrastructure, to include utilities and community services such as fire, medical, and law enforcement.
- The site must be accessible from an existing or feasibly constructed road of sufficient capacity to safely and efficiently accommodate the delivery of large items such as launch vehicle stages, fuel tanker trucks, and the delivery of equipment.
- The site must be located in an area that would result in infrequent or minimal chances of the Federal government's priority use of airspace necessitating the rescheduling of previously planned launches.
- The site's natural features (e.g., topography, soil type, presence of floodplains and/or wetlands) and risk exposure(s) (e.g., ability to satisfy FAA regulations, 14 CFR Part 420) must not unduly complicate the construction or operation of the launch complex.

Secondary Criteria

- The site provides the potential for alternative means of delivering large items needed for long-term launch site operations to include the potential for dock or rail access.
- The site acquisition and development costs must be affordable for the County, cost competitive in relation to other potential sites, and have an anticipated timeline pursuant to the commercial need envisioned by the project (i.e., reasonably developable within approximately 24 months after approval of a launch license application).

2.4.1.2 Evaluation of Sites in Camden County, Georgia

The four sites identified by the county, in addition to the proposed Spaceport Camden site, and evaluated in this EIS are the West Site/Undeveloped (Ceylon) site, the Durango/Gilman Mill site in St. Marys, a Little Cumberland Island site, and a Cumberland Island site. These sites are shown in Exhibit 2.4-1.

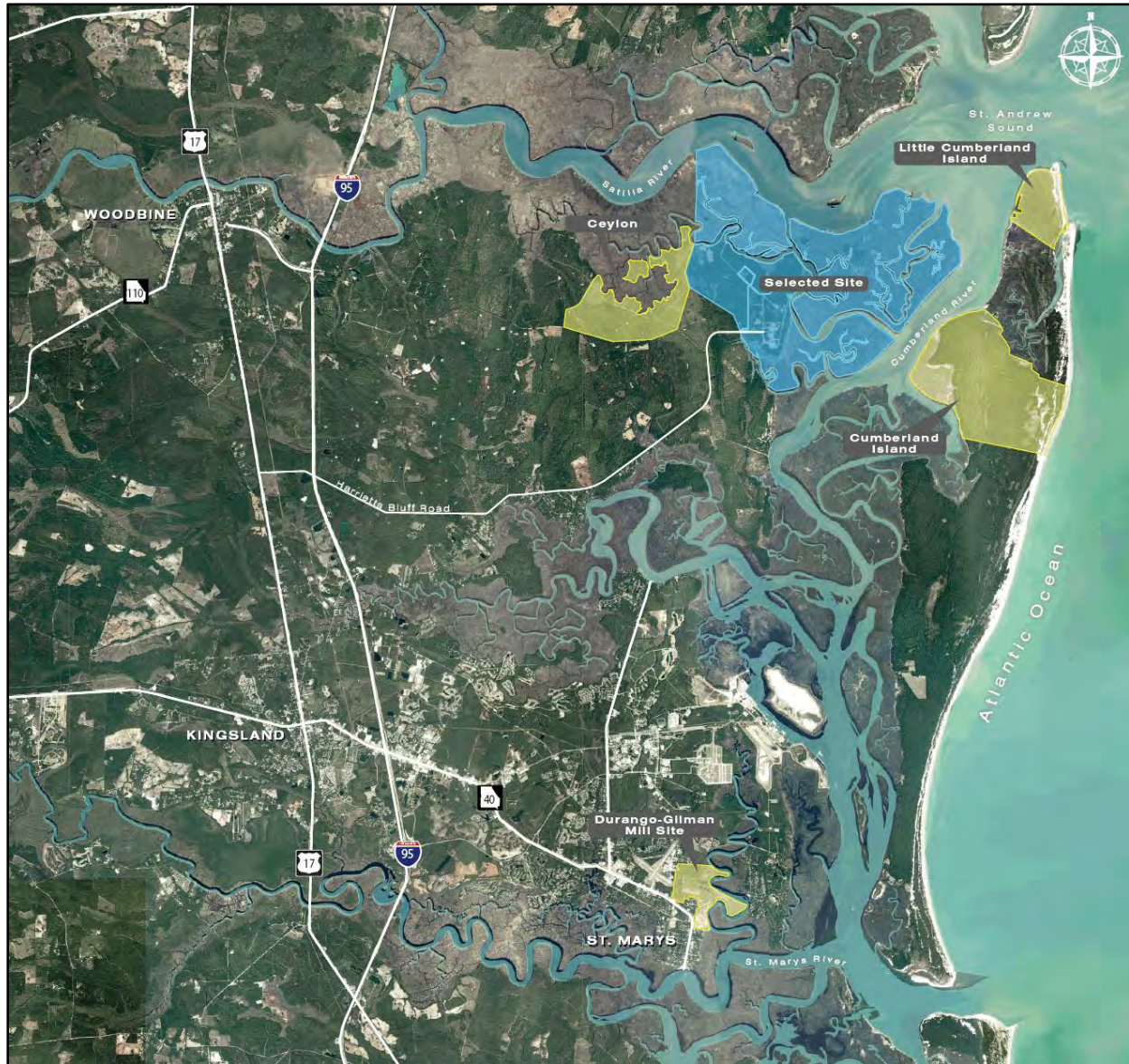


Exhibit 2.4-1. Spaceport Camden Alternate Sites

West Site/Undeveloped (Ceylon)

The subject property site is a large tract, approximately 4,305 acres in total, with approximately 3,157 acres of woodland and the remaining acreage marshland, of undeveloped land north of the general unincorporated area of Camden County called "Harriett Bluff," east of I-95, south of the Satilla River, on the west-edge of the Union Carbide site, and currently owned by SLF IV-GA Big Pasture, LLC. The subject property is primarily an undeveloped site and is zoned as a planned unit development (PUD) that is referred to by the developer as "Ceylon." The specific Camden County land reference number is 129-001. The site includes African Island, which is surrounded on three sides by Todd Creek and the north side by the Satilla River and marshland.

The site does have greater than 100 acres of usable upland for siting of the various facilities; however, the nature of the site does not allow the siting of the required facilities to adequately support the launch and landing of liquid-fueled medium-large lift-class, orbital vehicles, while also safely accommodating other required facilities. Assuming a launch pad location on African Island, the necessary 2-mile

separation distance to other manned facilities is not met. Therefore, this criterion has not been met by the West Site/Ceylon location.

Durango Gilman Mill Site in St. Marys

The property site is within the city limits of St. Marys, Georgia, adjacent to the Naval Submarine Base Kings Bay. The site consists of more than 700 acres and is an abandoned former Durango-Gilman paper mill site (the site was established by the Gilman Paper Company then later operated by the Durango Paper Company).

The Durango Gilman Mill Site in St. Marys does not have a reasonable or common sense chance of being zoned for an onsite launch site complex due to the location in and around the densely populated town center and the U.S. Naval Submarine Base Kings Bay. In accordance with the reasonableness standard of 40 CFR §1502.14, the Durango Gilman Mill Site in St. Marys does not meet this requirement.

Little Cumberland Island

Little Cumberland Island is located at the northern tip of Cumberland Island and is a 2,400-acre tract separated from Cumberland Island by Christmas and Brockington creeks. Though within the legislated boundary of Cumberland Island National Seashore, Little Cumberland Island is privately owned and not open to the public. Little Cumberland Island has 1,600 acres of uplands, with approximately 2.5 miles of sand beach. There are 100 2-acre lots where development is allowed, but according to county records, only 44 lots have been built on. Within the original legislation establishing Cumberland Island National Seashore (Public Law 92-536, 23 October 1972, as since amended), Little Cumberland Island is considered within the boundary of the park; however, the island will remain under private ownership and must be maintained “in a manner consistent with the purposes for which the seashore is established ... and the lands are used and occupied in accordance therewith.” Otherwise, it is subject to acquisition by the NPS.

The Little Cumberland Island site does not have a reasonable or common sense chance of being zoned for an onsite launch site complex due to the nature of its designation as a trust that is compliant with the formation of the congressionally mandated Cumberland Island National Seashore and the wilderness area that is within the national seashore’s boundary and would require an act of Congress and presidential signature to overturn. In accordance with the reasonableness standard of 40 CFR §1502.14, the Little Cumberland Island site does not meet this requirement.

Cumberland Island

Cumberland Island is approximately 17.5 miles long with an area of 36,415 acres. Cumberland Island National Seashore and the wilderness area within its boundaries are under the control and management of the NPS. The potential launch site location would be the less-populated area in the north of the island (see Exhibit 2.4-1). In the early 1960s, the site was a finalist considered by NASA for the Apollo program launch site.

There are privately owned houses on the southern, western, and northern portions of the island. In 1972, landholders started to transfer most of their Cumberland Island holdings to the Federal government to be designated as a national seashore. Some former land owners transferred their property to the NPS, but retained rights of use and occupancy during their lifetime. Eventually, most of the property will revert to the NPS and become part of the national seashore; however, some properties on the south end of the island remain in fee simple ownership, with no reversion agreements with the NPS.

The United States Congress designated the Cumberland Island Wilderness Area in 1982, and it now has a total of 9,886 acres of designated wilderness and 10,500 acres of potential wilderness. Designated

wilderness is the highest level of conservation protection for Federal lands. Only Congress may designate wilderness or change the status of wilderness areas. Wilderness areas are designated within existing Federal public land. Congress has directed four Federal land management agencies—U.S. Forest Service, Bureau of Land Management (BLM), the USFWS, and NPS—to manage wilderness areas so as to preserve and, where possible, to restore their wilderness character.

The Cumberland Island site does not have a reasonable or common sense chance of being zoned for an onsite launch site complex due to the nature of its designation as a congressionally mandated national seashore and wilderness area that would require an act of Congress and presidential signature to overturn. In accordance with the reasonableness standard of 40 CFR §1502.14, the Cumberland Island site does not meet this requirement.

Based upon the limitations identified, all of these sites were eliminated from further consideration as alternatives.

2.4.2 Alternate Onsite Locations for the Vertical Launch Facility

Three potential locations on the Spaceport Camden site were considered for the location of the Vertical Launch Facility. Each of these locations was assessed against siting criteria. Siting is influenced by many factors, including FAA regulations contained in 14 CFR Parts 400–499 and their appendices, topography of the location, and the condition of the land under consideration. The following paragraphs discuss the siting criteria and the siting options considered.

2.4.2.1 Onsite Alternatives Siting Criteria

The siting criteria for the location of the Vertical Launch Facility on the Union Carbide Corporation property included two primary criteria and one additional secondary criterion. Failure of a location to meet either of the primary criteria was sufficient to eliminate the location from further consideration as a Vertical Launch Facility location.

Primary Criteria

- The facility location must, at a minimum, meet the exclusion zone defined in 14 CFR §420.21 Table 2–2 for a medium-large orbital expendable launch vehicle.
- The facility location’s natural features (e.g., topography, soil type, presence of floodplains and/or wetlands) and risk exposure(s) (e.g., ability to satisfy FAA regulations, 14 CFR Part 420) must not unduly complicate the construction or operation of the launch complex.

Secondary Criteria

- The preferred launch complex will be as far north, away from the U.S. Naval Submarine Base Kings Bay, as possible, while meeting the other evaluation criteria.

2.4.2.2 Evaluation of Onsite Vertical Launch Facility Locations

Two potential locations were considered in addition to the proposed location (identified as Fairfield North) for the Vertical Launch Facility: Silo and Fairfield South. These alternative facility locations within the launch site are shown on Exhibit 2.4-2.

Silo

Silo is located along the road leading to the old Thiokol rocket engine test location on the north end of the property. Silo is the northernmost location considered for the Vertical Launch Facility at the launch site and is the farthest away from the Naval Submarine Base Kings Bay.

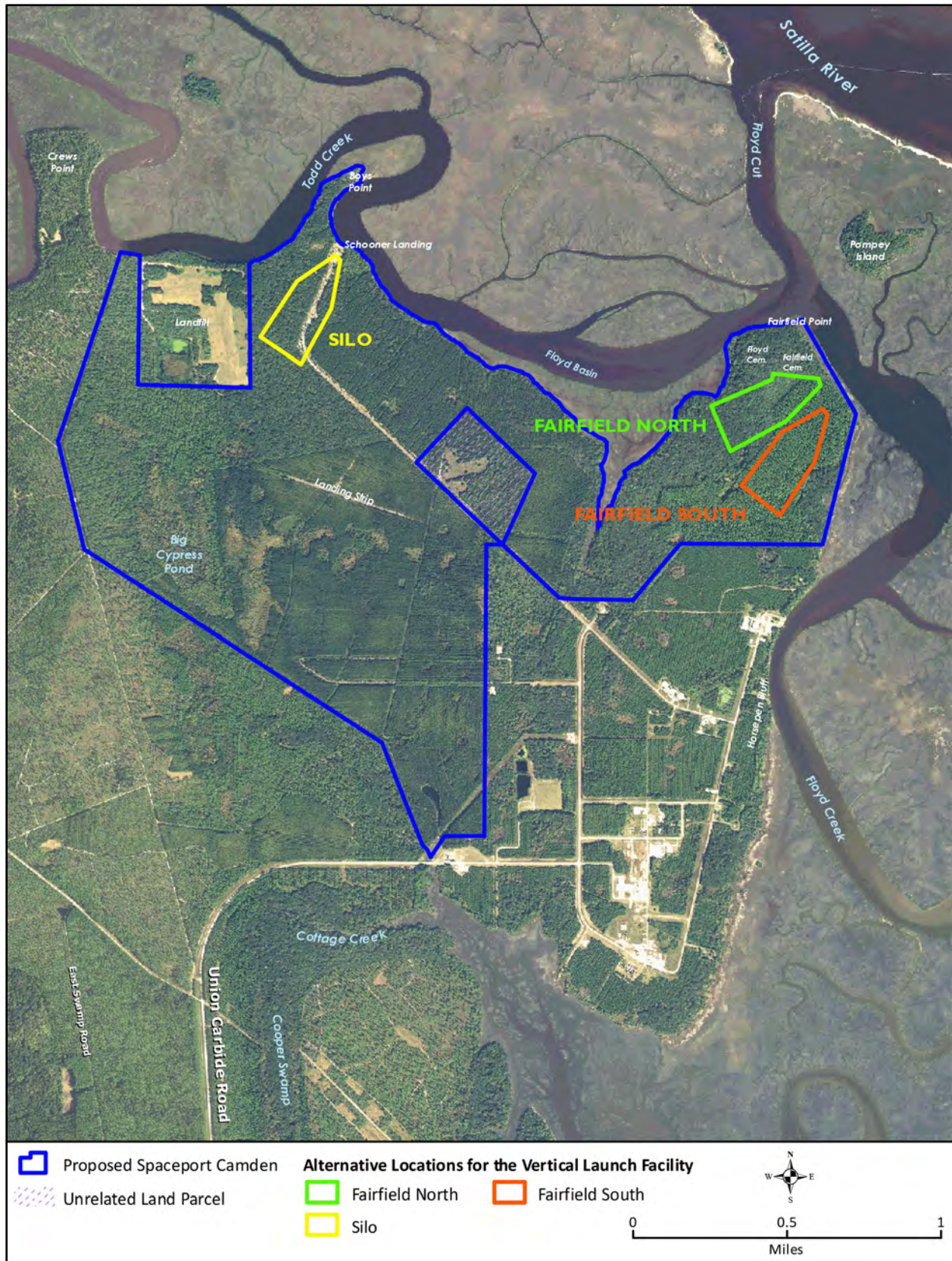


Exhibit 2.4-2. Alternative Locations for the Vertical Launch Facility Within the Spaceport Camden Site

The Silo site does not meet the exclusion zone requirements, as it is too close to the west property edge and the 2-mile radius significantly overlaps the location for the Launch Control Center Complex, which is a required operational area for a launch. (The Visitor Center is also just inside the 2-mile radius but is not a required facility for a launch.) Therefore, the Silo site does not meet the required criteria.

Fairfield South Site

Fairfield South is the southern location in the Fairfield Point area of the property near Floyd Creek and the existing deep water dock. The Fairfield North and Fairfield South locations are very similar and both would be approximately 2 miles from the main gate. The distance to the western edge of the property on the north side is more than 2.35 miles for both Fairfield locations. Fairfield North is further away from the Naval Submarine Base Kings Bay, by about 700 to 800 feet, than the Fairfield South location. Fairfield South also borders or is close to a large suspected prehistoric site. Fairfield South does have the advantage of being closer to the existing deep water dock than Fairfield North. The proximity of the suspected prehistoric site to the Fairfield South site would not unduly complicate the construction or operation of the launch complex. Therefore, the Fairfield South location does meet both primary criteria as an alternative location for the Vertical Launch Facility.

While initially identified as an alternative location for the Vertical Launch Facility, the Fairfield South location was subsequently determined to be essentially the same as the Fairfield North location. The relocation of the launch pad by a couple of hundred yards would not be expected to result in differences in the potential environmental impacts associated with the two locations. The Fairfield South location has been incorporated into the Fairfield North location as a part of the Proposed Action. Should subsequent investigation of the Fairfield North site uncover information that would indicate siting the facility there could result in impacts avoidable by moving the launch pad location, relocation of the Vertical Launch Facility to the Fairfield South location would be considered as part of the Proposed Action.

2.4.3 Alternatives Proposed During Scoping

As indicated in Chapter 1, *Introduction*, the scoping process provides an opportunity for the public to help define the scope of the EIS, including the alternatives to be considered. During the scoping period, several topics were identified by government agencies and the public that were evaluated for their potential to be considered alternatives to the Proposed Action. These topics can be broadly grouped into five categories:

- Limitations to flight activities, particularly limitations to flight trajectories
- Restrictions on closure and safety areas
- Modifications to the location of facilities within Spaceport Camden
- Alternative locations for the spaceport
- Alternative uses for the property identified as the location of the spaceport in the Proposed Action

Table 2.4-1 identifies these topics and provides an assessment as to which of these topics are considered as alternatives to the Proposed Action in this EIS.

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
Proposed By Agencies During Scoping		
Limit Activities in Right Whale Calving Areas During Calving Season	The National Marine Fisheries Service (NMFS) suggested that first stage landings and spaceport-related vessel traffic be prohibited during calving season and within the calving area for the northern right whale.	Seasonal prohibitions and avoidance measures could be considered as mitigations if the analysis indicates the potential for adverse impacts to the northern right whale or northern right whale habitat. Therefore, this suggestion will be considered as a potential mitigation measure rather than a separate alternative in this EIS.
Limit Flight Trajectories	The U.S. Navy suggested that proposed flight trajectory limitations be considered.	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for any launch would be specific to each particular launch operator's mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements.
Modified Site Configuration	The U.S. Fish and Wildlife Service (USFWS) suggested that facilities be located to avoid and accommodate species and habitat of special concern. Specific suggestions included: "During project planning facilities with the highest potential for leaks or releases should be sited away from the most environmentally sensitive areas on and near the project site, such as protected species habitats and tidal marsh environments. Forested uplands should serve as buffers between the facilities and the sensitive habitats. For example, the site has documented occurrences of the federally threatened eastern indigo snake. The snake is a commensal species of the gopher tortoise, a Federal candidate species. The site should be surveyed to identify gopher tortoise habitat so that it may be avoided in siting the facilities of the project. Currently the Launch Control Center and Payload Processing Building are adjacent to or sited on possible gopher tortoise habitat. As another example, the launch facility is currently proposed close to the brackish tidal marsh and an active	Alternative locations have been screened to some extent to avoid sensitive areas for onsite locations of the Vertical Launch Facility; additional buffer has been provided should the need arise to move locations. However, there are no plans to conduct species surveys at this time because construction activities may occur several years from the publication of this EIS. As a result, considerations as part of consultation would include pre-construction site-specific surveys to identify sensitive species prior to land disturbance and address accordingly (e.g., move facility footprints or move gopher tortoises). The need to move other facilities may be determined by the impacts analysis of the Proposed Action, and the ability to move facilities may be impacted by siting criteria or adverse impact potentials. For instance, moving the Vertical Launch Facility further to the southwest by 1.25 miles would result in movement of the noise profiles further southwest, which would then result in further potential for noise impacts to Little Cumberland Island and a larger closure area closer to shore. However, any substantive changes to the Proposed Action in the future outside the scope of analysis within this EIS and associated consultations would require additional NEPA analysis and re-initiation of consultation.

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
	eagle nest on Pompey Island. We recommend moving it inland to the southeast at least 1.25 miles to create a much wide forested buffer to protect the marsh. This would also serve to lessen any potential impacts to the active eagle nest and the pelican nesting colony. Also connectivity between habitats utilized by species of concern should be considered. The indigo snake moves between upland gopher tortoise burrows in cold weather months and wetlands in warm months. Impediments to these type movements should be avoided. If avoidance is not possible, they should be minimized or as a last resort they should be mitigated for.”	
Launch Trajectory Limitations	The U.S. Marine Corps suggested that launch trajectory limitations should be developed to include the recovery pattern/path with specifics of first stage recovery plan and impact area provided.	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for any launch would be specific to each particular launch operator’s mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements.
Proposed by Individuals During Scoping		
Ocean Only Trajectories	Limit the range of trajectories to include only those trajectories that pass over the Atlantic Ocean and do not travel over land.	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for any launch would be specific to each particular launch operator’s mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements.
Reduce Hazard Area Size	It was suggested that the size of the hazard area should be limited, so that the radius of the hazard area is no more than 1.5 miles from the launch	Characteristics of the hazard area, including size, are dictated by FAA regulations located at 14 CFR Parts 415, 417, and 420.

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
	pad and so that neither the hazard area nor the closure area intersects with upland area on the property owned by MWV-Cabin Bluff, LLC.	
Modified Site Configuration	It was suggested that the site configuration be modified to ensure that neither the hazard area nor the closure area intersects with upland area on the property owned by MWV-Cabin Bluff, LLC.	Changes to the site configuration could be considered as a mitigation if the analysis indicates the potential for adverse impacts to the upland areas on the property owned by MWV-Cabin Bluff, LLC. This suggestion seems best suited as a potential mitigation measure rather than a separate alternative. Characteristics of the hazard area, including size, are dictated by FAA regulations located at 14 CFR Parts 415, 417, and 420.
Develop Climate Change Research Center	It was suggested that an alternative land use be to develop the National Center for Climate Change Studies and Research in Camden County to serve as an innovative, technological think-tank of companies developing products to improve our earth.	The suggested use for the property does not meet the purpose and need as defined for this EIS. The County has indicated it would not purchase the property should the spaceport not come to fruition. This could possibly be discussed in the Cumulative Impacts discussion with regard to No Action.
Other Uses of Property by County	It was asked what other land uses or alternative plans would be considered for these tracts owned now by Dow Chemical and Bayer CropScience should the County go forward with purchase and spaceport not come to fruition.	Alternative plans for the property do not meet the purpose and need as defined for this EIS. The County has indicated it would not purchase the property should the spaceport not come to fruition. This could possibly be discussed in the Cumulative Impacts discussion with regard to No Action.
Develop Technological Park	It was suggested that the natural resources and energy supply of this land could be better used to develop a technological park whose businesses would study, develop, research, and manufacture products applied to climate change, pollution clean-up and containment methods, renewable energy sources, innovative solutions and products, even related to space exploration, in a more sustainable, environmentally and financially sound manner.	The suggested use for the property does not meet the purpose and need as defined for this EIS. The County has indicated it would not purchase the property should the spaceport not come to fruition. This could possibly be discussed in the Cumulative Impacts discussion with regard to No Action.
Other Locations in the State of Georgia	It was suggested that if State funding was anticipated, other locations within the State of Georgia should be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1, <i>Launch Site Selection Criteria</i> . Those sites in other Georgia locations do not meet the criteria for the site to be located in Camden County, Georgia.
4,305-acre Parcel 129 001, SLF IV-GA Big Pasture LLC	It was suggested that the property located immediately west and adjacent to the site be considered.	The County identified this property as a possible alternative to the proposed site. The site is identified as the West Site/Undeveloped (Ceylon) in Section 2.4.1.2, <i>Evaluation of Sites in Camden County, Georgia</i> .

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
7,914-acre Parcel 156 001, Mead Timber Company & MWV-Cabin Bluff LLC	It was suggested that the property located immediately south of the site be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. The property does meet some criteria; however, the County may have difficulty acquiring this property. It is an active commercial property; the Lodge at Cabin Bluff is located here.
1,144-acre Parcel 143 001, Davis M Love III Family Ltd Partnership	It was suggested that the property located immediately southwest of the site be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. Because of the size and shape of the property, it does not have the clear potential to satisfy FAA regulations, 14 CFR Part 420.
400-acre Parcel 129 001a, MWV Cabin Bluff LLC	It was suggested that the property located immediately west of the site be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. This site is not large enough to provide sufficient usable uplands and adjacent property to act as a buffer.
2,110-acre Parcel 088 002, McCarthy Trustees	It was suggested that the property located along Interstate 95 (I-95) in northern Camden County be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. Because of the size and shape of the property, it does not have the clear potential to satisfy FAA regulations, 14 CFR Part 420.
4,854-acre Parcel 112 001, Seven States Timberlands LLC	It was suggested that the property located along I-95 in northern Camden County be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. Because of the size and shape of the property, it does not have the clear potential to satisfy FAA regulations, 14 CFR Part 420.
1,179- acre Parcel 025 003, Tarboro Land & Timber LP	It was suggested that the property in western Camden County be considered.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. Because of the size and shape of the property, it does not have the clear potential to satisfy FAA regulations, 14 CFR Part 420.
Use of Property by Developers	It was suggested that consideration be given to impacts from residential development should the spaceport not be approved and constructed.	Alternative plans for the property do not meet the purpose and need as defined for this EIS. The County has indicated it would not purchase the property should the spaceport not be approved.
Launch Over Other Inhabited Islands	It was suggested that if it were determined to be acceptable to launch over an inhabited, environmentally sensitive barrier island, that launch trajectories that cross over other inhabited, but less environmentally sensitive barrier islands or inland areas should be considered as well.	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for any launch would be specific to each particular launch operator's mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements.
Trajectory Windows	It was suggested that several trajectory windows should be considered to include Jekyll Island, Naval Submarine	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
	Base Kings Bay, Little Cumberland and Cumberland Island.	any launch would be specific to each particular launch operator's mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 400 requirements.
Inland Launch Sites	It was suggested that if there were "little to no risk to persons or property under the flight path of an ascending commercial rocket, the EIS must consider alternative launch site properties, further inland, which could serve to launch commercial rockets over inhabited areas but which don't include nearby unique environmental and cultural features, such as exist on coastal landscapes and barrier islands."	Alternative sites, including some further inland, suggested in other public comments have been assessed against siting criteria (see previous site assessment discussions).
Minimize Impact to Species	It was suggested that an alternative be considered that minimizes impact to northern right whale critical habitat as well as nesting birds and sea turtles. To include prohibition on launches during certain seasons, lighting controls, and other measures to minimize impacts on wildlife.	Prohibiting launches during certain seasons, controlling lighting, and other measures could be considered as mitigations if the analysis indicates the potential for adverse impacts to the northern right whale, its respective habitat, or to other species. This suggestion seems best suited as a potential mitigation measure rather than a separate alternative. Therefore, this recommendation would be treated as a mitigation technique, not as a new alternative for consideration.
Restrict Launch Trajectories	It was suggested that launch or landing trajectories and exclusion zones avoid certain populated areas, such as all points west of the launch site; points north such as Dover Bluff, Hazzards Neck, all land in Glynn County, including Jekyll Island and St. Simons Island, and all land in South Carolina and North Carolina; points South such as St. Marys, Naval Submarine Base Kings Bay, the southern half of Cumberland Island, and all land in Florida; and even certain points east, such as Little Cumberland Island.	The Proposed Action in this EIS considers a limited range of trajectories between 83 and 115 degrees from true north. The launch trajectories used for any launch would be specific to each particular launch operator's mission. FAA conducts a policy review, payload review, financial determination, and safety review as part of the launch license evaluation process for an individual launch operator. For FAA to complete a safety review, an individual launch operator is required to submit a flight safety analysis to FAA that details the specific vehicle trajectory, hazard areas and demonstrates compliance with the 14 CFR Part 415 and 417 requirements.
Canaveral National Seashore	It was suggested that Canaveral National Seashore is available and should be used rather than Cumberland Island.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. This alternative site does not meet the criteria for the site to be located in Camden County, Georgia.

Table 2.4-1. Topics Identified During Public Scoping Evaluated as Possible Alternatives

Alternative	Description	Disposition
Kennedy Space Center	It was suggested that Kennedy Space Center already has launch pads and should be used instead of Spaceport Camden.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. This alternative site does not meet the criteria for the site to be located in Camden County, Georgia.
Wallops Flight Facility	It was suggested that Wallops Flight Facility should be used instead of Spaceport Camden.	This alternative was reviewed against the siting criteria identified in Section 2.4.1.1. This alternative site does not meet the criteria for the site to be located in Camden County, Georgia.

3 AFFECTED ENVIRONMENT

This chapter provides background information on each of the resources potentially affected by the Proposed Action and Ocean-Landing Only Alternative as well as the No Action Alternative. It identifies each resource area; defines the resource-related region of influence (ROI) for the Proposed Action and Ocean-Landing Only Alternative, which is applicable to both alternatives unless noted otherwise; identifies the applicable regulatory requirements (Federal, State, and local) for each resource; and provides a description of the existing conditions for each resource.

3.1 Air Quality

3.1.1 Definition and Description

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. A region's air quality is influenced by many factors, including the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The Earth's atmosphere consists of four main layers: the troposphere, stratosphere, mesosphere, and ionosphere. For the purposes of this EIS, the discussion of air quality is defined as at or below 3,000 feet above ground level, which USEPA accepts as the nominal height of the atmosphere mixing layer in assessing contributions of emissions to ground-level ambient air quality under the Clean Air Act (CAA) (USEPA, 1992). Although launch vehicle emissions from operations at or above 3,000 feet above ground level would occur, these emissions would not result in appreciable ground-level concentrations.

3.1.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action:

Clean Air Act, National Ambient Air Quality Standards

The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and State air quality standards established under the CAA and its amendments (40 CFR Subchapter C, Parts 50–97). These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare. The NAAQS provide both short- and long-term standards for the following criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter equal to or less than 10 and 2.5 microns (PM₁₀ and PM_{2.5}, respectively), ozone, and lead. The State of Georgia has adopted the Federal NAAQS standards for all pollutants (Georgia Administrative Code 391-3).

Under the CAA, it is the responsibility of the individual states to achieve and maintain the NAAQS. To accomplish this, states use the USEPA-required State Implementation Plan (SIP). If an area is designated as "nonattainment" (designated areas), states must develop an SIP that details the path to attain and maintain the NAAQS. An SIP identifies goals, strategies, schedules, and enforcement actions designed to reduce the level of pollutants in the air and bring the state into compliance with the NAAQS (Table 3.1-1). Georgia has implemented SIPs for the 2008 Ozone, 2010 PM_{2.5}, 2008 Lead, 2008 Nitrogen Dioxide, and 2010 Sulfur Dioxide standards.

All areas of the United States are designated as having air quality better than (attainment) or worse than (nonattainment) the NAAQS (Table 3.1-1). Areas where there are insufficient air quality data for USEPA

to form a basis for attainment status are unclassifiable. Thus, such areas are treated as attainment areas until proven otherwise. “Maintenance areas” are those that were previously classified as nonattainment but where air pollution concentrations have been successfully reduced to levels below the standard. Maintenance areas are subject to special maintenance plans to ensure compliance with the NAAQS.

Table 3.1-1. Summary of National Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	Federal Primary NAAQS	Federal Secondary NAAQS
Carbon monoxide (CO)	8-hour	9 ppm	No standard
	1-hour	35 ppm	No standard
Lead (Pb)	Rolling 3-month average	0.15 µg/m ^{3(a)}	0.15 µg/m ³
Nitrogen dioxide (NO ₂)	Annual	53 ppb ^(b)	53 ppb
	1-hour	100 ppb	No standard ^(c)
Particulate matter ≤10 micrometers (PM ₁₀)	24-hour	150 µg/m ³	150 µg/m ³
Particulate matter <2.5 micrometers (PM _{2.5})	Annual	12 µg/m ³	15 µg/m ³
	24-hour	35 µg/m ³	35 µg/m ³
Ozone (O ₃)	8-hour	0.070 ppm ^(c)	0.070 ppm
Sulfur dioxide (SO ₂)	Annual	No standard	No standard
	24-hour ^(a)	No standard	No standard
	3-hour	No standard	0.50 ppm ^(c)
	1-hour	75 ppb ^(d)	No standard

Notes: µg/m³ = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; ppb = parts per billion; ppm = parts per million.

^a In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m³ as a calendar quarter average) also remain in effect.

^b The level of the annual NO₂ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

^c Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O₃ standards additionally remain in effect in some areas. Revocation of the previous (2008) O₃ standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

^d The previous SO₂ standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet one year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO₂ standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO₂ standards (Title 40 Code of Federal Regulations Part 50.4(3)). An SIP call is a U.S. Environmental Protection Agency (USEPA) action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the required NAAQS.

Source: (USEPA, 2017a)

Hazardous air pollutants (HAPs) are chemicals that are known or suspected of causing cancer or other serious health effects. Unlike the criteria pollutants, HAPs currently do not have national ambient standards. Some volatile organic compounds (VOCs) are classified as HAPs. VOCs are also ozone precursors and include any organic compound involved in atmospheric photochemical reactions, except those designated by a USEPA administrator as having negligible photochemical reactivity. HAPs are not

covered by the NAAQS but may present a threat of adverse human health or environmental effects under certain conditions.

HAPs emitted from mobile sources are called Mobile Source Air Toxics (MSATs) and include acetaldehyde, acrolein, benzene, 1,3-butadiene, diesel particulate matter, formaldehyde, naphthalene, and polycyclic organic matter. These compounds are emitted from highway vehicles and non-road equipment and are known or suspected to cause serious health and environmental effects. In 2001, USEPA issued its first MSAT Rule, which identified 21 compounds as being HAPs that required regulation. In February 2007, USEPA issued a second MSAT Rule, which generally supported the findings in the first rule and provided additional recommendations of compounds having the greatest impact on health. The rule also identified several engine emission certification standards that must be implemented.

As mentioned above, unlike the criteria pollutants, there are no NAAQS for HAPs. The primary control methodologies instituted by Federal regulation for MSATs involve technological improvements for reducing their content in fuel and altering engine operating characteristics to reduce the volume of pollutants generated during combustion. MSATs would be the primary HAPs emitted by mobile sources during construction and operations. The equipment used during construction would likely vary in age and have a range of pollution reduction effectiveness. Construction equipment, however, would be operated intermittently over a large area and would produce negligible ambient HAPs in a localized area. Operational equipment, including vehicles driven by commuters, is anticipated to be primarily newer equipment (post-2010 model year) that generate lower emissions and would also produce negligible ambient HAPs. There are no MSATs generated by the combustion of liquid oxygen, nitrogen, or helium. While some quantity of MSATs could be produced through combustion of RP-1 (based on comparison to studies of similar kerosene-based jet fuels), no studies are currently available that directly assess the emission of MSATs based on RP-1 combustion in association with rocket launches. Therefore, MSAT emissions are not considered further in this analysis.

General Conformity

The USEPA General Conformity Rule applies to Federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds called *de minimis* thresholds. A conformity applicability analysis is the first step of a conformity evaluation and assesses whether a Federal action must be supported by a conformity determination. This is typically done by quantifying applicable direct and indirect emissions that are projected to result due to implementation of the Federal action. If the results of the applicability analysis indicate that the total emissions would not exceed the *de minimis* emissions thresholds, then the conformity evaluation process is completed. If *de minimis* thresholds would be exceeded, the agency is required to complete a conformity determination in which the action must be shown to conform with the applicable SIP(s).

New Source Review (Preconstruction Permit)

New major stationary sources and major modifications at existing major stationary sources are required by the CAA to obtain an air pollution permit before commencing construction. This permitting process for major stationary sources is called New Source Review and is required whether the major source or major modification is planned for nonattainment areas or attainment and unclassifiable areas. In general, permits for sources in attainment areas and for other pollutants regulated under the major source program are referred to as Prevention of Significant Deterioration (PSD) permits, while permits for major sources emitting nonattainment pollutants and located in nonattainment areas are referred to

as nonattainment new source review permits. In addition, a proposed project may have to meet the requirements of nonattainment new source review for the pollutants for which the area is designated as nonattainment and PSD for the pollutants for which the area is designated as attainment. Additional PSD permitting thresholds apply to increases in stationary source greenhouse gas (GHG) emissions. PSD permitting can also apply to a new major stationary source (or any net emissions increase associated with a modification to an existing major stationary source) that is constructed within 6.2 miles of a Class I area and which would increase the 24-hour average concentration of any regulated pollutant in the Class I area by 1 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) or more. The Proposed Action does not include any major stationary sources, so the PSD requirements would not apply.

Title V (Operating Permit)

The Title V Operating Permit Program consolidates all CAA requirements applicable to the operation of a source, including requirements from the SIP, preconstruction permits, and the air toxics program. It applies to stationary sources of air pollution that exceed the major stationary source emission thresholds, as well as other non-major sources specified in a particular regulation. The program includes a requirement for payment of permit fees to finance the operating permit program whether implemented by USEPA or a State or local regulator. Installations subject to Title V permitting shall comply with the requirements of the Title V Operating Permit Program, which are detailed in 40 CFR Part 70 and all specific requirements contained in their individual permits. The proposed Spaceport Camden is not likely to be considered a major source of criteria or HAPs, and Title V permitting would not be required.

Greenhouse Gases

GHGs are gas emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. Scientific evidence indicates that increasing global temperature due to an increase in GHG emissions is associated with climate change. Further discussion of GHG emissions is provided in Section 3.3, *Climate*.

3.1.3 Existing Conditions

Spaceport Camden would be located in Camden County, Georgia. Camden County is located within the Jacksonville (Florida) – Brunswick (Georgia) Interstate Air Quality Control Region, which includes 25 counties in Florida and 14 in Georgia (defined in 40 CFR §81.91). The air quality analysis focuses on the local environs surrounding the proposed vertical launch area and control center, which are located in Camden County. According to USEPA, Camden County is in attainment for all criteria pollutants (USEPA, 2017b), and a conformity determination would not be required. The proposed project area is located entirely in Camden County; however, because it is the designated Federal regulatory region for air quality under the CAA, the Jacksonville-Brunswick Interstate Air Quality Control Region is the ROI used for the air quality analysis.

Existing conditions in, or materially impacting, Camden County that were or may be important to assessing the relative impact of the spaceport project on its surroundings include: regular tug traffic along the Intracoastal Waterway, operations at the U.S. Naval Submarine Base Kings Bay, the two paper mills (WestRock and Rayonier) on the border of Camden County in Fernandina Beach, and the recently ceased pesticide production operations of Bayer CropScience on the proposed spaceport site.

Although air is well mixed throughout the atmosphere, the atmosphere itself is not physically uniform but has significant variations in temperature and pressure with altitude, which define a number of atmospheric layers. These include the troposphere (surface to 6 miles), stratosphere (6 to 31 miles),

mesosphere (31 to 50 miles), and thermosphere (50 to 217 miles). The boundaries between these four layers are defined by abrupt changes in temperature. These boundaries are the tropopause, stratopause, and mesopause. In the troposphere and mesosphere, temperature generally falls with increasing altitude, while in the stratosphere and thermosphere, temperature rises with increasing altitude. Only emissions occurring below 3,000 feet AGL in the troposphere have the potential to affect human health and regional air quality. Therefore, these will be the only pollutant emissions evaluated in this EIS.

For impact analysis in Chapter 4, *Environmental Consequences*, emissions that would be generated from spaceport operations were compared with Camden County and the Air Quality Control Region emissions obtained from USEPA's 2014 National Emissions Inventory (NEI) (USEPA, 2017c). NEI data are the latest available; these are presented in Table 3.1-2. The county data include emissions amounts from point sources, area sources, and mobile sources. *Point sources* are stationary sources that can be identified by name and location. *Area sources* are point sources from which emissions are too low to track individually, such as a home or small office building, or a diffuse stationary source, such as wildfires or agricultural tilling. *Mobile sources* are any kind of vehicle or equipment with gasoline or diesel engine, an airplane, or a ship. Two types of mobile sources are considered: on-road and nonroad. On-road sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Nonroad sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (USEPA, 2017d).

Table 3.1-2. Camden County and Regional Air Emissions Inventory (2014)

Location	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOCs
	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
Camden County	19,430	3,684	6,242	1,211	120	24,722
Jacksonville-Brunswick Interstate Air Quality Control Region	1,019,481	141,537	204,620	73,842	54,124	1,002,704

Notes: CO = carbon monoxide; NO_x = nitrogen oxides; PM₁₀ and PM_{2.5} = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO₂ = sulfur dioxide; VOCs = volatile organic compounds; tpy = tons per year.

Source: (USEPA, 2017c)

3.2 Biological Resources

3.2.1 Definition and Description

Biological resources comprise the plant and animal species, habitats, and ecological relationships of the land, water, and Atlantic coastal areas within the construction and operational ROI. The operational ROI for biological resources extends out for a radius of approximately 8 miles around the Spaceport Camden site to account for potential noise and visual effects from launches. The construction ROI is much smaller and contained on the Spaceport Camden site. Plant associations are referred to generally as "vegetation," and animal species are referred to generally as "fish" or "wildlife." *Habitat* can be defined as the resources and conditions present in an area that support a plant or animal. Particular consideration is given to sensitive species and habitats. Sensitive species include those protected by Federal or State law (see Section 3.2.2, *Regulatory Setting*). Sensitive habitats consist of essential fish

habitat (EFH), wetlands, floodplains, and other sensitive areas as identified during previous site surveys and scoping meetings.

3.2.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

Endangered Species Act

The ESA (16 U.S.C. §1531–1543) applies to Federal actions in two separate respects. First, the ESA requires that Federal agencies, in consultation with the responsible wildlife agency (i.e., NMFS, USFWS, ensure that proposed actions are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of a critical habitat (16 U.S.C. §1536 [a][2]). Regulations implementing the ESA expand the consultation requirement to include those actions that “may affect” a listed species or critical habitat.

Second, if an agency’s proposed action is likely to adversely affect, or take, a listed species, then the agency must obtain an incidental take statement from the responsible regulatory agency (i.e., NMFS, USFWS). The ESA defines the term *take* to mean “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt any such conduct” (16 U.S.C. §1532[19]). The regulatory definitions of *harm* and *harass* are relevant to FAA’s determination as to whether the Proposed Action would result in adverse effects on listed species:

Harm is defined by regulation as “an act which actually kills or injures” fish or wildlife (50 CFR §222.102).

Harass is defined by regulation to mean an “intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering” (50 CFR §17.3).

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) established, with limited exceptions, a moratorium on the “taking” of marine mammals in waters or on lands under U.S. jurisdiction. The act further regulates “takes” of marine mammals in the high seas by vessels or persons under U.S. jurisdiction. The term *take*, as defined in Section 3 (16 U.S.C. §1362) of the MMPA, means “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” *Harassment* was further defined in the 1994 amendments to the MMPA, which provided for two levels of harassment: Level A (injury) and Level B (behavioral harassment):

Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) or

Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including but not limited to migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered (Level B harassment) (16 U.S.C. §1362 [18][B][i],[ii]).

Section 101(a)(5) of the MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (exclusive of commercial fishing) within a specified geographic region. These incidental takes

1 may be allowed if the NMFS determines the taking will have a negligible impact on the species or stock
2 and the taking will not have an unmitigable adverse impact on the availability of such species or stock
3 for taking for subsistence uses.

4 **Migratory Bird Treaty Act**

5 The Migratory Bird Treaty Act (MBTA) was enacted to ensure the protection of shared migratory bird
6 resources. The MBTA prohibits the intentional take, possession, import, export, transport, selling,
7 purchase, barter, or offering for sale, purchase, or barter, any migratory bird or its egg, part, or nest,
8 except as authorized under a valid permit. Current regulations authorize permits for the intentional
9 taking of migratory birds for activities such as scientific research, education, and depredation control.
10 However, these regulations do not expressly authorize the incidental taking of migratory birds resulting
11 from actions where the take was not the intent of the action. The MBTA protects a total of 1,026 bird
12 species. Assessment of a project's effects on migratory birds places an emphasis on "species of concern"
13 as defined by EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. This EO directs
14 Federal agencies to take action to further implement the MBTA. In accordance with this EO, FAA signed
15 a Memorandum of Agreement with the USFWS and other Federal agencies in December 2002 to address
16 aircraft-wildlife strikes. Through this Memorandum of Agreement, the agencies established procedures
17 to coordinate their missions to more effectively mitigate against existing and future environmental
18 conditions that contribute to wildlife strikes with aircraft.

19 **Bald and Golden Eagle Protection Act**

20 The Bald and Golden Eagle Protection Act (16 U.S.C. §668–668d) prohibits the taking or possession of
21 and commerce in bald and golden eagles. It also protects bald and golden eagles from the unauthorized
22 capture, purchase, or transportation of the birds, their nests, or their eggs.

23 **Magnuson-Stevens Fishery Conservation and Management Act**

24 The Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. §§1801 et seq.) was
25 enacted to conserve and restore the nation's fisheries and requires that NMFS and regional fishery
26 councils describe and identify EFH for all species that are federally managed. EFH is defined as those
27 waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Under
28 the act, Federal agencies must consult with NMFS regarding any activity or proposed activity that is
29 authorized, funded, or undertaken by the agency that may adversely affect EFH.

30 **Executive Order 13112, Invasive Species**

31 EO 13112, *Invasive Species*, states that no Federal agency shall authorize, fund, or carry out actions that
32 it believes are likely to cause or promote the introduction or spread of invasive nonnative species in the
33 U.S. or elsewhere.

34 **Council on Environmental Quality Guidance on Incorporating Biodiversity Considerations**

35 In accordance with 40 CFR §§1507.2(e), 1508.8(b), and 1508.27, the guidance on incorporating
36 biodiversity considerations into environmental impact analysis under NEPA directs Federal agencies to
37 consider the effects of Federal actions on biodiversity to the extent that is possible to both anticipate
38 and evaluate those effects. The guidance outlines the general principles and discusses the importance of
39 context—that is, examining the direct, indirect, and cumulative impacts of a specific project in the
40 regional or ecosystem context.

Memorandum of Understanding to Foster Ecosystem Approach

The memorandum of understanding emphasizes consideration of all relevant and identifiable ecological and economic consequences, both long term and short term; coordination among Federal agencies; partnership; communication with the public; efficient and cost-effective implementation; use of best available science; improved data and information management; and responsiveness to changing circumstances. The memorandum of understanding was signed by the CEQ, all U.S. departments, USEPA, and Office of Science and Technology Policy.

3.2.3 Existing Conditions

For the purposes of this EIS, the ROI for biological resources includes those areas that would be impacted by construction activities (construction ROI) and operational activities (operational ROI) as described under the Proposed Action and alternatives. Within this EIS, biological resources are divided into four major categories: terrestrial vegetation and habitats, terrestrial animals (to include feral horses on Cumberland Island), marine vegetation and habitats, and marine animals. Special status species and environmentally sensitive or critical habitat potentially present within the ROI are discussed in their respective categories. For the purposes of this EIS, special status species are defined as those species listed as threatened or endangered under the ESA, species proposed for listing, candidate species for listing under the ESA, state-listed species, and species afforded Federal protection under the MMPA, Bald and Golden Eagle Protection Act, and the MBTA. Environmentally sensitive habitat includes EFH. Critical habitat includes federally designated critical habitat under the ESA. Background information sources for the existing site includes, but is not limited to, the following:

- Results of previous onsite characterization studies
- Information on Federal and State protected species, as listed in the NOI, EIS scoping response letters from the general public, USFWS, NMFS, the NPS, and GDNr
- USFWS Information for Planning and Consultation (IPaC)
- NatureServe – Terrestrial Ecological Classifications, Alliances and Associations of Camden, Glynn, and McIntosh Counties, Georgia
- Wetland survey results

Descriptions of terrestrial and marine habitats and species associated with the ROI area are described in the following sections.

3.2.3.1 Terrestrial Vegetation and Habitats

Several types of terrestrial habitats occur within the construction ROI (Exhibit 3.2-1). There are no ESA-listed plant species in the construction ROI, although the federally endangered hairy rattle weed (*Baptismal arachnifera*) does occur north of the Satilla River. These habitats are grouped into ecological associations based on soil characteristics and the mix of plant and animal species present in the area. Construction activities and daily operations of Spaceport Camden described under the Proposed Action would primarily occur in upland ecological associations. Other associations within the operational ROI affected by the launch, landing, or static fire tests would include nearby waterways and Cumberland Island. Terrestrial vegetation of particular interest found within the construction and operational ROI is listed in Table 3.2-1. Descriptions for the community types found at the Spaceport Camden site were summarized from the *Alliances and Associations of Camden, Glynn, and McIntosh Counties, GA* (NatureServe, 2009).

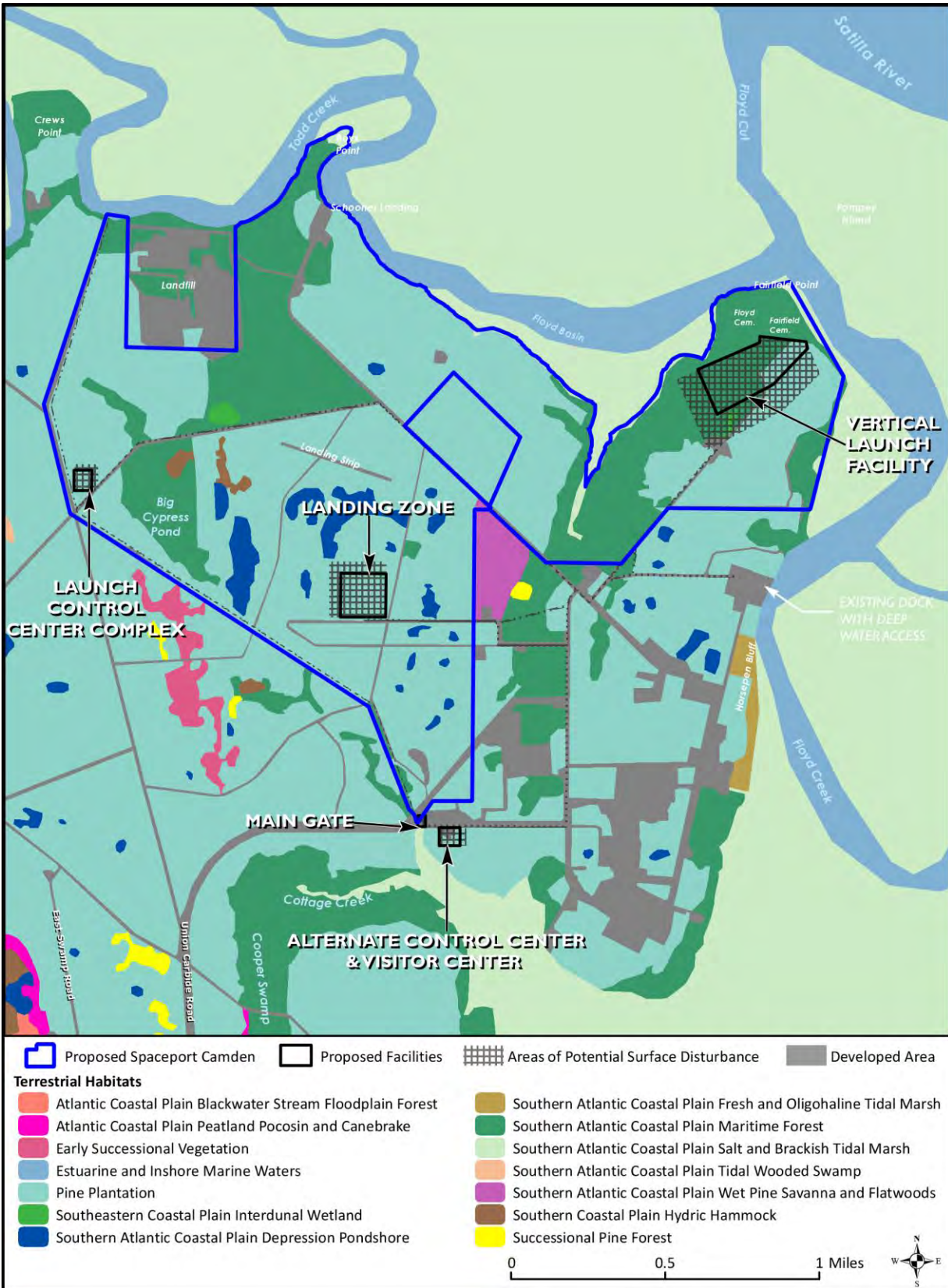


Exhibit 3.2-1. Terrestrial Habitats Present Within the Construction Region of Influence

Source: (NatureServe, 2009)

Table 3.2-1. Summary List of Terrestrial Vegetation

Scientific Name	Common Name	Status	
		State	Federal
Plants			
<i>Acacia farnesiana</i>	Sweet acacia	-	-
<i>Aeschynomene viscidula</i>	Sticky joint-vetch	-	-
<i>Agalinis filifolia</i>	Seminole purple foxglove	-	-
<i>Agalinis maritima</i> var. <i>grandiflora</i>	Saltmarsh purple foxglove	-	-
<i>Andropogon brachystachyus</i>	Shortspike bluestem	-	-
<i>Aristida beyrichiana</i>	Beyrich threeawn	-	-
<i>Asimina pygmea</i>	Dwarf pawpaw	-	-
<i>Asplenium heteroresiliens</i>	Morzenti's spleenwort	T	-
<i>Calopogon multiflorus</i>	Many-flowered grass-pink	-	-
<i>Carex chapmanii</i>	Chapman's sedge	-	-
<i>Carex dasycarpa</i>	Velvet sedge	R	-
<i>Carex decomposita</i>	Cypress-knee sedge	-	-
<i>Carex gholsonii</i>	Gholson's sedge	-	-
<i>Carex godfreyi</i>	Godfrey's sedge	-	-
<i>Carpinus caroliniana</i> ssp. <i>caroliniana</i>	American hornbeam	-	-
<i>Cephalanthus occidentalis</i>	Buttonbush	-	-
<i>Cladium mariscus</i> ssp. <i>jamaicense</i>	Jamaica swamp sawgrass	-	-
<i>Coreopsis integrifolia</i>	Ciliate-leaf tickseed	T	-
<i>Cornus foemina</i>	Stiff dogwood	-	-
<i>Ctenium floridanum</i>	Florida orange-grass	-	-
<i>Dalea carnea</i>	Pink-tassels	-	-
<i>Diospyros virginiana</i>	Common persimmon	-	-
<i>Eleocharis albida</i>	White spikerush	-	-
<i>Eleocharis montana</i>	Nodose spikerush	-	-
<i>Eleocharis montevidensis</i>	Spikerush	-	-
<i>Elyonurus tripsacoides</i>	Pan-american balsamscale	-	-
<i>Epidendrum magnoliae</i>	Greenfly orchid	U	-
<i>Forestiera godfreyi</i>	Godfrey's wild privet	E	-
<i>Forestiera segregata</i>	Florida wild privet	R	-
<i>Fuirena scirpoidea</i>	Southern umbrella-sedge	-	-
<i>Gaylussacia dumosa</i> var. <i>dumosa</i>	Dwarf huckleberry	-	-
<i>Gaylussacia tomentosa</i>	Blue huckleberry	-	-
<i>Helianthus agrestis</i>	Southeastern sunflower	-	-
<i>Ilex amelanchier</i>	Serviceberry holly	-	-
<i>Ilex glabra</i>	Gallberry	-	-
<i>Iris tridentata</i>	Savanna iris	-	-
<i>Itea virginica</i>	Virginia sweetspire	-	-
<i>Juniperus virginiana</i> var. <i>silicicola</i>	Southern red cedar	-	-
<i>Justicia angusta</i>	Narrowleaf water-willow	-	-
<i>Leitneria floridana</i>	Corkwood	T	-
<i>Liatris tenuifolia</i> var. <i>quadriflora</i>	Florida narrowleaf blazing star	-	-
<i>Litsea aestivalis</i>	Pond spice	R	-
<i>Lycium carolinianum</i>	Carolina wolfberry	-	-
<i>Lyonia ferruginea</i>	Rusty staggerbush	-	-

Table 3.2-1. Summary List of Terrestrial Vegetation

Scientific Name	Common Name	Status	
		State	Federal
<i>Lyonia fruticosa</i>	Coastal plain staggerbush	-	-
<i>Lyonia lucida</i>	Fetterbush	-	-
<i>Magnolia virginiana</i>	Sweetbay magnolia	-	-
<i>Mikania cordifolia</i>	Heartleaf climbing hempweed	-	-
<i>Morella cerifera</i>	Wax myrtle	-	-
<i>Muscadinia rotundifolia</i> var. <i>munsoniana</i>	Munson grape	-	-
<i>Neptunia pubescens</i> var. <i>pubescens</i>	Tropical neptunia	-	-
<i>Nyssa biflora</i>	Swamp tupelo	-	-
<i>Orbexilum virgatum</i>	Slender leather-root	-	-
<i>Osmanthus americanus</i> var. <i>americanus</i>	Devilwood	-	-
<i>Palafoxia integrifolia</i>	Palafoxia	-	-
<i>Persea borbonia</i>	Red bay	-	-
<i>Persea palustris</i>	Swamp bay	-	-
<i>Persicaria arifolia</i>	Halberd-leaf tear-thumb	-	-
<i>Phlebodium aureum</i>	Goldfoot fern	-	-
<i>Physostegia leptophylla</i>	Narrowleaf obedient plant	-	-
<i>Pinus elliotii</i>	Slash pine	-	-
<i>Pinus palustris</i>	Longleaf pine	-	-
<i>Pinus taeda</i>	Loblolly pine	-	-
<i>Plantago sparsiflora</i>	Pineland plantain	-	-
<i>Platanthera chapmanii</i>	Chapman's fringed orchid	-	-
<i>Polygonum glaucum</i>	Sea-beach knotweed	-	-
<i>Pteroglossaspis ecrinata</i>	Wild coco	T	-
<i>Pycnanthemum floridanum</i>	Florida mountain-mint	-	-
<i>Quercus austrina</i>	Bluff white oak	-	-
<i>Quercus chapmanii</i>	Chapman oak	-	-
<i>Quercus geminate</i>	Sand live oak	-	-
<i>Quercus laurifolia</i>	Laurel oak	-	-
<i>Quercus minima</i>	Dwarf live oak	-	-
<i>Quercus similis</i>	Swamp post oak	-	-
<i>Quercus virginiana</i>	Southern live oak	-	-
<i>Rhexia nuttallii</i>	Nuttall meadowbeauty	-	-
<i>Rhynchospora harperi</i>	Harper's beaksedge	-	-
<i>Sabal palmetto</i>	Cabbage palmetto	-	-
<i>Sageretia minutiflora</i>	Climbing buckthorn	T	-
<i>Sapindus marginatus</i>	Soapberry	R	-
<i>Sarracenia minor</i> var. <i>minor</i>	Hooded pitcherplant	U	-
<i>Scirpus lineatus</i>	Drooping bulrush	-	-
<i>Serenoa repens</i>	Saw palmetto	-	-
<i>Spiranthes eatonii</i>	Eaton's ladies-tresses	-	-
<i>Sporobolus curtissii</i>	Curtis' dropseed	-	-
<i>Thalia dealbata</i>	Powdery alligator-flag	-	-
<i>Thalia geniculata</i>	Bent alligator-flag	-	-
<i>Tillandsia bartramii</i>	Bartram's airplant	-	-
<i>Tillandsia fasciculata</i>	Quill-leaf airplant	-	-

Table 3.2-1. Summary List of Terrestrial Vegetation

Scientific Name	Common Name	Status	
		State	Federal
<i>Tillandsia recurvata</i>	Ball-moss	-	-
<i>Tridens carolinianus</i>	Carolina redtop	-	-
<i>Triphora trianthophora</i>	Three-birds orchid	-	-
<i>Ulmus americana</i>	American elm	-	-
<i>Vaccinium myrsinites</i>	Shiny blueberry	-	-
<i>Vicia minutiflora</i>	Pygmy-flower vetch	-	-
<i>Vigna luteola</i>	Wild yellow cowpea	-	-
<i>Vitis palmata</i>	Riverbank grape	-	-
<i>Vittaria lineata</i>	Shoestring fern (sporophyte)	-	-
<i>Zamia floridana</i> var. <i>umbrosa</i>	Florida coontie	-	-

Notes: E = endangered; R = rare; T = threatened; U = unusual.

Southeastern Coastal Plain Interdunal Wetland

This fresh marsh community occurs in open flatwoods and stream head environments and in narrow to broad interdune depressions. These areas contain standing water most years, but water levels are reduced during severe droughts. Interdunal wetlands are dominated by Jamaica swamp sawgrass (*Cladium mariscus* ssp. *jamaicense*) and often have substantial shrub cover, which is maintained by fire.

Southern Atlantic Coastal Plain Maritime Forest

The maritime forest is a xeric maritime hammock found on deep, sandy soils with an overstory dominated by sand live oak (*Quercus geminate*). Shrubs typically include saw palmetto (*Serenoa repens*), redbay (*Persea borbonia*), rusty staggerbush (*Lyonia ferruginea*), devilwood (*Osmanthus americanus* var. *americanus*), coastal plain staggerbush (*Lyonia fruticosa*), and wax myrtle (*Morella cerifera*).

Southern Atlantic Coastal Plain Wet Pine Savanna and Flatwoods

This community has a sparse overstory of longleaf pine (*Pinus palustris*) and occurs on sandy, mesic to moderately dry soils with low pH. Curtis' dropseed (*Sporobolus curtissii*) and Beyrich threeawn (*Aristida beyrichiana*) are common, and the shrub layer is often dense with saw palmetto, shiny blueberry (*Vaccinium myrsinites*), dwarf huckleberry (*Gaylussacia dumosa* var. *dumosa*), blue huckleberry (*Gaylussacia tomentosa*), dwarf live oak (*Quercus minima*), gallberry (*Ilex glabra*), and fetterbush (*Lyonia lucida*).

Southern Atlantic Coastal Plain Depression Pondshore

Found in peaty or acidic, mucky, semipermanently wet depression, this community is dominated by swamp tupelo (*Nyssa biflora*). Scattered shrubs may include species such as Virginia sweetspire (*Itea virginica*) and buttonbush (*Cephalanthus occidentalis*).

Southern Coastal Plain Hydric Hammock

These hammocks usually form in areas where deep groundwater seeps from limestone outcrops. The canopy typically includes cabbage palmetto (*Sabal palmetto*), laurel oak (*Quercus laurifolia*), southern live oak (*Quercus virginiana*), sweetbay magnolia (*Magnolia virginiana*), and American elm (*Ulmus americana*). Understory species may include species such as stiff dogwood (*Cornus foemina*), American hornbeam (*Carpinus caroliniana* ssp. *caroliniana*), common persimmon (*Diospyros virginiana*), sweetbay magnolia (*Magnolia virginiana*), swamp bay (*Persea palustris*), and swamp tupelo (*Nyssa biflora*).

Southern Atlantic Coastal Plain Salt and Brackish Tidal Marsh

This brackish woodland community is infrequently flooded and is found along tidal creeks about 25 to 35 kilometers from the ocean (by river distance). The canopy may range from 10 to 80 percent closure and be 4 to 10 meters tall with a shrub layer that is open to dense. It is dominated by southern red cedar (*Juniperus virginiana* var. *silicicola*) in the canopy and wax myrtle in the shrub layer.

Pine Plantation

Pine plantations at Spaceport Camden are primarily loblolly pine (*Pinus taeda*), but there are also some slash pine (*Pinus elliottii*) plantations (CH2MHill, 2015). These mono-specific stands have been converted from the native vegetative types, which would have included oak hammock, mixed hardwood forest, and native pine flatwoods, characterized by an open canopy of longleaf pine and slash pine and diverse grasses and forbs. Understory diversity is very low due to the dense row planting. Emergent and scrub shrub wetlands are scattered within the pine plantation.

Barrier Island

Cumberland Island falls under the barrier island ecological association, and its entire terrestrial area is classified as coastal upland community. This community is associated with sand beaches, beach dunes, coastal grassland, coastal interdunal swales, and scrub communities. There are 22 different biological communities on Cumberland Island, including various upland forest communities.

Invasive Nonnative Plant Species

Invasive nonnative plant species have been documented at multiple locations within the Spaceport Camden site (CH2MHill, 2015). These species have the potential to outcompete and overtake native plant communities, degrade threatened and endangered species habitat, and alter natural processes such as the hydrology of wetlands. Chinese privet (*Ligustrum sinense*) and Chinese tallow (*Triadica sebifera*) have been identified on the site (CH2MHill, 2015).

3.2.3.2 Terrestrial Animals

A rich diversity of game and nongame animals is found within the ROI, including special status species, due to the variety of habitats that occur. The various ecological associations provide habitat for birds, reptiles, amphibians, fish, and mammals. Table 3.2-2 provides a list of terrestrial species that may be found within the ROI. The lists are representative of species that could occur but are not considered comprehensive. Only sea turtles, which nest within the ROI on Cumberland Island National Seashore, are included in the table below for terrestrial species.

Table 3.2-2. Representative List of Terrestrial Animals Within the Region of Influence

Scientific Name	Common Name	Status	
		State	Federal
Amphibians and Reptiles			
<i>Lithobates capito</i>	Gopher frog	R	-
<i>Notophthalmus perstriatus</i>	Striped newt	T	C
<i>Pseudobranchius striatus striatus</i>	Broad-striped dwarf siren	-	-
<i>Caretta caretta</i>	Loggerhead sea turtle	E	T
<i>Chelonia mydas</i>	Green sea turtle	T	T
<i>Clemmys guttata</i>	Spotted turtle	U	-
<i>Crotalus adamanteus</i>	Eastern diamond-backed rattlesnake	-	-
<i>Dermochelys coriacea</i>	Leatherback sea turtle	E	E

Table 3.2-2. Representative List of Terrestrial Animals Within the Region of Influence

Scientific Name	Common Name	Status	
		State	Federal
<i>Drymarchon couperi</i>	Eastern indigo snake	T	T
<i>Farancia erythrogramma erythrogramma</i>	Common rainbow snake	-	-
<i>Gopherus polyphemus</i>	Gopher tortoise	T	C
<i>Lepidochelys kempii</i>	Kemp's ridley sea turtle	E	E
<i>Malaclemys terrapin</i>	Diamondback terrapin	-	-
<i>Micrurus fulvius fulvius</i>	Eastern coral snake	-	-
<i>Nerodia floridana</i>	Florida green water snake	-	-
<i>Pituophis melanoleucus mugitus</i>	Florida pine snake	-	-
<i>Pseudemys nelsoni</i>	Florida redbelly turtle	-	-
<i>Regina alleni</i>	Striped crayfish snake	-	-
<i>Rhadinaea flavilata</i>	Pine woods snake	-	-
Birds			
<i>Ammodramus maritimus</i>	Seaside sparrow	-	BCC
<i>Ammodramus maritimus macgillivrayi</i>	Macgillivray's seaside sparrow	-	-
<i>Calidris canutus rufa</i>	Red knot	T	T
<i>Charadrius melodus</i>	Piping plover	T	T
<i>Charadrius wilsonia</i>	Wilson's plover	T	BCC
<i>Elanoides forficatus</i>	Swallow-tailed kite	R	BCC
<i>Haematopus palliatus</i>	American oystercatcher	R	BCC
<i>Haliaeetus leucocephalus</i>	Bald eagle	T	BCC
<i>Himantopus mexicanus</i>	Black-necked stilt	-	-
<i>Laterallus jamaicensis</i>	Black rail	-	BCC
<i>Mycteria americana</i>	Wood stork	E	T
<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	-	-
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	-	-
<i>Passerina ciris</i>	Painted bunting	-	BCC
<i>Pelecanus occidentalis</i>	Brown pelican	-	-
<i>Picoides borealis</i>	Red-cockaded woodpecker	E	E
<i>Plegadis falcinellus</i>	Glossy ibis	-	-
<i>Sternula antillarum</i>	Least tern	R	BCC
Mammals			
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	R	-
<i>Geomys pinetis</i>	Southeastern pocket gopher	T	
<i>Equus ferus</i>	Feral horse	-	-
<i>Lasiurus intermedius</i>	Northern yellow bat	-	-
<i>Neofiber alleni</i>	Round-tailed muskrat	T	
<i>Perimyotis subflavus</i>	Tri-colored bat	-	-
<i>Sciurus niger shermani</i>	Sherman's fox squirrel	-	-

Notes: BCC = birds of conservation concern; E = endangered; R = rare; T = threatened; U = unusual.

Source: (GDNR, 2014; USFWS IPaC, 2016)

1 **Terrestrial Special Status Animal Species**

- 2 As shown in Table 3.2-2, the following ESA-listed species, candidate species for listing under the ESA,
3 species protected by the Bald and Golden Eagle Protection Act, and state-listed species may be present
4 within the ROI (full descriptions of these species are provided in Appendix D, *Biological Resources*):

- 1 • Eastern indigo snake (*Drymarchon corais couperi*) – Federally threatened, the indigo snake is
2 primarily found in sandhills habitat, but during warmer months it may also be found in stream
3 bottoms, swamps, and flatwoods. The indigo snake has been found within the construction ROI
4 in the sandy portions that extend south from Todd Creek to the abandoned airstrip (Exhibit
5 3.2-2) and may be found throughout the site, both in wetlands and uplands, particularly in areas
6 with gopher tortoise burrows (CH2MHill, 2015). The indigo snake uses gopher tortoise burrows
7 during the cold weather months and forages in wetlands during warm weather months.
- 8 • Gopher tortoise (*Gopherus polyphemus*) – A Federal candidate species in the eastern portion of
9 its range (east of the Mobile and Tombigbee Rivers), the gopher tortoise is found primarily in
10 longleaf pine and oak sandhills but may also be found in pine flatwoods, dry hammock, scrub,
11 coastal grasslands, and in disturbed habitats, such as roadsides and powerline rights-of-way.
12 Gopher tortoises are found within the construction ROI in the open sandy areas between Todd
13 Creek and the airstrip, and on the peninsula near the Floyd Family Cemetery (Exhibit 3.2-2). The
14 pine plantation areas may have also historically supported a large gopher tortoise population
15 before the dense plantings shaded out suitable forage plants (CH2MHill, 2015).
- 16 • Red-cockaded woodpecker (*Picoides borealis*) – Federally listed as endangered, this small
17 woodpecker requires large expanses of mature, open pine forest, particularly longleaf, slash, or
18 loblolly pine. Currently there is no suitable nesting habitat within the construction ROI for red-
19 cockaded woodpeckers (RCWs), as most of the upland areas are in young plantation pine
20 (CH2MHill, 2015), and GDNR records²⁴ did not indicate any RCWs within 3 miles of the site
21 (Yellin, 2014).
- 22 • Striped newt (*Notophthalmus perstriatus*) – A Federal candidate species, striped newts prefer
23 pine flatwoods and sandhills as adults, while using isolated, ephemeral wetlands for breeding
24 and larval development. These wetlands are typically vegetated with emergent sedges, grasses,
25 and forbs. Striped newts have not been documented within the construction ROI, but they may
26 occur in the oak hammocks between the airstrip and landfill (Exhibit 3.2-2); this area contains
27 ephemeral depression ponds that historically were surrounded by native pine forest (CH2MHill,
28 2015). According to the USFWS, two newts were found on the adjacent property and similar
29 habitats are anticipated on the project site (USFWS, 2015); the USFWS has determined that
30 soils, topography, and wetlands on the project site are typical for striped newt habitat (USFWS,
31 2018).
- 32 • Wood storks (*Mycteria americana*) – Federally threatened birds that nest in large colonies,
33 primarily in cypress or mangrove swamps, where they often nest in the upper branches of large
34 trees. Wood stork colonies occur outside of the construction ROI, but within the operational ROI
35 approximately 5 miles north of the Spaceport Camden site at Black Hammock, 10 miles
36 northeast of the site at Jekyll Island, 15 miles to the south near St. Marys, and 4 miles
37 east/southeast of the site at Cumberland Island (Exhibit 3.2-2) (GDNR, 2016a). Historically, they
38 have been seen foraging at the borrow pit near the landfill, in the wet weather pond near the
39 southern boundary of the site, and along shallows and mudflats along Todd Creek (CH2MHill,
40 2015), but wood storks may vary the areas they use for foraging and roosting based on
41 environmental conditions.

²⁴ The GDNR provided a list of natural communities, plants, and animals of highest priority conservation status within a 3-mile radius of the project site from the Natural Heritage Database.

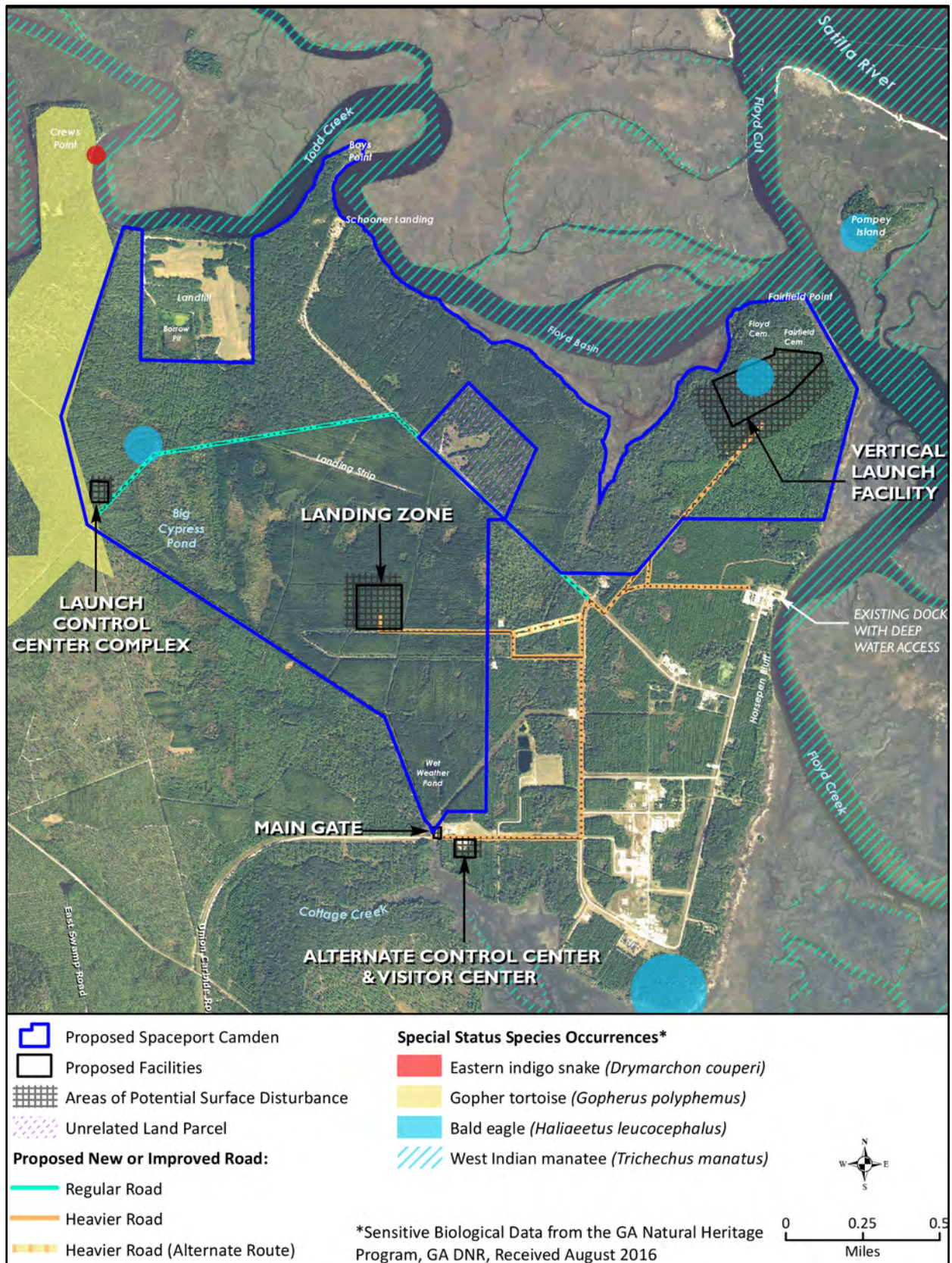


Exhibit 3.2-2. Known Occurrences of Terrestrial and Marine Special Status Animal Species

- 1 • Bald eagle (*Haliaeetus leucocephalus*) – Protected by the Bald and Golden Eagle Protection Act,
2 bald eagles typically nest in forested areas adjacent to large bodies of water, staying away from
3 heavily developed areas when possible. Eagle nests occur within or near the construction ROI
4 and operational ROI. Nest locations within the construction ROI, provided by GDNR, are
5 indicated in Exhibit 3.2-2 (GDNR, 2016a). Bald eagle nesting also occurs within the operational
6 ROI on Cumberland Island and Jekyll Island.
- 7 • Piping plover (*Charadrius melodus*) – Federally listed as threatened in the Atlantic coast region,
8 piping plovers have been known to occur throughout the year (July through late May) and utilize
9 a variety of habitats, including beaches, mudflats, sandflats, and spoil islands. Piping plovers may
10 be found within the operational ROI foraging along intertidal mudflats and beaches and the
11 shorelines of streams, ephemeral ponds, lagoons, and salt marshes. Piping plover critical habitat
12 includes portions of Cumberland Island and Jekyll Island (Exhibit 3.2-3).
- 13 • Red knot (*Calidris rufa*) – Federally listed as threatened, red knots are found within the
14 operational ROI primarily in intertidal, marine habitats, especially near coastal inlets, estuaries,
15 and bays. Red knots may occur on Cumberland Island and Jekyll Island (Exhibit 3.2-3).
- 16 • Wilson’s plover (*Charadrius wilsonia*) – State-listed as threatened, Wilson’s plovers are found
17 within the operational ROI primarily in coastal beach habitats, including dry sand beaches,
18 dunes, newly forming beaches, intertidal sand flats, mudflats, salt pans, and coastal lagoons.
19 Breeding habitat in Georgia is primarily on the outer barrier island beaches, with limited nesting
20 on dredge deposit sites. Wilson’s plover may occur on Cumberland Island and Jekyll Island.
- 21 • Southeastern pocket gopher (*Geomys pinetis*) – State-listed as threatened, pocket gophers
22 require loose, sandy, well-drained soil for burrow construction and an abundant supply of
23 grasses and forbs for food. Most of the known remaining populations in Georgia are found in
24 areas where natural longleaf forest and associated groundcover remains; no suitable habitat
25 exists within the construction ROI (CH2MHill, 2015).
- 26 • Round-tailed muskrat (*Neofiber alleni*) – State-listed as threatened, muskrats live in shallow
27 grassy ponds, marshes, and bogs. The easternmost Georgia occurrence record is of skulls found
28 in barn owl pellets near Woodbine in Camden County (GDNR, 2016b). No suitable habitat exists
29 within the construction ROI (CH2MHill, 2015).
- 30 • Sea turtles with terrestrial species status are further described in Section 3.2.3.4, *Marine*
31 *Animals*.

Migratory Birds

33 Migratory birds pass through the Spaceport Camden site, and breeding neotropical migrants may be
34 found primarily in riparian, hammock, and barrier island habitats. These areas can serve as temporary
35 habitat for neotropical birds migrating to and from the Caribbean and South and Central America.
36 Neotropical migrants are more common within the site during fall migration than spring migration.

37 The USFWS has identified certain migratory nongame bird species that are at risk of becoming
38 candidates for listing under the ESA without additional conservation actions. The most recent listing of
39 these “birds of conservation concern” for the ROI is from 2008 (Table 3.2-2).

40 Cumberland Island is recognized as a globally significant important bird area (NPS, 2017a). Cumberland
41 Island provides critical nesting habitat for multiple protected shorebird, wading bird, and sea bird
42 species such as least terns, herons, and egrets. Nesting season for shorebirds, wading birds, and sea
43 birds occurs primarily between March 1 and August 31.

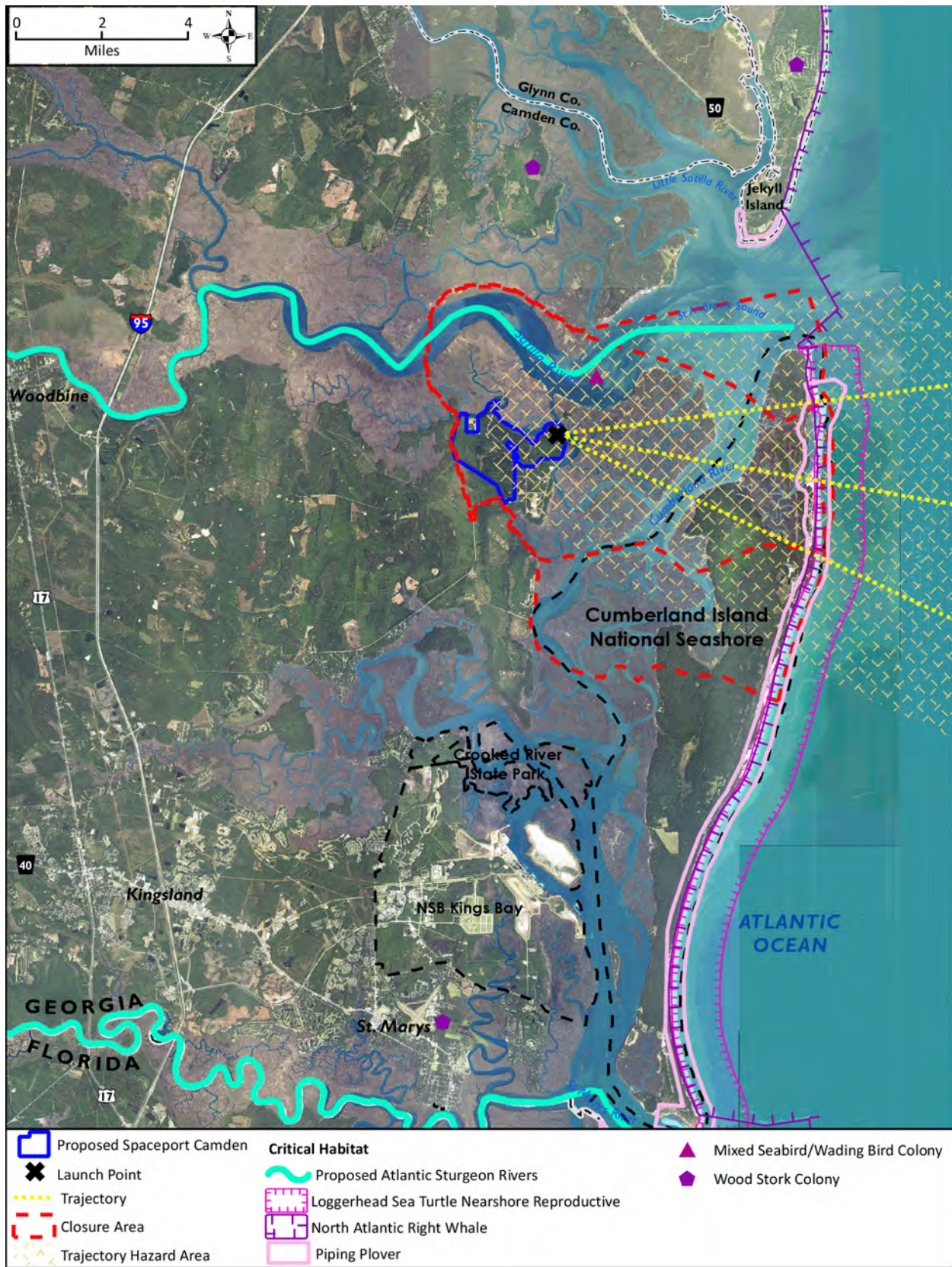


Exhibit 3.2-3. Terrestrial and Marine Species Critical Habitat

Source: (NMFS, 2016a; NMFS, 2016b; NMFS, 2014; USFWS, 2009)

Nonnative Animal Species

Coyotes, feral hogs, feral cats, and fire ants are nonnative animal species that are known to occur within the construction ROI (CH2MHill, 2015).

Cumberland Island is also home to feral horses, which are considered nonnative. The NPS has conducted population surveys since 2003 that have returned counts ranging from 120 to 148 horses a year (NPS, 2017d). The horse herd on Cumberland likely consumes between 200 to 400 tons of vegetation each year, removing up to 98 percent of it in areas they frequent (NPS, 2017d). This impact can cause damage to island resources by destabilizing dunes and streambanks, selectively removing native grasses and forbs, and threatening the biodiversity of native plants and wildlife (NPS, 2017d).

3.2.3.3 Marine Vegetation and Habitats

Vegetation found in marine and estuarine waters within the ROI include algae and various grasses. EFH, including aquatic habitats such as wetlands, hardbottom areas, seagrasses, and rivers, where fish spawn, breed, feed, or grow to maturity, are described below.

Seagrass

Submerged vegetation refers to plant species that occur entirely under water and may be categorized as seagrass (marine and high-salinity estuarine environments) or submerged aquatic vegetation (fresh/brackish environments). Submerged vegetation is a major component of productive coastal estuaries. Submerged vegetation provides sediment stabilization, primary production, detrital and nutrient production, habitat, nursery foraging grounds, and protection for many aquatic and marine species (Dawes, 1987; Wolfe, Reidenauer, & Means, 1988).

Intertidal Mudflats and Sandflats

Intertidal mudflats and sandflats have characteristically different benthic community assemblages based on differences in grain size, organic content (which provides a food source for deposit feeders), and physical disturbance/sediment reworking by currents or wind waves. Intertidal mudflats occur in areas with less physical disturbance from currents or waves, are composed of fine-grained silts and clays, and are rich in organic material. These conditions allow development of diverse, abundant, and stable infaunal and epifaunal communities that provide important foraging areas in the estuary (Dame et al., 2000; Alber, Flory, & Payne, 2005). Benthic algae colonize the mudflat surface and are also important to the estuarine food web, accounting for as much as one-half of the primary productivity within these systems (Velasquez, 2005; Alexander & Robinson, 2006; Businski, undated).

Essential Fish Habitat

EFH is defined as those waters and substrate necessary for fish spawning, feeding, or growth to maturity. As defined in Section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (i.e., MSA), “fish” includes finfish, mollusks, crustaceans, and all other forms of marine animal and plant life, other than marine mammals and birds. Various types of communities, including diverse physical and biological features, are considered EFH. EFH communities range from naturally occurring hardbottom areas and artificial reefs to floating mats of *Sargassum* algae.

Habitat utilized by a species can change with life history stage, abundance of the species and competition from other species, and environmental variability in time and space. The type of habitat available, its attributes, and its functions are important to species productivity and societal benefits. Some potential threats to habitat include certain fishing practices, marina construction, navigation projects, dredging, alteration of freshwater input into estuaries, and runoff. The South Atlantic Fishery

- 1 Management Council identified and described 36 EFH types and associated fisheries that occur within
- 2 the Atlantic Ocean from North Carolina to Florida. Table 3.2-3 lists EFH and managed species in these
- 3 areas. Exhibit 3.2-4 shows the EFH within the ROI.

Table 3.2-3. Essential Fish Habitat and Associated Fishery Management Plan Identified by the South Atlantic Fishery Management Council

Habitat Type	Associated Fishery Management Plan
Tidal freshwater (palustrine)	Shrimp; red drum
Estuarine and marine emergent wetlands (e.g., intertidal marshes)	Shrimp; red drum; snapper grouper
Tidal palustrine forested areas	Shrimp
Estuarine scrub/shrub (mangroves and mangrove fringe)	Shrimp; red drum; snapper grouper, spiny lobster
Estuarine and marine submerged aquatic vegetation (e.g., seagrass)	Shrimp
Subtidal and intertidal nonvegetated flats	Red drum; snapper grouper
Oyster reefs and shell banks	Red drum; snapper grouper; spiny lobster
Unconsolidated bottom	Shrimp
Offshore marine habitats used for spawning and growth to maturity	Rock shrimp (included in Shrimp Fishery Management Plan)
All interconnecting water bodies as described in the Habitat Plan	Shrimp, snapper grouper, coastal migratory pelagics, golden crab, spiny lobster, dolphin wahoo
Offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters	Royal red shrimp (included in Shrimp Fishery Management Plan)
Gulf Stream	Red drum; snapper grouper
Upper regions of the continental slope from 180 meters (590 feet) to about 730 meters (2,395 feet) over blue/black mud, muddy sand, or white calcareous mud	Snapper grouper; spiny lobster
Ocean high-salinity surf zones	Snapper grouper
Live/hard bottom	Coastal migratory pelagics
Medium- to high-profile outcroppings on and around the shelf break one from shore to at least 600 feet (or 2,000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex	Cobia included in Coastal Migratory Pelagics Fishery Management Plan
Spawning area in the water column above the adult habitat and the additional pelagic environment, including <i>Sargassum</i>	Golden crab
Sandy shoals of capes and offshore bars	Spiny lobster
All State-designated nursery habitats of particular importance, including primary nursery areas and secondary nursery areas	Coral
High-salinity bays, estuaries, and seagrass habitat	
U.S. continental shelf from Chesapeake Bay south through the Florida Straits and into the Gulf of Mexico	
Nearshore shelf/oceanic waters	
Shallow subtidal bottom	
Sponges	
Algal communities	
Rough, hard, exposed stable substrate in subtidal to outer shelf depths, subtropical temperatures (15° to 35°C), within a wide range of salinity and turbidity levels sufficiently low enough to provide algal symbionts and adequate sunlight penetration for photosynthesis	
Defined hard substrate in subtidal to outer shelf depths throughout the	

Table 3.2-3. Essential Fish Habitat and Associated Fishery Management Plan Identified by the South Atlantic Fishery Management Council

Habitat Type	Associated Fishery Management Plan
management area	
Muddy, silty bottoms in subtidal to outer shelf depths within a wide range of salinity and light penetration	
Charleston Gyre	
Florida Current	Dolphin wahoo
Pelagic <i>Sargassum</i>	Dolphins in the Coastal Migratory Pelagics Fishery Management Plan

Note: °C = degrees Celsius.

Source: (SAFMC, 2017a)

- 1 In addition to establishing EFH, the MSA also directs the identification of habitat areas of particular
2 concern (HAPCs). HAPCs are subsets of EFH that are rare, especially ecologically important, particularly
3 susceptible to human-induced degradation, or located in environmentally stressed areas (50 CFR
4 §600.815(a)(8). HAPCs typically include high-value intertidal and estuarine habitats, offshore areas of
5 high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and
6 shellfish. HAPCs that may occur in the ROI are described in Table 3.2-4 and shown in Exhibit 3.2-4. Other
7 HAPCs have been identified by the South Atlantic Fishery Management Council, but they do not occur
8 within the ROI.

Table 3.2-4. Habitat Areas of Particular Concern that Occur in the Region of Influence and Associated Fishery Management Plan

Habitat Areas of Particular Concern Description	Associated Fishery Management Plan
All coastal inlets, all State-designated habitats of particular importance to shrimp, State-identified overwintering areas	Shrimp
All areas within the Economic Exclusion Zone that contain <i>Sargassum</i> population	<i>Sargassum</i>
All coastal inlets, all State-designated nursery habitats of particular importance to red drum; documented sites of spawning aggregations in North Carolina, South Carolina, Georgia, and Florida described in the habitat plan; other spawning areas identified in the future; and habitats identified for submerged aquatic vegetation	Red drum
Medium- to high-profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hardbottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets, all State-designated nursery habitats of particular importance to snapper grouper; pelagic and benthic <i>Sargassum</i> ; Hoyt Hills for wreckfish; the <i>Oculina</i> bank HAPC; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and fishery management council-designated Artificial Reef Special Management Zones	Snapper grouper complex

Source: (SAFMC, 2017b)

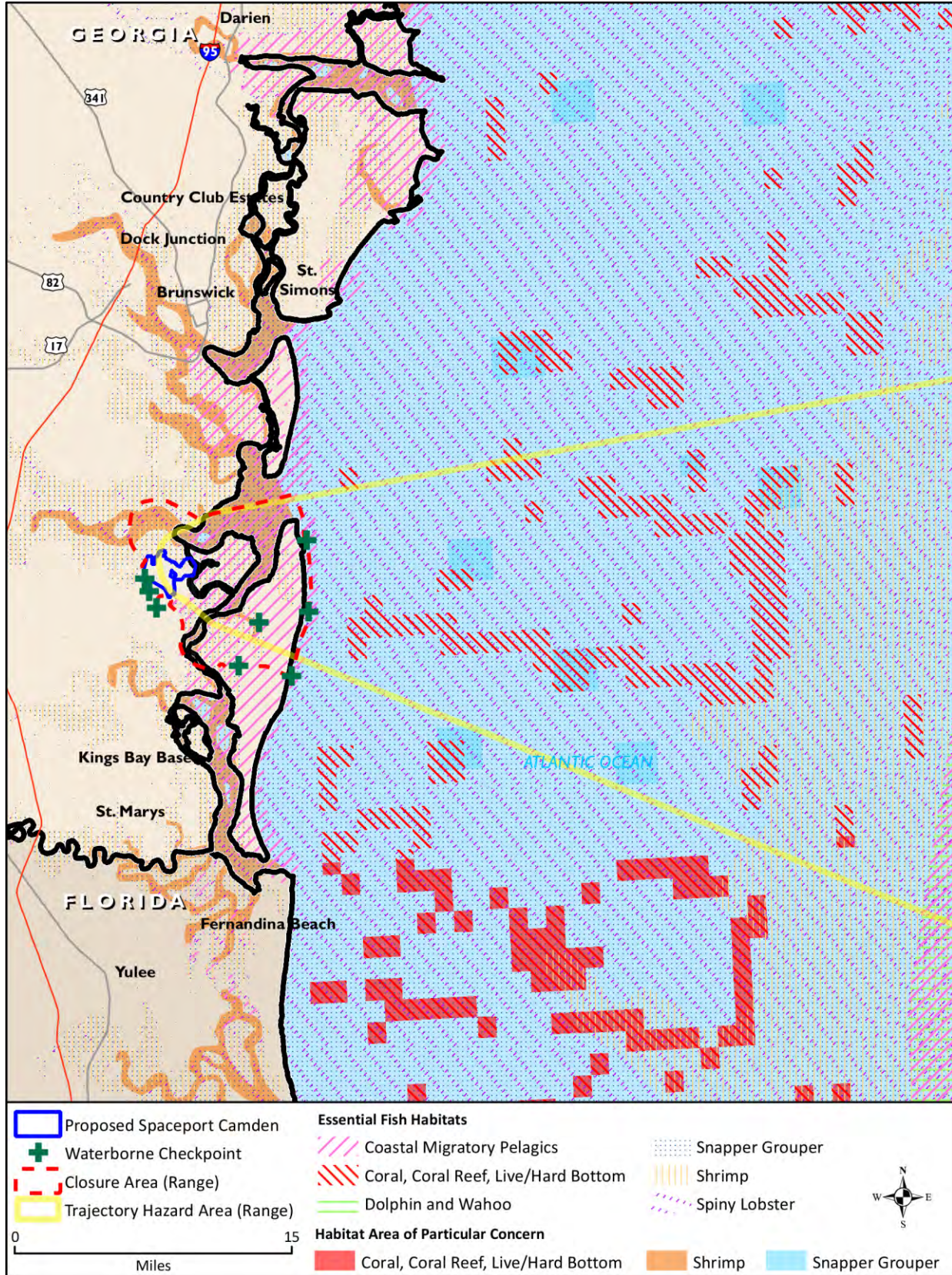


Exhibit 3.2-4. Essential Fish Habitat and Habitat Areas of Particular Concern in the Region of Influence

3.2.3.4 Marine Animals

Marine animals include species found in both marine and estuarine environments. Additional information on marine animals is included in Appendix D, *Biological Resources*.

Marine Mammals

Marine mammals are species that rely on ocean environments for all or a significant portion of their life cycles. Marine mammals that occur in the ROI include whales, dolphins, porpoises (under the National Oceanic and Atmospheric Administration [NOAA] jurisdiction) and manatees (under USFWS jurisdiction). All marine mammals are protected under the MMPA and two of these species (North Atlantic right whale and West Indian manatee) are also protected under the ESA. Twenty-eight marine mammal species are present in the Atlantic Ocean waters along the southeast United States. Of those species, only five marine mammals occur within the nearshore and coastal waters that are included in the ROI for the proposed Spaceport Camden. These species are discussed below. Refer to Appendix D, *Biological Resources*, for more detailed information.

- North Atlantic right whale (*Eubalaena glacialis*) – Federally endangered, North Atlantic right whale calving occurs in the coastal waters off Georgia and northern Florida from December through March after a gestation period of 12 to 13 months (Kraus & Hatch, 2001). Based on aerial surveys conducted by New England Aquarium personnel between December and March from 1997 through 2009, right whale sightings are common in the waters off shore of Camden County (New England Aquarium, 2016).
- Humpback whale (*Megaptera novaeangliae*) – The humpback whale, designated as depleted under the MMPA, may occur in the waters off Camden County from fall through spring. The probability of occurrence in the ROI is low, considering life history characteristics, historical records of sightings, and strandings of humpback whales (refer to Appendix D, *Biological Resources*, for additional information).
- Atlantic spotted dolphin (*Stenella frontalis*) – The Atlantic spotted dolphin, protected under the MMPA, belongs to the Western North Atlantic Stock. This species may occur within the ROI, considering the habitat preferences and historical records of sightings (refer to Appendix D, *Biological Resources*, for additional information).
- Bottlenose dolphin (*Tursiops truncatus*) – The bottlenose dolphin, protected under the MMPA, occurs in tropical and temperate waters of the Atlantic Ocean and can be found in inshore, nearshore, and offshore waters along the U.S. east coast. Based on habitat preferences and incidental sightings in the vicinity of Spaceport Camden (Department of the Navy, 2008), bottlenose dolphins are expected to occur regularly within the ROI.
- West Indian manatee (*Trichechus manatus*) – Federally threatened, West Indian manatees that occur off Spaceport Camden belong to the Florida Stock and are closely monitored and managed by the USFWS (Exhibit 3.2-2). The Florida manatee population is further broken down into four management units, and the ROI overlaps with the Atlantic Coast Management Unit.

Sea Turtles

There are five species of sea turtles which may occur within the operational ROI: the green sea turtle (*Chelonia mydas*), the hawksbill sea turtle (*Eretmochelys imbricata*), the Kemp's ridley sea turtle (*Lepidochelys kempii*), the loggerhead sea turtle (*Caretta caretta*), and the leatherback sea turtle (*Dermochelys coriacea*). The USFWS and NOAA Fisheries share Federal jurisdiction for sea turtles, with the USFWS having lead responsibility on nesting beaches and NOAA Fisheries in the marine

environment. All sea turtle species that occur in the area are listed under the ESA as either threatened or endangered. The occurrence of the olive ridley sea turtle (*Lepidochelys olivacea*) in the project area is extralimital (outside the species' normal range). Currently, there are no olive ridley nesting beaches in the eastern United States, and there are no known feeding, breeding, or migration areas within the vicinity of Spaceport Camden.

- Green sea turtle (*Chelonia mydas*) – Federally threatened, the green sea turtle female nesting abundance in Georgia was estimated to be five individuals between 2011 and 2012 (NOAA, 2015). Critical habitat was designated for the green sea turtle in 1998 (63 FR 46693) but does not occur within the ROI.
- Hawksbill sea turtle (*Eretmochelys imbricata*) – The likelihood that the federally endangered hawksbill sea turtle will occur within the ROI is low, considering that Camden County, Georgia, is located north of the typical nesting range for the hawksbill turtle, and the region lacks suitable juvenile and adult habitat. Critical habitat was designated for the hawksbill sea turtle in 1998 (63 FR 46693) but does not occur in or near the ROI.
- Kemp's ridley sea turtle (*Lepidochelys kempii*) – The federally endangered Kemp's ridley sea turtle distribution is limited to the Gulf of Mexico and the western North Atlantic Ocean from Florida to the Grand Banks (NMFS and USFWS, 2015; NOAA Fisheries, 2016). There is a low potential in the ROI for the Kemp's ridley sea turtle, since only occasional nesting occurs in Georgia.
- Loggerhead sea turtle (*Caretta caretta*) – The federally threatened loggerhead sea turtle is known to nest on Cumberland Island National Seashore, which is an important loggerhead sea turtle critical habitat area. Since 2014, Cumberland Island has produced over 1,800 nests. (NPS, 2017b). Given the presence of both nesting and foraging habitat, loggerhead sea turtles are expected to occur regularly in the ROI.
- Leatherback sea turtle (*Dermochelys coriacea*) – The federally endangered leatherback sea turtle occurrence in the ROI is expected to be seasonal, rare, and correlate with the availability of preferred species of prey. Leatherback turtles may also occur in the ROI while migrating between nesting habitat south and more productive foraging habitat in the North Atlantic. Very few nests have been confirmed in Georgia, although a consistent pattern of low annual nesting (less than 10 nests) has emerged since 2000 (GDNR, 2016a).

Marine Fish

To protect marine fish resources, NOAA Fisheries works with the regional fishery management councils to identify the essential habitat for every life stage of each federally managed species using the best available scientific information. EFH has been described for approximately 1,000 managed species to date. EFH includes all types of aquatic habitat including wetlands, seagrasses, rivers, and all locations where fish spawn, breed, feed, or grow to maturity (see the Essential Fish Habitat subsection). The most abundant fish species and their life stages occurring within the ROI and federally managed fisheries covered under the MSA are discussed in Appendix D, *Biological Resources*. Two federally listed fish species may occur within the ROI:

- Atlantic sturgeon (*Acipenser oxyrinchus*) – Critical habitat for the federally endangered Atlantic sturgeon has been proposed, including in the Satilla River (82 FR 39160, August 17, 2017), which is north of Spaceport Camden.
- Shortnose sturgeon (*Acipenser brevirostrum*) – The National Marine Fisheries Shortnose Sturgeon Recovery Plan indicates that collection efforts for sturgeon in the St. Marys and Satilla

Rivers in 1994 and 1995 were not successful (NMFS, 1998); therefore, probability of occurrence within the Spaceport Camden Action Area is low.

Marine Invertebrates

Many invertebrate species occur in the nearshore waters within the ROI. The variety of species spans many taxonomic groups (taxonomy is a method of classifying and naming organisms), generally referred to as a phylum. Major invertebrate phyla—those with greater than 1,000 species (World Register of Marine Species Editorial Board, 2015)—are described in Appendix D, *Biological Resources*. No invertebrate species listed under the ESA are expected in the project area. Some shrimp species potentially present in the area are managed as part of a commercial fishery (see Appendix D for more detailed information on marine invertebrates).

3.3 Climate

3.3.1 Definition and Description

Climate describes the weather characteristics and patterns in a region over time. It is measured by assessing the patterns of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count, and other meteorological variables in a given region over long periods of time. Climate differs from weather, in that weather only describes the short-term conditions of these variables in a given region. The climate of a location is affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents.

GHGs are gas emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in GHG emissions from human activities. The climate change associated with this global warming is predicted to produce negative economic and social consequences across the globe.

Research has shown there is a direct correlation between fuel combustion and GHG emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that “domestic aviation contributes 3 percent of total carbon dioxide emissions, according to USEPA data,” compared with other industrial sources, including the remainder of the transportation sector (20 percent) and power generations (41 percent). The International Civil Aviation Organization estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic GHG emissions globally. Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate.

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. FAA, with support from the U.S. Global Change Research Program and its participating Federal agencies (e.g., NASA, NOAA, USEPA, and the Department of Energy), has developed the Aviation Climate Change Research Initiative in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for Air Transportation Noise & Emissions Reduction (PARTNER) Center of Excellence research initiative to quantify the effect of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the International Civil Aviation Organization.

The six primary GHGs, defined in Section 202(a) of the CAA, are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Section 16(e) of EO 13693, released in

March 2015, also includes nitrogen trifluoride. Each GHG has an estimated global warming potential, which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the Earth's surface. The global warming potential rating system is standardized to carbon dioxide, which has a value of one. The CO₂e rate is calculated by multiplying the emissions of each GHG by its global warming potential and adding the results together to produce a single, combined emissions rate representing all GHGs.

3.3.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

U.S. Environmental Protection Agency's Mandatory Reporting of Greenhouse Gases Rule

USEPA issued the Final *Mandatory Reporting of Greenhouse Gases Rule* on September 22, 2009. GHGs covered under the Final *Mandatory Reporting of Greenhouse Gases Rule* are carbon dioxide, methane, nitrogen oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers. GHG emissions are also regulated under PSD and Title V permitting programs, which was initiated by a USEPA rulemaking issued on June 3, 2010, known as the GHG Tailoring Rule (75 FR 31514). GHG emissions thresholds for permitting of stationary sources are an increase of 75,000 tons per year of CO₂e at existing major sources and facility-wide emissions of 100,000 tons per year of CO₂e for a new source or a modification of an existing minor source. The 100,000 tons per year of CO₂e threshold defines a major GHG source for both construction (PSD) and operating (Title V) permitting, respectively. However on June 23, 2014, the U.S. Supreme Court issued its decision in *Utility Air Regulatory Group v. USEPA* (No. 12-1146). As a result of the decision, USEPA will no longer apply or enforce Federal regulatory provisions or USEPA-approved PSD SIP provisions that require a stationary source to obtain a PSD permit if GHGs are the only pollutant that the source emits or has the potential to emit above the major source thresholds, or for which there is a significant emissions increase and a significant net emissions increase from a modification (e.g., 40 CFR §52.21 (b)(49)(v)). Nor does USEPA intend to continue applying regulations that would require that states include in their SIP a requirement that such sources obtain PSD permits.

Similarly, USEPA will no longer apply or enforce Federal regulatory provisions or provisions of USEPA-approved Title V programs that require a stationary source to obtain a Title V permit solely because the source emits or has the potential to emit GHGs above the major source thresholds (e.g., the regulatory provision relating to GHG subject to regulation in 40 CFR §71.2). USEPA also does not intend to continue applying regulations that would require Title V programs submitted for approval by USEPA to require that such sources obtain Title V permits. Therefore, Spaceport Camden will not be required to obtain a Title V permit based solely upon potential to emit GHGs.

3.3.3 Existing Conditions

Camden County, Georgia, is located in the extreme southeast corner of Georgia on the Atlantic Coast and the St. Marys River, which creates the border between Georgia and Florida. From 1915 to 2014, the average annual high and low temperatures in Camden County were 78.5 and 58.6 degrees Fahrenheit (°F), respectively. The average high temperature in July is 91.8 °F and the average low in January was 42.8 °F. Annual precipitation averages 51.38 inches of rain per year with most of the rain falling during the summer months. The number of days with any measurable precipitation is 106 (University of Georgia, 2016).

While the six primary GHGs, defined in Section 202(a) of the CAA, are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are produced in relatively very small quantities, and most often by very specific niche industries such as electronic component manufacture. Additionally, USEPA's NEI database only tracks the most abundant GHGs (carbon dioxide, nitrous oxide, and methane). Therefore, analysis will focus on these three primary GHGs represented as carbon dioxide equivalents (i.e., CO₂e) based on their global warming potential. Although climate change is a global impact, the impacts from this project are also evaluated in the context of local and regional GHG emissions. Baseline GHG emissions for Camden County, obtained from USEPA's 2014 NEI, are summarized in Table 3.3-1.

Table 3.3-1. Camden County Greenhouse Gas Air Emissions Inventory (2014)

Location	CH ₄	CO ₂	N ₂ O	CO ₂ e
	(tpy)	(tpy)	(tpy)	(tpy)
Camden County	94	645,223	14	651,667
Jacksonville-Brunswick Interstate Air Quality Control Region	17,346	28,871,135	528	29,462,242

Notes: CH₄ = methane; CO₂ = carbon dioxide; N₂O = nitrous oxide; CO₂e = carbon dioxide equivalent; tpy = tons per year.

Source: (USEPA, 2017c)

Due to Camden County's coastal location, the area is likely to be more susceptible to the potential impacts of climate change such as sea-level rise and increased frequency of extreme weather events such as hurricanes. Conversely, because this is a coastal area, some protective measures are likely to already be in place such as hurricane evacuation routes.

3.4 Coastal Resources

3.4.1 Definition and Description

Coastal resources encompass the natural resources present within coastal waters and on adjacent shoreland, including fish and animals and their habitats. The Georgia Coastal Management Program was enacted in 1998 to protect these coastal resources. Coastal resources within the ROI are defined by Georgia's coastal zone boundary. Georgia's coastal zone includes the counties of Chatham, Effingham, Bryan, Liberty, Long, McIntosh, Wayne, Glynn, Brantley, Camden, and Charlton. The seaward boundary of Georgia's coastal zone extends to the outer limits of State jurisdiction, which is 3 nautical miles seaward from the mean low watermark. The inland boundary of Georgia's coastal zone is the political boundaries of the 11 counties noted above. Encompassed within these boundaries are all upland areas in these 11 counties, as well as all waters of the State and all submerged lands within the defined coastal zone.

The Georgia Coastal Management Program does not include lands that are subject solely to the discretion of, or held in trust by, the Federal government. Lands within the ROI that are excluded from the coastal zone boundary include the Cumberland Island National Seashore and Naval Submarine Base Kings Bay. However, Federal agencies are required to be fully consistent with Georgia's Coastal Management Program.

3.4.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

Coastal Zone Management Act of 1972

The CZMA provides for the effective, beneficial use, protection, and development of the U.S. coastal zone. Under the CZMA, the term “coastal zone” is defined as coastal waters and adjacent shorelands strongly influenced by each other and in proximity to the several coastal states, including islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. Camden County is one of the 11 coastal counties under the Georgia Coastal Management Program.

One of the programs outlined by the CZMA is the National Coastal Zone Management Program, which is a voluntary partnership among the Federal government and coastal and Great Lakes states and territories. Under this program, state governments design unique coastal zone management programs which are subsequently approved by NOAA. Once these programs have been approved, the CZMA requires that any Federal actions that could have a reasonably foreseeable impact on a state’s coastal zone (even if the action occurs outside the designated coastal zone) be consistent with the approved coastal management program for that state. FAA may not issue a license, permit, or authorization to an applicant unless an applicant’s proposed action meets the consistency requirements of the state’s coastal management program.

Georgia Coastal Management Program

The mission of the Georgia Coastal Management Program is to balance economic development in Georgia’s coastal zone with the preservation of natural, environmental, historic, archaeological, and recreational resources for the benefit of Georgia’s present and future generations (GDNR, 2017). The Georgia Coastal Management Program is based on a network of agencies implementing 33 statutes that protect and enhance the state’s natural, cultural, and economic coastal resources.

The Federal permit applicant must submit a CZMA consistency determination to GDNR to ensure the Proposed Action is consistent with the Georgia Coastal Management Program (15 CFR §§930.57–930.58). The following types of Federal actions must be consistent with the statutes of the Georgia Coastal Management Program:

- Direct Federal activities – activities and development projects performed by a Federal agency, or a contractor for the benefit of a Federal agency
- Federal license or permit activities – activities not performed by a Federal agency, but requiring Federal permits or licenses or other forms of Federal approval
- Plans for the exploration or development of, or production from, any area which has been leased under the Outer Continental Shelf Lands Act
- Federal financial assistance to state agencies and local governments

In its simplest form, the consistency process involves two stages: (1) a consistency determination or certification is made by a Federal agency or Federal permit applicant regarding a proposed activity that affects the coastal area, and; (2) the Coastal Resources Division makes a consistency decision (i.e., concurs with or objects to the consistency determination or certification of the Federal agency or permit applicant). The Division’s role is to ensure that each relevant State permit is issued before the corresponding Federal permit is issued. The Coastal Resources Division does not usurp the authority of

any other State agency; rather, the Division provides the necessary coordination to review Federal activities in the coastal area.

Part of the necessary data and information required to complete the State's review is the issuance of any applicable State licenses or permits. Enforceable statutes that may require a permit/license include: Air Quality Act, Coastal Marshlands Protection Act, Comprehensive Solid Waste Management Act, Erosion and Sedimentation Control Act (including buffer variances where applicable), Groundwater Use Act, Hazardous Waste Management Act, Programmatic General Permits for docks, Revocable License Program, Septic Tank Law, Shore Protection Act, Surface Mining Act, Underground Storage Tank Act, Water Quality Control Act, and Water Wells Standards Act. GDNR has six months to review the consistency determination (16 CFR §930.62), then either concur with or object to the determination that the Proposed Action is consistent with the Georgia Coastal Management Program.

Coastal Marshlands Protection Act

The Coastal Marshlands Protection Act provides the Georgia Coastal Resources Division with the authority to protect and regulate activities within marshland, intertidal area, mudflats, tidal water bottoms, and salt marsh area within estuarine areas of the state.

EO 13158, Marine Protected Areas

Marine protected areas (MPAs) are broadly defined as areas of the ocean that are established for the protection of natural or cultural resources (NOAA, 2016). There are currently over 1,600 total MPAs designated in U.S. waters in habitats ranging from open ocean environments to estuaries. Examples include national marine sanctuaries, national seashores, and national wildlife refuges, among many others. While some activities are restricted within MPAs, most allow certain types of use. Two MPAs exist within the ROI, the Satilla River Marsh Island Natural Area and Cumberland Island National Seashore (National Ocean Service, 2017).

3.4.3 Existing Conditions

Existing conditions of coastal resource areas are described in the following sections of the EIS: Section 3.2, *Biological Resources*; Section 3.8, *Historical, Architectural, Archaeological, and Cultural Resources*; Section 3.9, *Land Use*; and Section 3.14, *Water Resources*. Background information collected on the existing site includes, but is not limited to, the following:

- Results of previous onsite characterization studies
- Information or issues of concern to coastal resources identified during public scoping meetings, including response letters from the USFWS, NMFS, NPS, and GDNR
- Archaeological survey results
- Wetland survey results

Cumberland Island National Seashore was identified in the EIS scoping meetings as a main area of concern within the coastal zone from operational activities at the spaceport. Cumberland Island contains 9,886 acres of designated wilderness and 10,500 acres of potential wilderness (Austin, 2015). Public comments expressed concern from noise, vibration, and potential debris occurring during launch and landing operations over the island.

3.4.3.1 Satilla River Marsh Island Natural Area

The Satilla River is a blackwater stream; the river begins in the swamps of the coastal plain, then flows 260 miles before connecting to the St. Andrew Sound. Large acres of old growth exist in the expansive floodplains of the Satilla River. Historically, the river was part of a transportation and subsistence network for the Creek Indian Nation. The Satilla River Marsh Island Natural Area is managed by GDNR and has a total area of 0.18 square kilometer.

3.4.3.2 Cumberland Island National Seashore

Cumberland Island National Seashore was created by Congress in 1972 (Public Law 92-536, codified at 16 U.S.C. §§459i et seq. “to provide for public outdoor recreation use and enjoyment of certain significant shoreline lands and waters of the United States and to preserve related scenic, scientific, and historical values.” Cumberland Island is the southernmost sea island off the coast of Georgia and is separated from the mainland by the Cumberland River (which is part of the Intracoastal Waterway) (NPS, 2017a). Cumberland Island is approximately 17.5 miles long and has a width ranging from 0.5 mile to 3 miles. The north end of Cumberland Island is the widest with the western edge bordering the Intracoastal Waterway, approximately 4 miles due east of the proposed spaceport site and the beach side of Cumberland Island about 7 miles from the spaceport. The south end of Cumberland Island is across from the U.S. Naval Submarine Base Kings Bay and the city of St. Marys, with the western shoreline of the island approximately 1.5 to 2 miles due east of the base and the city, respectively, and the beach side about 2.5 miles due east. The barrier island has more than 16,500 acres of salt marshes, mud flats, and tidal creeks, and there are more than 2,500 acres of freshwater wetlands that range from permanent and semi-permanent ponds to seasonal wetland areas, including emergent, scrub/shrub, and forested palustrine areas (NPS, 2017a).

In accordance with NPS policy (Director’s Order #18: Wildland Fire Management), Cumberland Island National Seashore is required to have an approved Fire Management Plan. The Fire Management Plan serves as a detailed and comprehensive plan of action to implement fire management policy, principles, and goals, including regular planned burns (“prescribed fire”) on Cumberland Island and managing unplanned ignitions (e.g., fires caused by lightning strikes or other sources) in accordance with the park’s fire management objectives. The complete park, including Little Cumberland Island, are arranged into three Fire Management Units (FMUs): Natural (FMU 1), Historic (FMU 2), and Little Cumberland Island (FMU 3) (see Exhibit 3.4-1). The Natural Zone (FMU 1) includes all of the wilderness areas of the park that are within the planned trajectories of the spaceport. The northernmost division of FMU 2 and Little Cumberland Island Zone (FMU 3) is also within the planned trajectories of the spaceport.

Thirty-five species of mammals are found on Cumberland Island, including white-tailed deer, bobcat, opossum, raccoon, otter, mink, armadillo, bat, mole, shrew, squirrel, and several species of rats and mice (NPS, 2017a). Feral animals include horses and swine. Coyotes appeared on the island circa 2003 (NPS, 2017a). Dolphins, manatees, and several species of whales occur in offshore waters (NPS, 2017a). More than 300 bird species, including full-time residents, nesters, and winter migrants, have been documented on Cumberland Island National Seashore, which offers important habitat to winter migratory shore and wading birds (NPS, 2017a). The 2012 mid-winter shorebird survey tallied 30,958 birds and 37 species (NPS, 2017a). The beach and associated dunes provide nesting habitat in the spring/summer months to American oystercatchers, least terns, Wilson’s plovers, and willets (NPS, 2017a).

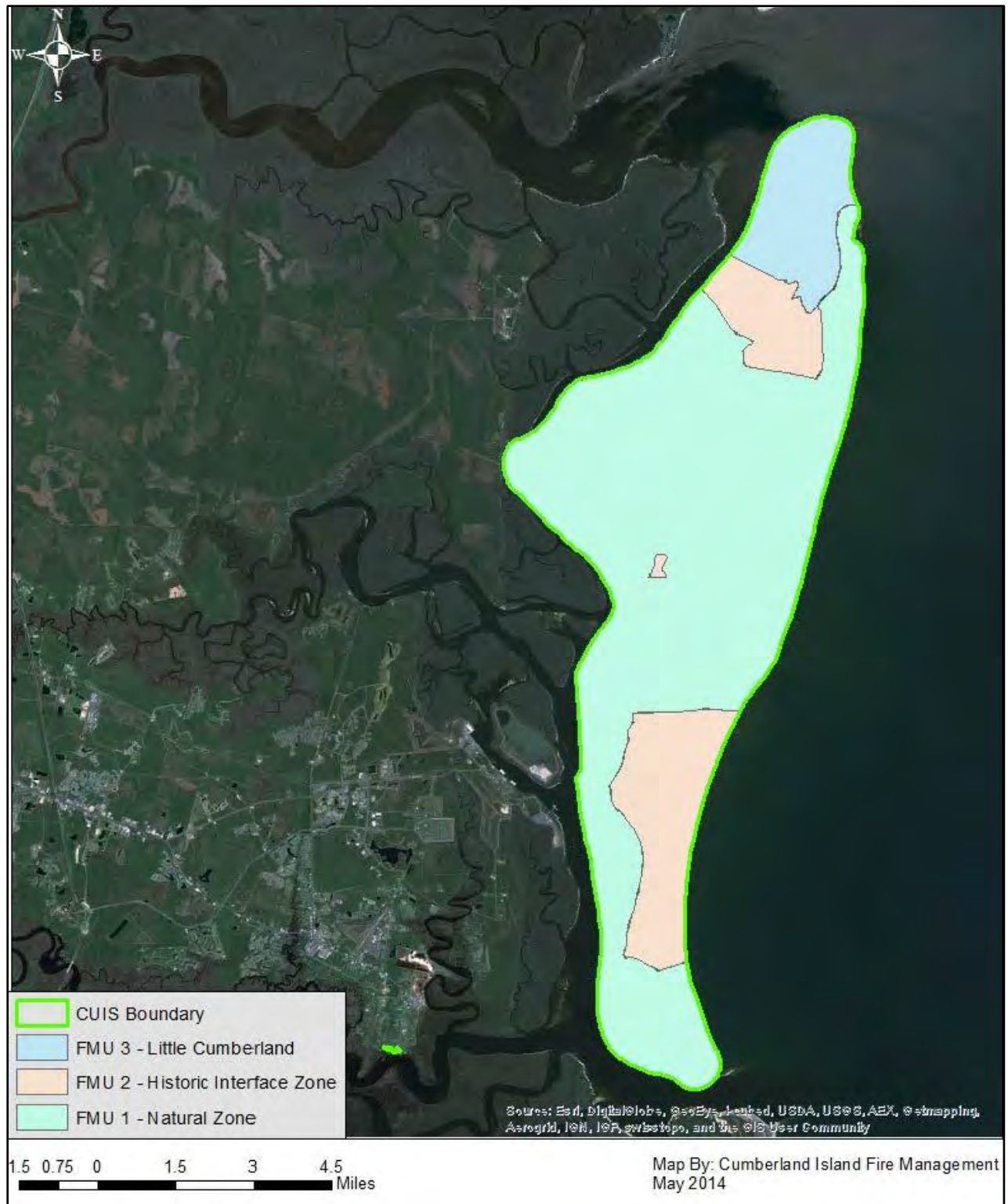


Exhibit 3.4-1. Cumberland Island National Seashore Fire Management Units (FMUs)

Source: (NPS, 2015)

3.5 Department of Transportation Act, Section 4(f)

This section provides impact analyses for resources under Section 4(f) of the U.S. Department of Transportation Act.

3.5.1 Definition and Description

Section 4(f) refers to the original section within the U.S. Department of Transportation Act of 1966, which established the requirement for consideration of park and recreational lands, wildlife and waterfowl refuges, and historic sites in transportation project development. Properties eligible for protection under Section 4(f) include the following:

- Parks and recreational areas of national, state, or local significance that are both publicly owned and open to the public
- Publicly owned wildlife and waterfowl refuges of national, state, or local significance that are open to the public to the extent that public access does not interfere with the primary purpose of the refuge
- Historic sites of national, state, or local significance in public or private ownership regardless of whether they are open to the public (see 23 U.S.C. §138(a) and 49 U.S.C. §303(a))

Section 4(f) applies to projects that receive funding from or require approval by an agency of the U.S. Department of Transportation (USDOT), including the FAA.

3.5.2 Regulatory Setting

The regulation known as Section 4(f) was originally established in the U.S. Department of Transportation Act of 1966 (49 U.S.C. §1653(f) and later recodified as 49 U.S.C. § 303. In 2005, Congress enacted legislation that required the USDOT to issue additional regulations that clarify Section 4(f) standards and procedures (USDOT, 2012). These new regulations were finalized in March 2008 (23 CFR Part 774). Section 4(f) mandates that the Secretary of Transportation will not approve any transportation project requiring the use of publicly owned parks, recreation areas, wildlife and waterfowl refuges, or significant historic sites, regardless of ownership, unless the following conditions apply.

- There is no prudent and feasible alternative to using that land.
- The program or project includes all possible planning to minimize harm to the public park, recreation area, wildlife or waterfowl refuge, or significant site, resulting from that use.

To be protected under Section 4(f), public parks, recreation facilities, and wildlife or waterfowl refuges must be considered *significant* (USDOT, 2012). Pursuant to 23 CFR §771.135(c), Section 4(f) resources are presumed to be significant unless the official having jurisdiction over the site concludes that the entire site is not significant. Historic sites qualifying for Section 4(f) protection must be officially listed on or eligible for inclusion on the NRHP, or contribute to a historic district that is eligible for or listed on the NRHP.

A use of properties protected under Section 4(f) occurs under either of the following conditions (23 CFR §771.135(p)).

- Land from a qualifying Section 4(f) property is acquired and permanently incorporated into a transportation facility.

- There is a temporary occupancy of Section 4(f) land during construction of the transportation facility that is considered adverse to the preservationist purposes of the Section 4(f) statute.

In addition, a *constructive use* could occur when no land is acquired from a Section 4(f) property, but the proximity of the project results in indirect impacts that would substantially impair the current use of the property, such as visual, noise, or vibration impacts or impairment of property access.

The regulations require coordination with the official(s) having jurisdiction over affected Section 4(f) properties for a number of situations, including (but not limited to) determining if a property is significant, for determining *constructive use*, for evaluating the reasonableness of measures to minimize harm, and prior to making approvals. FAA has coordinated with officials with jurisdiction over the Section 4(f) properties identified in Section 3.5.3, *Existing Conditions*.

3.5.3 Existing Conditions

Region of Influence

The ROI for historic sites eligible for protection under Section 4(f) corresponds to the area of potential effect (APE) for historical, architectural, archaeological, and cultural resources as defined in Section 3.8, *Historical, Architectural, Archaeological, and Cultural Resources*. To adequately capture all publicly owned parks, recreation areas, or wildlife and waterfowl refuges potentially eligible for protection under Section 4(f), a conservative ROI was developed.²⁵ Section 4(f) properties may experience impacts amounting to use through three primary mechanisms, each of which was considered in the development of the ROI:

- The ROI for Section 4(f) includes the 11,800-acre footprint of the proposed Spaceport Camden site where *permanent incorporation* could result for any eligible Section 4(f) properties, if located in the area.
- Areas of *temporary occupancy* (e.g., temporary construction access roads or material staging areas outside of the project site) were considered for the development of the Section 4(f) ROI; however, no areas outside the fence line for the Spaceport Camden site would be occupied during construction.
- The ROI includes a wider area where proximity-related impacts may result in a substantial impairment of the activities, attributes, or features of a Section 4(f) property, also known as *constructive use*. Because the proximity-related impacts are the farthest reaching, an ROI developed to cover potential constructive use would also cover areas where permanent incorporation and temporary occupancy could occur.

To include a full range of possible proximity impacts that may impair Section 4(f) properties and potentially result in constructive use, the ROI includes areas where noise impacts from construction activities, facility operations, and launch and landing activities would occur. It also includes hazard and closure areas where public access would be limited or restricted.

FAA Order 1050.1F states, in most locations, a significant noise impact would occur if the Proposed Action would cause noise sensitive areas to experience a 1.5 A-weighted decibel (dBA) day-night average sound level (DNL) increase when compared to the no action alternative during the same time

²⁵ The approach to developing the ROI for Section 4(f) as described in this EIS is specific to and unique for the Spaceport Camden Draft EIS and does not represent a new standard approach that will be implemented by the FAA Office of Commercial Space Transportation on future reviews of spaceport facilities or launch activities.

1 frame and the end-state noise level would be at or above 65 dBA DNL. Although this threshold is
2 commonly used to evaluate noise impacts, it is not used to develop the Section 4(f) ROI in this EIS for
3 two primary reasons. First, as noted in FAA Order 1050.1F, the 65 dBA DNL threshold does not fully
4 address the effects of noise on visitors to areas such as national parks or wildlife refuges where a quiet
5 setting is a recognized attribute and purpose of the area. Additionally, and as described in
6 Section 3.11.1, *Noise and Noise-Compatible Land Use, Definition and Description*, of this EIS, DNL is a
7 day-night average sound level that is typically used to evaluate noise impacts from regularly occurring
8 transportation sources such as railroads, highways, and airports.

9 For these reasons, the Section 4(f) ROI was developed using a maximum A-weighted noise level (or
10 $L_{A,max}$) to evaluate the short-duration, high-intensity nature of launch and landing noise from Spaceport
11 Camden. While DNL is a cumulative noise metric that typically expresses values as the average level
12 over a 24-hour day, $L_{A,max}$ represents the maximum sound level achieved over the duration of the event.
13 A composite of 65 dBA $L_{A,max}$ noise contours from all launch trajectories was modelled and used to
14 delineate the Section 4(f) ROI. Because launch noise is anticipated to propagate farther from Spaceport
15 Camden than landing noise (see Section 3.11, *Noise and Noise-Compatible Land Use*), the ROI based on
16 launch noise will include noise impacts from landing activities.

17 The 65 dBA $L_{A,max}$ contour represents the geographic extent that noise from launches under any of the
18 trajectories considered in this EIS would result in a maximum noise level of 65 dBA or greater. The level
19 of 65 dBA was chosen based on a review of outdoor speech interference data presented in *Information*
20 *on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate*
21 *Margin of Safety* (USEPA, 1974). Using outdoor speech interference as a proxy for potential Section 4(f)
22 impairment and delineating the limits of the ROI on a contour representing the extent of 65 dBA $L_{A,max}$
23 noise, therefore, corresponds to an area where noise impacts may affect the most sensitive of
24 Section 4(f) properties. This represents a conservative ROI from which to identify and screen potential
25 Section 4(f) use.

26 **Screening Process**

27 As a first step in the Section 4(f) screening, FAA conducted an initial screening of the ROI to identify all
28 properties eligible for protection under Section 4(f) that have the potential to be affected by the
29 Proposed Action and alternatives. Each property was evaluated to determine if it: is publically owned; is
30 open and accessible to the public; has the major or primary purpose for park, recreation, or refuge
31 activities; and is *significant* as a park, recreation area, or refuge. FAA identified over 50 properties
32 eligible for protection under Section 4(f).

33 None of the properties identified in the ROI would experience use through *permanent incorporation* or
34 *temporary occupancy*, and the only possible Section 4(f) use of the properties would be *constructive use*.
35 *Constructive* use may occur if a project's proximity impacts are so severe as to substantially impair the
36 activities, features, or attributes that qualify a property for protection under Section 4(f). In general,
37 constructive use may include impacts such as noise, access restrictions, vibration, ecological intrusions,
38 and visual impacts. The primary mechanism by which the Proposed Action and alternative could result
39 in *constructive* use are noise impacts from launch and landing activities. *Constructive use* may also occur
40 from visual impacts should the proximity of the Proposed Action substantially impair the aesthetic
41 features or attributes of the properties where those features are considering contributing elements of
42 the property. Additional screening criteria were applied to the properties to determine if they required
43 more detailed consideration under Section 4(f) to identify potential *constructive use* as a result of
44 proximity impacts, including noise and visual impacts, or if they could be dismissed from further
45 consideration.

1 To rise to the level of *constructive use*, a noise impact must substantially impair the activities, features,
2 or attributes that qualify the property for protection under Section 4(f). For noise impacts to result in
3 substantial impairment, a lack of noise must be a recognized attribute of the property. The remaining
4 properties described below are one for which serenity and quiet are significant attributes of the
5 property and that may be sensitive to new sources of noise. The other properties eligible for Section 4(f)
6 protection were dismissed from detailed consideration because a certain level of noise is an inherent
7 and pre-existing attribute of the property or because already existing noise exposure from outside
8 sources was identified during the screening. In these cases, the launch and landing noise from the
9 Proposed Action and Alternatives would not substantially impair the 4(f) property and further evaluation
10 for the potential of *constructive use* is not necessary. Likewise, to rise to the level of *constructive use*, a
11 visual impact must substantially impair an aesthetic feature or attribute of a property protected by
12 Section 4(f), where that feature or attribute is considered an important element contributing to the
13 value of the property. The properties below are ones for which a relatively natural or undeveloped
14 viewshed may be part of the property's setting.

15 The screening process identified eight parks and recreational areas eligible for Section 4(f) protection,
16 and for which the potential *constructive use* resulting from the Proposed Action and Alternatives has
17 been considered in detail. This includes: Cumberland Island National Seashore, Jekyll Island State Park,
18 Crooked River State Park, Harriet's Bluff Community Park, Coastal Georgia Greenway, Blythe Island
19 County Park, Fort Clinch State Park, and Egan's Creek Greenway. These properties are described below.

20 **Cumberland Island National Seashore**

21 The Cumberland Island National Seashore is located on the largest and southernmost of Georgia's
22 barrier islands. Cumberland Island, where the park is located, is located about 2 miles east of St. Marys,
23 Georgia, and is only accessible by boat. The island is over 17 miles long measured from north to south
24 and totals 36,415 acres in size (NPS, 2014). Cumberland Island National Seashore is managed by the NPS
25 and is located approximately 2 miles southeast of the proposed Spaceport Camden site at its closest
26 point. Cumberland Island National Seashore was included in the National Park System because of its
27 unique historical, natural, and cultural resources. It was established on October 23, 1972. The
28 establishing legislation, Public Law 92-536, states that the purpose of the park is "to provide for public
29 outdoor recreation use and enjoyment of certain significant shoreline lands and waters of the United
30 States, and to preserve related scenic, scientific, and historical values..."

31 Cumberland Island National Seashore contains over 50 miles of trails and roads as well as 18 miles of
32 beach and it also includes over 9,800 acres of congressionally-designated Wilderness. Human-
33 dominated habitats including isolated residences and historical landscapes make up a small percentage
34 of the island's area. NPS-operated and maintained facilities on the island include the Sea Camp Ranger
35 Station, Ice House Museum, Dungeness Ruins, five campgrounds, the remains of Robert Stafford's
36 plantation and cemetery, Plum Orchard Mansion, Cumberland Wharf, the Settlement, and First African
37 Baptist Church.

38 Activities that take place in Cumberland Island National Seashore include camping, hiking, biking,
39 birdwatching, and beachcombing. In general, the park provides outdoor recreational opportunities in an
40 uncrowded and undeveloped environment and offers the opportunity to experience outdoor solitude
41 and natural soundscapes for visitors.

42 The park's general management plan limits visitation to approximately 300 people per day (NPS, 2014)
43 and in 2016, approximately 61,897 people visited the island (Wright, 2017). Except for December 25, the
44 park is open year-round. An NPS concessioner provides year-round ferry service for visitors to the
45 Cumberland Island National Seashore; however, ferry service to Cumberland Island National Seashore
46 from December 1 to February 28 is limited to only five days per week with no service on Tuesdays and

1 Wednesdays. In addition to the concessioner ferry, private ferries carry people and vehicles to the
2 island, which includes a network of public roads. Two airstrips are found on the island, including the
3 Stafford Airstrip and Candler Airstrip. Generally, one flight per day of single engine, fixed-wing aircraft
4 takes place at the Stafford Airstrip.

5 **Jekyll Island State Park**

6 Jekyll Island State Park, owned by the State of Georgia and managed by the Jekyll Island State Park
7 Authority, is located within Glynn County, Georgia, on a barrier island located off the southeastern coast
8 of Georgia. At its closest point, Jekyll Island is located approximately 6 miles northeast of the proposed
9 Spaceport Camden site. It is approximately 5,700 acres in size and measures about 7 miles long by 1.5
10 miles wide, has 8 miles of wide, flat beaches on its east shore with sand packed hard enough for easy
11 walking or biking, and approximately 20 miles of hiking trails. It also hosts a residential community, 10
12 hotels, rental cottages and several recreational opportunities and businesses including golf courses, a
13 tennis center, miniature golf and bike rentals, an oceanfront soccer complex, a convention center, a
14 waterpark, campground, and restaurants. The island also hosts a youth learning facility, with a focus on
15 environmental education, called Camp Jekyll. The island is also the home to approximately 1,000 private
16 residences and 75 commercial businesses including hotels, restaurants, variety stores, a marina, real
17 estate managers, and private tour operators.

18 The island itself is open all year round, at all times of the day. Over 3.6 million people are projected to
19 visit the park in 2017 (Carswell, 2017). Common activities in the park include golf, tennis, fishing,
20 camping, cycling, birdwatching, walking and hiking, and water-based recreation. The island hosts a
21 variety of organized events including weddings, ceremonies, races, festivals, and conventions.
22 Environmental education, research, environmental conservation, and historic preservation activities also
23 take place on the island through various programs including the Georgia Sea Turtle Center, an in-house
24 Conservation Department, the Jekyll Island Museum, and the Jekyll Island National Historic Landmark
25 District (Carswell, 2017).

26 Serenity and quiet is an important attribute in Jekyll Island's multi-use trail system, historic sites, and
27 natural areas. In other parts of the park, visitors may experience noise related to cars, recreational
28 vehicles, landscaping, construction, music festivals, fireworks, and propeller aircraft and helicopters
29 using the airstrip at the northwestern side of the island (Carswell, 2017).

30 **Crooked River State Park**

31 Crooked River State Park is a publically owned park located in Camden County on southern tip of
32 Georgia's Colonial Coast at the north end of Naval Submarine Base Kings Bay and is managed by Georgia
33 State Parks. At approximately 500 acres, it contains 62 campsites, 11 cottages, 5 picnic shelters, a group
34 shelter, a nature center and a visitor center. There are 4.5 miles of nature trails, 4 playgrounds, a mini
35 golf course and a boat ramp within its boundaries. The park is located approximately 7 miles southwest
36 of the proposed Spaceport Camden site and 11 miles from I-95 which draws travelers to the park during
37 their North/South migration (GDNR, 2013). The park is utilized for camping, birdwatching, boating,
38 hiking, fishing, and biking. Water access from the park includes both motorized and non-motorized
39 boats and river tours depart from the park. The park is accessible year round and overnight to campers.
40 Access for day visitors closes at 10:00 p.m. nightly.

41 **Harriett's Bluff Community Park**

42 Harriett's Bluff Community Park is located in Camden County along Harriett's Bluff Road, approximately
43 7 miles southwest of the proposed Spaceport Camden site. Consisting of 21 acres, the park offers a
44 screened pavilion with full kitchen facilities, picnic tables, basketball court, tennis court, a nature trail,
45 and restrooms. The park is open every day of the year, from dawn to dusk and primary uses of the park

1 include family gatherings and parties, walking trail usage, playground usage, tennis, and basketball.
2 Approximately 4,000 to 5,000 people visit the park each year (Brunson, 2017).

3 **Coastal Georgia Greenway**

4 The Coastal Georgia Greenway, a 155-mile trail system through Georgia's six coastal counties, is an
5 alternative transportation network to link the towns, attractions, recreational sites, historic and cultural
6 sites, waterways, and natural habitats of the coast. Within Camden County, Georgia, the greenway
7 consists of the following segments: City of Woodbine and its existing East Coast Greenway Trail
8 segment; Satilla River Waterfront Park segment; City of Kingsland segment; Crooked River State Park
9 segment; City of St. Marys segment; and Cumberland Sound Ferry to Fernandina Beach, Florida
10 segment. Within Glynn County, Georgia, the segments potentially affected are the Brunswick, Georgia,
11 and Jekyll Island segments. The Greenway, when completed, will connect resources such as historic
12 attractions, business and shopping areas, and recreational sites. The greenway would be a part of the
13 larger East Coast Greenway that would eventually connect Maine to Key West, Florida. The existing
14 segments of the greenway are used by walkers, bikers, and runners. The existing and planned trails that
15 comprise the greenway are open the public at all times and are managed by the local governments in
16 which the trail segments are located.

17 **Blythe Island Regional Park**

18 Blythe Island Regional Park is a 1,100-acre public park developed and managed by Glynn County,
19 Georgia, with the help of the Georgia Department of Natural Resources. Located approximately 14 miles
20 north of the proposed Spaceport Camden site and a few miles off I-95, the park offers camping, picnic
21 pavilions, a playground, a freshwater lake for swimming and fishing, and a marina and dock to access
22 the South Brunswick River (Glynn County, 2017).

23 **Fort Clinch State Park**

24 Fort Clinch State Park is located in Nassau County, Florida approximately 17 miles south of the proposed
25 Spaceport Camden site. The park is managed by the Florida Division of Recreation and Parks and is
26 accessible by State Road A1A. The park comprises 2,178 acres of land designed to provide public
27 outdoor recreation and other park-related uses. The purpose of Fort Clinch State Park is also to protect
28 the pre-Civil War Era fort and interpret the fort's historical artifacts. As noted in the approved unit
29 management plan, the park offers active living history interpretations that showcase the life of Union
30 Soldiers in the 1860s (Florida Department of Environmental Protection, 2017). The park also includes
31 interpretation of the Civilian Conservation Corps Program (CCC), as Fort Clinch was one of eight parks
32 built by the CCC. In addition to the historical value, visitors to the park can experience diverse natural
33 communities including white sand beaches, coastal dunes, maritime hammock habitat, and a saltwater
34 estuary. The park also provides numerous opportunities for outdoor recreation activities such as
35 camping, beach activities, fishing, hiking, biking, and wildlife viewing.

36 Fort Clinch State Park is open to the public 356 days per year and gates are open from 8:00 a.m. to
37 sunset. In 2014-2015, the park recorded 300,663 visitors (Florida Department of Environmental
38 Protection, 2017).

39 **Egans Greenway**

40 Egans Creek Greenway consists of over 300 acres of land that runs north to south along Egans Creek at
41 the northern End of Amelia Island, approximately 19 miles south of the proposed Spaceport Camden
42 site. This protected area is managed by the City of Fernandina Beach Parks and Recreation Department

and opened in 2000 as an undeveloped park for conservation and passive recreational activities. It includes grass-covered trails, a nature pavilion, restrooms, interpretive displays, and a picnic area. Activities in the greenway include walking, biking, fishing and wildlife viewing. The area is open every day from sunrise to sunset with no overnight use. Approximately 35,000 people visit the greenway annually.

3.6 Farmlands

3.6.1 Definition and Description

Farmlands include prime farmlands, unique farmlands, and any ongoing farming areas, including pasturelands, croplands, and forests. Farmlands are defined as those agricultural areas considered important and protected by Federal, State, and local regulations. Important farmlands include all pasturelands, croplands, and forests (even if zoned for development) considered to be prime, unique, or of statewide or local importance.

The *prime farmlands* classification is defined as those having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and must also be zoned (or available) for these uses. In addition, prime farmland is defined by a combination of characteristics from the soil quality, growing season, and moisture supply that can produce economically sustained high yields of crops when treated and managed according to acceptable farming methods. It requires an adequate and dependable water supply from precipitation or irrigation, favorable temperature, and soils with acceptable acidity or alkalinity, acceptable salt and sodium content, few or no rocks, and permeable to water and air. Prime farmland is not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA NRCS, 2017).

The *unique farmlands* classification is used for those producing specific high-value food and fiber crops. Unique farmlands require a special combination of soil quality, location, growing season, and moisture supply needed to produce economically sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods (USDA NRCS, 2017).

Other agricultural areas that produce food, feed, forage, fiber, and oilseed crops are of local or statewide importance. This classification can include pasturelands, croplands, and forests. Typically, these areas are adjacent to prime or unique farmlands and/or designated, zoned, or protected by State or local agencies (e.g., land use zoning for agricultural or farmland type land uses) (Department of Energy, 1980).

3.6.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply.

Farmland Protection Policy Act of 1981

The purpose of the Farmland Protection Policy Act of 1981 (Public Law 97-98, §§1539–1549; 7 U.S.C. §§4201 et seq.) is to minimize impacts from Federal programs by preventing avoidable and irreversible change in farmland land uses to nonagricultural uses. It ensures Federal programs are implemented while being compatible with State, local government, and private programs and policies to protect farmland (USDA, 2017).

1 There is a farmland conversion impact rating (Form AD-1006) to evaluate the degree of impact and
2 determine if consultation with the National Resources Conservation Service (NRCS) is required for this
3 resource. The Proposed Action does not recommend a change in land use; therefore, no consultation is
4 needed.

5 **CEQ Memorandum on the Analysis of Impacts on Prime or Unique Agricultural Lands**

6 The CEQ memorandum provides guidance on the identification and impact analysis of prime or unique
7 farmlands from Federal programs.

8 **Other State and Local Regulations**

9 Other applicable State and local regulations include Camden County's zoning code (existing land use),
10 proposed land use, and their comprehensive planning vision and guidelines related to farmlands.

11 **3.6.3 Existing Conditions**

12 The ROI for farmlands is identified by two areas:

- 13 • Construction ROI: Land that may be directly affected by construction and site specific operation
14 within the Spaceport Camden site boundary, as shown in Exhibit 2.1-2
- 15 • Operational ROI: The land that may be indirectly affected by the proposed launch trajectory and
16 hazard area and the proposed access controlled areas, as shown in Exhibit 2.1-10 and Exhibit
17 2.1-11

18 **Prime and Unique Farmland**

19 The Soil Survey Geographic database for Camden County was used to identify prime and unique
20 farmlands. There are no prime or unique farmlands within the construction or operational ROI. The
21 closest location of prime or unique farmlands is approximately 5 miles west of the western boundary of
22 the Spaceport Camden site. See Exhibit 3.6-1 to see the prime and unique farmland.

23 **Statewide and Locally Important Farmland**

24 Statewide and locally important farmlands were identified using the Camden County zoning code,
25 proposed land use, and visual inspection of aerial imagery (Exhibit 3.6-1).

26 There are no farmlands located within the construction ROI. The Camden County zoning code and
27 proposed land use identifies the Spaceport Camden site as general industrial land use. General
28 industrial uses can include supporting forestry activities and post-crop harvesting but not forestry and
29 logging (Camden County, 2016). Currently, there are no agreements for either supporting forestry
30 activities or post-crop harvesting within the construction ROI (Camden County, 2016). The last known
31 timber-harvesting type use of this area was as a tree farm in the 1940s to 1960s (CH2MHill, 2015). This
32 and other similar previous uses have characterized the land, and a majority of the surrounding areas, as
33 planted rows of trees.

34 Based on the Camden County zoning code and proposed land use, there are no farmlands within the
35 operational ROI. This area is primarily zoned for conservation uses, and a parcel to the southwest, north
36 of Union Carbide Road, is zoned as planned development. The closest farmland land use is an area
37 designated as agriculture forestry, approximately 1 mile west-southwest of the western boundary. This
38 is outside the construction and operational ROIs. See Section 3.9, *Land Use*, for additional detail on land
39 use.

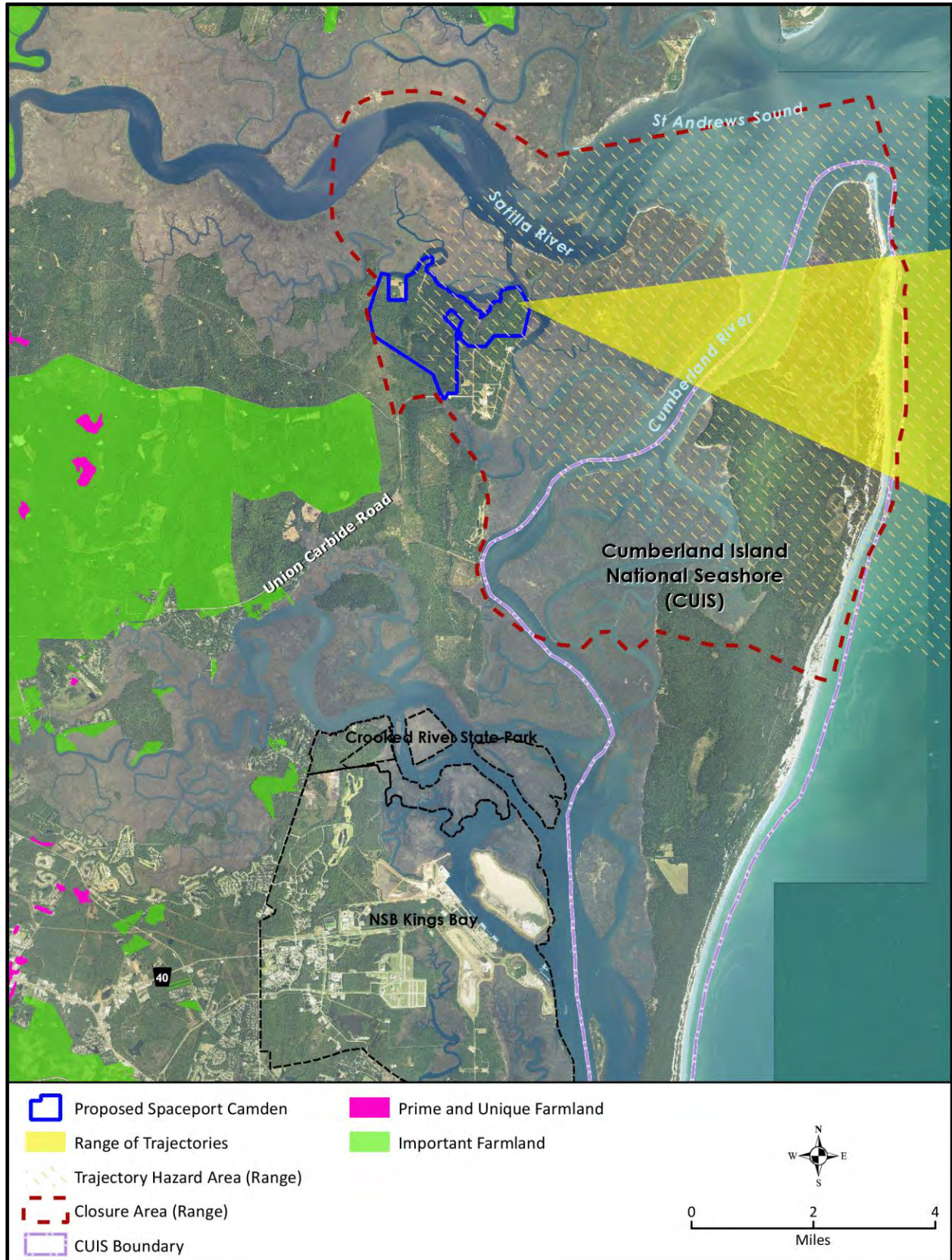


Exhibit 3.6-1. Existing Farmlands

Visual analysis of aerial imagery can be misleading for areas within and around the construction and operational ROIs because of the historical use of the land for tree planting and timber harvesting (CH2MHill, 2015). Aerial imagery shows that areas within both the site-specific and operational ROIs have trees planted in rows. The construction ROI has the potential for timber harvesting. The operational ROI is mostly composed of marshlands and wetlands, which are not conducive to timber harvesting. The exception is the parcel owned by Big Pasture LLC, bordered by the spaceport site and the roads proposed for closure (Points X₁, X₂, and X₃) and located north of Union Carbide Road, which also has the potential for timber harvesting. It is zoned as planned development. Areas west and south of the ROI are likely used for forestry and supporting forestry activities like timber harvesting but are not considered part of the ROI for farmlands.

3.7 Hazardous Materials, Solid Waste, and Pollution Prevention

3.7.1 Definition and Description

This section defines hazardous materials, solid waste, and pollution prevention commonly associated with industrial operations. This section includes a discussion of regulatory requirements relative to this resource area. This section also includes a description of hazardous materials and hazardous and solid wastes (if any) at the Proposed Action site, as well as a discussion of the regulatory status of the site. In this document, regulatory status relates to any applicable land covenants, restrictions on land use, restrictions on groundwater use, restrictions on future land conveyance, zones of contamination, levels of contamination, potential areas of concern, munitions response areas (MRAs), Resource Conservation and Recovery Act (RCRA) Landfill areas, ongoing site environmental monitoring requirements, ongoing site maintenance requirements, access requirements and access restrictions, etc. Note, under FAA Order Sub Clause EE and FF, a categorical exclusion (CATEX) only applies to environmental investigations and site remediation conducted “on previously developed FAA-owned, leased, or operated sites.” This is not applicable to the current site of the Proposed Action.

3.7.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

The Federal statutes of most importance to FAA are RCRA, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the Community Environmental Response Facilitation Act of 1992. The Emergency Planning and Community Right-to-Know Act (EPCRA), Pollution Prevention Act, and Hazardous Materials Transportation Act also apply to the Proposed Action. Federal, State, and local statutes, regulations, executive orders, and other requirements related to hazardous materials, solid waste, and pollution prevention are included in this section.

FAA Order 1050.1F, Environmental Impacts: Policies and Procedures

FAA considers hazardous material, pollution prevention, and solid waste impacts in NEPA documentation such as this EIS. FAA Order 1050.1F, Section 7, defines the terms *hazardous material*, *hazardous waste*, *hazardous substance*, and *solid waste* as follows:

Hazardous material is any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce. The term *hazardous*

materials includes hazardous wastes and hazardous substances, as well as petroleum and natural gas substances and materials (see 49 CFR §172.101).

Solid waste is defined by the implementing regulations of RCRA generally as any discarded material that meets specific regulatory requirements, and can include such items as refuse and scrap metal, spent materials, chemical by-products, and sludge from industrial and municipal waste water and water treatment plants (see 40 CFR §261.2 for the full regulatory definition). FAA actions for terminal area development may require consideration of solid waste impacts. The Proposed Action and alternatives analyzed in this document do not involve terminal area development.

FAA and CEQ guidance also encourages consideration of opportunities for pollution prevention in the Proposed Action and its alternatives.

Resource Conservation and Recovery Act

Hazardous waste is a type of solid waste defined under the implementing regulations of RCRA. A hazardous waste (see 40 CFR §261.3) is a solid waste that possesses at least one of the following four characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261 Subpart C, or is listed in one of four lists in 40 CFR Part 261 Subpart D, which contains a list of specific types of solid waste that USEPA has deemed hazardous. RCRA imposes stringent requirements on the handling, management, and disposal of hazardous waste, especially in comparison to requirements for non-hazardous wastes.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

Hazardous substance is a term broadly defined under Section 101(14) of CERCLA (see 42 U.S.C. §9601(14)). Hazardous substances include:

- any element, compound, mixture, solution, or substance designated as hazardous under Section 102 of CERCLA;
- any hazardous substance designated under Section 311(b)(2)(A) or any toxic pollutant listed under Section 307(a) of the CWA;
- any hazardous waste under Section 3001 of RCRA;
- any hazardous air pollutant (i.e., HAPs) listed under Section 112 of the CAA; and
- any imminently hazardous chemical substance or mixture for which the USEPA Administrator has “taken action under” Section 7 of the Toxic Substances Control Act.

Please note that the definition of hazardous substances under CERCLA excludes petroleum products, unless specifically listed or designated thereunder.

Georgia Comprehensive Solid Waste Management Act of 1990 and Georgia Rule Chapter 391-3-11

The State of Georgia has adopted Federal regulations for any solid waste that has been defined as a hazardous waste. These regulations are promulgated by the Board of Natural Resources, Georgia Rule Chapter 391-3-4. Solid waste in the form of construction debris would be generated during construction activities, or they could be generated in the form of litter or refuse during routine launch operations. Solid waste is defined in the Official Code of Georgia 12-8-20, Georgia Comprehensive Solid Waste Management Act of 1990, as garbage, rubbish, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, municipal, commercial, mining,

1 and agricultural operations and from community and institutional activities. State regulations specify
2 permit requirements for landfills and the types of waste that landfills can accept.

3 **Georgia Hazardous Site Reuse and Redevelopment Act and 2003 Brownfields Tax Incentive Law**

4 Brownfield sites are defined as “real property, the expansion, redevelopment, or reuse of which may be
5 complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant”
6 in Public Law 107-118 (House Resolution 2869), Small Business Liability Relief and Brownfields
7 Revitalization Act of 2002. Section 101 of CERCLA (42 U.S.C. §9601) further specifies that brownfield
8 sites include land that have been “contaminated by a controlled substance (as defined in Section 102 of
9 the Controlled Substances Act (21 U.S.C. §802)” or sites that have been “contaminated by petroleum or
10 a petroleum product.” Georgia adopted similar environmental protection legislation (i.e., Georgia
11 Hazardous Site Reuse and Redevelopment Act, last amended in 2005, and the 2003 Brownfields Tax
12 Incentive Law) to regulate contaminated sites and to require certain remediation standards.

13 The purpose of the brownfields program is to encourage voluntary cleanup and reuse of brownfields by
14 leveraging private funding for cleanups through redevelopment projects. Georgia provides incentives
15 that can be used by private parties, including liability limitation for prospective purchasers, and tax
16 incentives to recoup investigation and cleanup costs. The program makes it possible to acquire
17 contaminated property without assuming all of the liability, as the new owner is protected from third
18 party claims (lawsuits) resulting from prior contamination.

19 **Georgia Asbestos and Lead-Based Paint Regulations**

20 Proposed activities may also affect asbestos and lead-based paint (LBP) in existing structures. Asbestos
21 is a naturally occurring mineral that is a very effective heat and sound insulator. Consequently, it was
22 used in many buildings as a fire and noise retardant. Friable (brittle) asbestos becomes hazardous when
23 fibers become airborne and are inhaled. Georgia’s Asbestos Program is responsible for protecting
24 human health and the environment from activities that disturb asbestos. The program continues to
25 license asbestos contractors, approves asbestos supervisor training courses, and collects asbestos
26 abatement/demolition project notifications as mandated under the Georgia Asbestos Safety Act.

27 LBP was used as an additive and pigment in paints for many years prior to 1978; therefore, older
28 structures that have multiple layers of older paint are potential sources of lead. Exposure to lead is
29 usually through inhalation during renovation and demolition activities or through ingestion of paint
30 chips or lead-contaminated drinking water. The Georgia LBP program is responsible for enforcing the
31 State’s Renovation, Repair, and Painting Rules requirements, including accrediting training providers;
32 issuing certifications for renovators/supervisors, dust sampling technicians, and renovation firms;
33 conducting outreach and education; and developing technical guidance.

34 **3.7.3 Existing Conditions**

35 The ROI for hazardous materials, solid waste, and pollution prevention includes the existing
36 contaminated sites at the proposed project site or in the immediate vicinity of a project site (i.e.,
37 adjacent to) and local disposal capacity for solid and hazardous wastes generated from the Proposed
38 Action or alternatives.

39 Currently, hazardous materials are not used or stored and hazardous or solid wastes are not generated
40 or stored on areas associated with the Proposed Action. A former hazardous landfill is located within
41 the northwest corner of the site; however, this landfill is not part of the proposed land purchase, is
42 closed and has been operating under a RCRA post-closure care permit (#HW-063[D]) since 2011. The
43 closed landfill will be monitored through the post-closure care period which ends on 6 June 2021.
44 Activities associated with the Proposed Action, such as road improvement or facility construction, would

not occur on or near the landfill. Consequently, no direct or indirect impacts to the landfill would be expected from the Proposed Action and the landfill is not discussed further in this section.

Identification of Contaminated Sites

There are no sites within the construction ROI that are included on the USEPA National Priorities List. However, activities associated with the Proposed Action do overlap historical areas of contamination from historical usage.

The Department of Defense operated at the site in 1965 and the first 3-million-pound-thrust solid propellant rocket motor was manufactured and tested at the site. NASA cancelled the large rocket motor program in mid-1965. In 1966, Thiokol began production of silicone coatings and sealants for General Electric and TEMIK (aldicarb) for Union Carbide. In 1967, Thiokol began to manufacture orthochlorobenzalmalononitrile (CS) (also known as “tear gas”) for Edgewood Arsenal. This work developed into Thiokol’s production of several “deterrent containing” munitions including 40-millimeter (mm) CS rounds and the XM-15-CS canister cluster. Later, production included M49 trip flares, 81-mm mortar illumination cartridges, and M84A1 fuzes.

From 1976 to 1986, the site was owned and operated by Union Carbide for pesticide manufacturing. In 1986, Rhone Poulenc (ultimately Bayer CropScience) acquired manufacturing, and Union Carbide retained the landfill and the Solid Waste Management Units (SWMUs). In 1994, a settlement agreement was established between Union Carbide and Thiokol to share the liability and subsequent risk. In 2001, Union Carbide merged with Dow, and Dow continues to operate and maintain the landfill. Bayer CropScience operates the manufacturing facility. Several of the activities associated with the Proposed Action overlap contamination sites primarily associated with Department of Defense and Thiokol historical operations (see Exhibit 3.7-1). These contamination sites are discussed below.

The Vertical Launch Facility overlaps two historical contamination sites, the Munitions Response Area 2 (MRA-2), also known as SWMU 9, and the Empty Drums Area. The proposed Landing Zone overlaps two historical contamination sites, Loop Road Site and SWMU 6. The Proposed Action also includes improvements to several existing roads. These roads traverse the following historical contamination sites: MRA-1 (SWMU 8), MRA-2 (SWMU 9), Loop Road Site, and SWMU 6.

MRA-2/SWMU 9

MRA-2 is located in the eastern portion of the Union Carbide Woodbine Facility (Exhibit 3.7-1). The majority of the MRA is heavily vegetated with the exception of an access road traversing the MRA and an open area in the central portion of the MRA. Open burning of off-specification Munitions and Explosives of Concern (MECs) was conducted in the open area in the central part of the MRA. The site was not intended for open detonation; however, burning activities resulted in inadvertent detonations. No explosive safety quantity distances (ESQDs) are known to have been established for the disposal site and the estimated boundary of MRA-2 as depicted on Exhibit 3.7-1 represents the maximum estimated kick-out radius from detonations in the disposal area (CH2MHill, 2012).

Historical investigations at this site identified seven MEC items, consisting of one M71A2 primer, one M7A1 primer, and five partial M84 fuzes, on the ground surface at MRA-2. The locations and type of MEC were consistent with the site’s use for munitions demolition in the center of MRA-2. Most items were found in the central portion of the MRA. A geophysical investigation at MRA-2 identified 218 geophysical anomalies, including 10 quality control items, representing potential MEC. The highest density of geophysical anomalies was in the central portion of the MRA where the former disposal area was located. Most of the additional anomalies were located along the access road to the Floyd Family Cemetery and some anomalies were detected northwest of the road (CH2MHill, 2012).

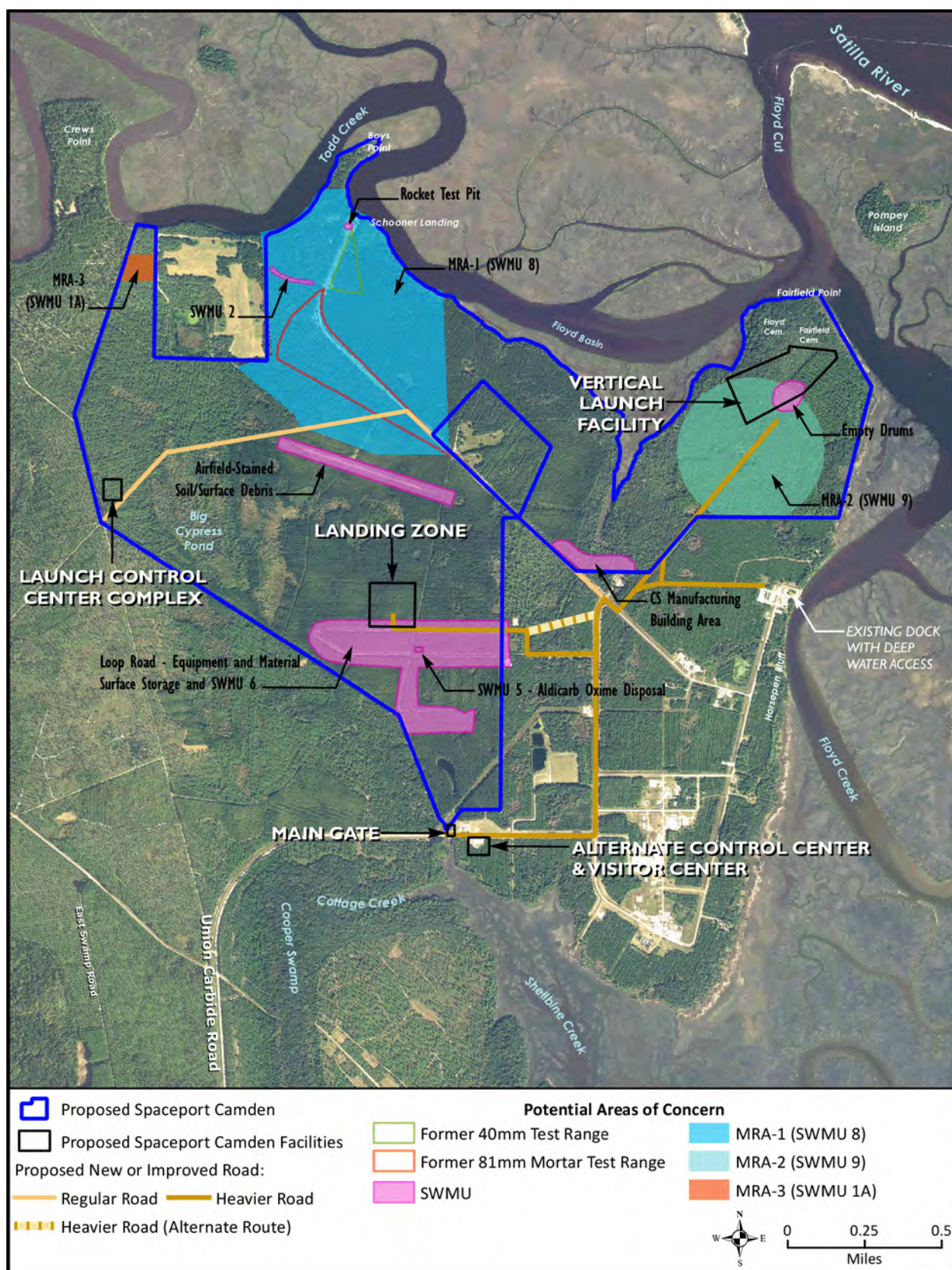


Exhibit 3.7-1. Proposed Project Locations and Existing Contamination Sites

Excavation of these anomalies during a 2009 Phase II MEC RCRA Facility Investigation resulted in the discovery of eight subsurface munitions-related items. None of these items were classified as MEC. The items included M49 flare components, M84 fuze components, and a mortar projectile primer. (Note: The Facility Investigation Report does not provide information as to how/if items discovered were managed or disposed of.) The Phase I and II MEC RCRA Facility Investigations concluded that at that time, the extent of MEC and munitions debris was adequately defined using the existing boundary (CH2MHill, 2012).

In an MEC Corrective Action Plan (CAP), dated February 2012 (CH2MHill, 2012), the following three alternatives were proposed for future management of MRA-2 and MRA-1 (discussed below):

Alternative 1 – Update Institutional Control Plan (ICP). The MEC-specific ICP consists of an MEC safety training program for all personnel visiting the site, restricted motor vehicle access to the site, and signage placed along access roads within the property boundary to alert employees and visitors of the location of potential MECs. The CAP recommended the following updates to the ICP: modification of boundaries for MRA-1 and MRA-2 based on distribution of MEC and site features; provide additional signage along the MRA borders; and potentially apply legal control mechanisms including easements, restrictive covenants, zoning, permitting, and siting restrictions.

Alternative 2 – Surface MEC Clearance with Institutional Controls – With this corrective action, all actions outlined in Alternative 1 (described above) plus a 100 percent surface clearance will be conducted within the modified boundaries of MRA-1 and MRA-2. This alternative would require all vegetation up to 3 inches in diameter to be removed from the MRAs. Surface clearing would be conducted using hand-held geophysical instruments and visual inspection to locate MEC and manually remove items from the ground surface. Surface clearance is defined as the clearance of MEC partially or completely exposed above mineral soil, including that obscured by leaves, grass, and other organic materials.

Alternative 3 – Surface and Subsurface MEC Clearance with Institutional Controls – With this corrective action, all actions outlined in Alternative 2 (described above) plus a 100 percent subsurface clearance to 2 feet below ground surface will be conducted within the modified boundaries of MRA-1 and MRA-2. Subsurface clearance would be conducted using geophysical instruments to locate MEC and a combination of picks and hand shovels to remove MEC from the subsurface (mag and dig method).

The CAP used screening factors that evaluated effectiveness, implementability, and cost of the three alternatives discussed above. Based on current and reasonably anticipated future site use and accessibility, the CAP determined that, Alternative 1 – *Update ICP*, would achieve the project objective of mitigating MEC hazards by preventing potential contact with MEC through site restrictions (signage and perimeter fencing) and passive restrictions (through training and educational programs). The CAP also determined that additional legal restrictions may be incorporated into the ICP to prevent future contact with MEC in the event of land use changes (CH2MHill, 2012). Land use and institutional controls, such as required training and MEC signage, are in place to educate and restrict access to the MRAs by unauthorized personnel.

Empty Drums Area

The Empty Drums Area is estimated to be less than 5 acres. A site reconnaissance of the Empty Drums Area conducted on October 2007 included a visual inspection of the general drum disposal area and the surrounding wooded area; an area sweep was conducted using a Schonstedt ordnance locator to determine the overall concentration of magnetic anomalies and collection of three soil sample locations based on field observations (CH2MHill, 2008).

1 Approximately 12 empty drums were observed on the ground surface. An extensive number of
2 anomalies were also identified below ground surface in an area measuring approximately 30 meters
3 (about 98 feet) (east to west) by 20 meters (about 66 feet) (north to south). No additional or significant
4 metal debris or drums were observed in the outlying areas. (Note: Available information does not
5 provide details as to how/if items discovered, such as the empty drums, were managed or disposed of.)
6 Based on field observations of areas containing unknown anomalies, three discrete soil samples and one
7 field duplicate were collected. The samples were analyzed for VOCs, semi-volatile organic compounds,
8 herbicides, and aldicarb. All detected parameters were significantly below their respective Residential
9 Screening Levels. No MECs or munitions debris were observed during the site reconnaissance or
10 sampling activities. Based on the 2007 site investigation, no further action was recommended for the
11 site (CH2MHill, 2008).

12 ***Loop Road Equipment and Material Surface Storage***

13 The Loop Road Site was reportedly used by Thiokol Corporation for the surface storage of miscellaneous
14 equipment and materials. Materials and equipment stored in this location included totes, empty rounds,
15 off-specification materials, CS canisters, and old equipment. The area encompasses approximately
16 81 acres. The majority of equipment and materials appear to have been removed. The area has never
17 been formally investigated. The site reconnaissance of the Loop Road area, which was conducted on
18 October 9 and 10, 2007, found no MEC or metallic debris during the sweep of the Loop Road area. A
19 small amount of general metal debris was noted. (Note: Available information does not provide details
20 as to how/if items discovered, such as the empty drums, were managed or disposed of.) Because the
21 site reconnaissance activities determined that only small amounts of metallic debris was present within
22 the Loop Road area, no further action was proposed. Consistent with USEPA's Final Guidance on
23 Completion of Corrective Action at RCRA Facilities (FRL-7454-7), Union Carbide recommended that a
24 determination of Corrective Action Complete without controls be considered for the Loop Road area
25 (CH2MHill, 2008).

26 ***SWMU 6***

27 At SWMU 6, surface and subsurface disposal activities occurred from 1966 to 1970. Unknown quantities
28 of scrap metal, gypsum granules, corncob grit, and tear gas grenades (i.e., "CS") were disposed of in
29 SWMU 6. Surface disposal of scrap metal, concrete, asphalt, and tar occurred south of Loop Road on the
30 east side of the firebreak road. This surface disposal area is approximately 300 feet by 40 feet. South of
31 the surface disposal area and paralleling the firebreak road are a series of discontinuous trenches in an
32 area approximately 300 feet long, 40 feet wide, and less than 6 feet deep. The ground surface is broken
33 by 3- to 4-foot-high mounds of earth, alternating with low areas running the length of the trenched
34 area. The disposal trenches are located between the earthen mounds. The mounds are believed to be
35 the soil excavated from the original trench during disposal activities. These trenches, which are
36 designated as Disposal Trench #1, contain layers of material believed to be primarily Nuchar® and
37 corncob grit (CH2MHill, 2008).

38 A 2000 Screening Level Risk Assessment concluded that the soils in SWMU 6 did not pose unacceptable
39 risks to human or ecological receptors under the future residential or industrial scenarios. Investigation
40 activities conducted as part of a 2008 Focused Field Investigation at SWMU 6 did not identify any issues
41 that would change the conclusions from the 2000 Screening Level Risk Assessment. The 2008 Focused
42 Field Investigation report recommended no further action (without any controls) for SWMU 6
43 (CH2MHill, 2008).

MRA-1 (SWMU 8)

MRA-1 consists of a former 40-mm grenade test range and a former 81-mm mortar test range located in the central portion of the Union Carbide Woodbine Facility (Exhibit 3.7-1). The majority of the area is heavily wooded with thin to moderate undergrowth.

Twenty-one MEC items, consisting of 40-mm tear gas ("CS") and high-explosive grenades, were discovered on the ground surface at MRA-1 during surface clearance and other site investigation activities during a 2008 Phase I MEC RCRA Facility Investigation. The locations were consistent with past use as a 40-mm test range, as all but one MEC items were discovered within or near the boundaries of the 40-mm test range. No surface MEC was discovered in the southern portion of MRA-1 (CH2MHill, 2012).

The subsurface geophysical investigation at MRA-1 identified 597 geophysical anomalies, including 19 quality control items, representing potential subsurface MEC. The highest density of geophysical anomalies was concentrated in the northern portion of MRA-1 within the 40-mm range and rocket test pad and along the access road to the landfill. Anomalies in the southern portion of MRA-1 were concentrated primarily along the access road bisecting the 81-mm mortar range. Excavation of these anomalies during a 2009 Phase II MEC RCRA Facility Investigation resulted in the discovery of 26 subsurface munitions-related items, of which 16 were classified as MEC and 10 as munitions debris. All of the MEC items were 40-mm CS or high-explosive grenades. The munitions debris consisted of 40-mm grenade components without energetic or chemical fillers, and one 81-mm mortar component. The majority of MECs was concentrated on the north end of MRA-1 in the estimated area of the 40-mm test range. The locations of most MEC items were consistent with historic use of the 40-mm and 81-mm ranges (CH2MHill, 2012). (Note: Available information does not provide details as to how/if items discovered, such as the empty drums, were managed or disposed of.)

As with MRA-2, three alternatives have been proposed for future management of MRA-1. These include maintaining the current MEC-specific ICP and implementing a surface or surface/subsurface clearance program at the site in combination with the ICP (see discussion above) (CH2MHill, 2012).

Land use and institutional controls, such as required training and MEC signage, are in place to educate and restrict access to the MRAs by unauthorized personnel. The current Union Carbide Woodbine MEC ICP contains detailed information on site accessibility of each MRA (CH2MHill, 2012).

Other Contamination Sites

Several other areas of contamination not discussed above are located within the site boundary (see Exhibit 3.7-1). Summary information on these sites is provided Table 3.7-1, below. Activities associated with the Proposed Action would not overlap areas for these sites, and no direct or indirect impacts would be expected from proposed road improvement or facility construction projects. Consequently, these sites are not discussed further in this document.

Table 3.7-1. Other Contamination Sites Within the Site Boundary

Site Name	Description	Activities	Status
Airfield Stained Soil/Surface Debris	A stained soil and debris area was located at the western end of the airfield and consists of a small pile of asphalt debris. ¹	Soil sampling results indicated that there has been no environmental impact to this area. ¹	No further action recommended. ¹
CS Manufacturing Building Area	The bunker and the surrounding area were reportedly used for manufacturing CS products. ¹	CS was not detected in any of the soil or groundwater samples collected during the FFI. ¹	No further action recommended. ¹

Table 3.7-1. Other Contamination Sites Within the Site Boundary

Site Name	Description	Activities	Status
MRA-3 (SWMU 1A)	A 2006 visual inspection identified scrap metal in this area.	Investigations found no surface or subsurface munitions-related items and a Phase II RFI concluded that the likelihood of MEC or MD being present at MRA-3 is low. ¹	No further action recommended. ²
Rocket Test Pit	Area was used for testing of solid rocket boosters and various ordnance products. ¹	Data collected during the FFI indicated that all detected parameters were below the industrial screening levels. ¹	No further action recommended. ¹
SWMU 2	Area was formerly used for surface storage activities that occurred during the period of 1967 to 1974. ¹	Site reconnaissance activities determined that all the surface drums formerly stored in the SWMU 2 area have been removed. ¹	No further action recommended. ¹
SWMU 5/Aldicarb Oxime Disposal	Site was reportedly used for the "one-time" subsurface disposal in 1973 of a single drum of aldicarb oxime. ¹	Site reconnaissance activities determined that the drum disposed in the SWMU 5 area had been previously removed with no apparent impacts. ¹	No further action recommended. ¹

Notes: FFI = Focused Field Investigation; MECs = Munitions and Explosives of Concern; MRA = Munitions Response Area; RFI = Resource Conservation and Recovery Act (RCRA) Facility Investigation; SWMU = Solid Waste Management Unit.

Sources:

¹ (CH2MHill, 2008)

² (CH2MHill, 2012)

Bayer CropScience Contamination Sites

Preliminary investigations have also identified 10 additional sites that may be potentially contaminated within the Bayer CropScience property. These sites are identified with the name of the suspected contaminant(s): (1) sanitary wastewater disposal; (2) gas/diesel compounds/benzene, toluene, ethylbenzene and xylene (BTEX); (3) pesticides; (4) BTEX; (5) munitions waste; (6) munitions waste; (7) acids and pesticides; (8) pesticides; (9) munitions/rocket fuel waste; and (10) pesticides.

They are located on the northwest quadrant of the Bayer CropScience property, with most of the sites adjoining or located near Union Carbide Road (which would be improved as part of the Proposed Action). They range in size from approximately 2 to 30 acres, with an average size of approximately 8 to 10 acres. Detailed information on the presence of hazardous constituents is unavailable from by Bayer CropScience. Thorough site investigations would be required prior to ground disturbance, and appropriate land restrictions and remediation would be identified in coordination with State regulators.

Asbestos/LBP

Information regarding existing buildings or foundations, when previous buildings were removed, or if remaining structures contain asbestos or LBP was not available from documents provided. Demolition or modification of any existing structures as part of the Proposed Action would be accomplished according to applicable regulatory requirements for asbestos and LBP (see Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, for more information for more information).

Identification of Solid and Hazardous Waste Disposal Capacity

Solid waste in the ROI would be disposed of at the Camden County Municipal Solid Waste (MSW) Landfill (License Number 020-017D). The MSW Landfill is located at 5395 Highway 110, Woodbine, Georgia, approximately 14 miles west of the proposed Spaceport Camden site. It is located on a 202-acre site with 56 acres currently permitted for solid waste disposal. In operation since 1992, the MSW landfill receives approximately 250 tons per day from within Camden County, plus 150 tons per day of imported solid waste. It is anticipated to be in operation until at least 2030 (Camden County, 2017a).

Construction and demolition (C&D) debris in the ROI would be disposed of at the Camden County C&D and Industrial Waste Landfill (License Number 020-019D). The landfill is located at 1600 Highway 110, Woodbine, Georgia, approximately 13 miles west of the proposed Spaceport Camden site. In operation since 2003, the landfill receives 200 to 300 tons per day of local waste and 1,200 tons per day of imported waste from nearby industries. The landfill covers 1,178 acres. Currently 294 acres are permitted to receive wastes, including C&D debris, yard trimmings, and land-clearing debris. This landfill is also approved to receive industrial wastes resulting from the manufacturing processes. It is anticipated to be in operation at least another 50 years (Camden County, 2017a). Both landfills are accessible from the proposed Spaceport Camden site via county-maintained roads that would be suitable for travel by disposal vehicles.

3.8 Historical, Architectural, Archaeological, and Cultural Resources

Historical, architectural, archaeological, and cultural resources in the study area may be affected by the proposed activities. This section outlines specific details of the NHPA Section 106 process as identified in the regulations at 36 CFR Part 800, including describing the regulatory setting, the APE, and the scope of resources within that area.

3.8.1 Definition and Description

This section provides descriptive and statutory definitions for the categories of cultural resources discussed in this EIS. Cultural resources are any prehistoric or historic district, site, building, structure, or object that meets the significance criteria for listing on the NRHP (36 CFR §60.4). These resources may also be considered important to a culture or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural resources, and traditional cultural resources. Historic properties (as defined in 36 CFR §800.16(l)(1)) are significant archaeological, architectural, or traditional resources that are either listed on, or eligible for listing on, the NRHP. Both historic properties and significant traditional cultural resources that may or may not meet the NRHP criteria (as defined in 36 CFR §60.4) but that are identified by American Indian Tribes or other recognized traditional cultural groups are evaluated for potential adverse effects from an action.

Eligibility for listing on the NRHP is defined in 36 CFR §60.4. A historic property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet at least one of four criteria: (a) association with events that have made a significant contribution to the broad patterns of our history; (b) association with the lives of persons significant in our past; (c) embodiment of distinctive characteristics of a type, period, or method of construction; (d) yield, or likelihood to yield, information important in prehistory or history. Ordinarily, a historic property must be more than 50 years old, and certain types of properties are not typically considered for listing on the NRHP, such as birthplaces and graves, and cemeteries. However, under certain criteria considerations, these properties may be eligible for listing on the NRHP, assuming that they already meet the regular requirement. For example, a grave

may be eligible for listing on the NRHP if it is associated with a historical figure of outstanding importance (Criteria Consideration C) or a cemetery may be eligible for the NRHP if it derives its primary significance from age, distinctive design features or association with historic events (Criteria Consideration D).

3.8.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

National Historic Preservation Act and other Federal Regulations for Cultural Resources

A number of Federal statutes, regulations, or guidelines must be considered when analyzing the effects of the Proposed Action on architectural, archaeological, and cultural resources. Foremost among these is the NHPA, as amended, of which Section 106 requires Federal agencies to take into account the effects of their undertakings on historic properties. Laws pertinent to the Proposed Action include, but may not be limited to, the NHPA of 1966, as amended; the Antiquities Act of 1906; the Historic Sites Act of 1935; NEPA; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the Native American Graves Protection and Repatriation Act of 1990; and the American Indian Religious Freedom Act of 1978.

Federal regulations governing cultural resource activities include the following: 36 CFR Part 800, *Protection of Historic Properties* (incorporating amendments effective August 5, 2004); 36 CFR Part 79, *Curation of Federally Owned and Administered Archaeological Collections*; 43 CFR Part 7, *Protection of Archaeological Resources*; 36 CFR Part 60, *National Register of Historic Places*; 36 CFR Part 63, *Determinations of Eligibility for Inclusion in the National Register*; and 36 CFR Part 68, *Secretary of Interior's Standards for the Treatment of Historic Properties*. Cultural resource-related executive orders that may affect the NEPA process include the following: EO 11593, *Protection and Enhancement of the Cultural Environment*; EO 13007, *Indian Sacred Sites*; EO 13175, *Consultation and Coordination with Indian Tribal Governments*; and EO 13287, *Preserve America*.

Consultation

FAA has initiated and is in the process of conducting Section 106 consultation and government-to-government consultations with federally recognized Indian tribes, the Georgia SHPO, and other entities. Other Section 106 consultations may include members of the public, non-federally recognized tribes or other ethnic identifies, or entities with economic or other interests in the resources that could experience direct or indirect effects.

Section 106 documentation is being prepared for the SHPO's review, as required by 36 CFR §800.11. On January 6, 2016, FAA initiated Section 106 consultation with the Georgia SHPO regarding the Proposed Action, and the SHPO acknowledged receipt of the notice on January 27, 2016. FAA coordinated further with the Georgia SHPO on May 24, 2016, again under Section 106 of the NHPA, regarding the APE; SHPO concurred with FAA's definition of the APE for the Proposed Action on June 12, 2016 (Exhibit 3.8-1). On April 3, 2017, and November 22, 2017, the SHPO concurred with FAA's recommendations of NRHP eligibility for archaeological and historic structure cultural resources, respectively, within the APE. On January 26, 2018, FAA submitted a Finding of Effects determination letter to the SHPO for potential impacts to those resources that are listed on, or eligible for listing on the NRHP. All correspondence is provided in Appendix A, *Public Involvement/Agency Coordination and Consultation*.

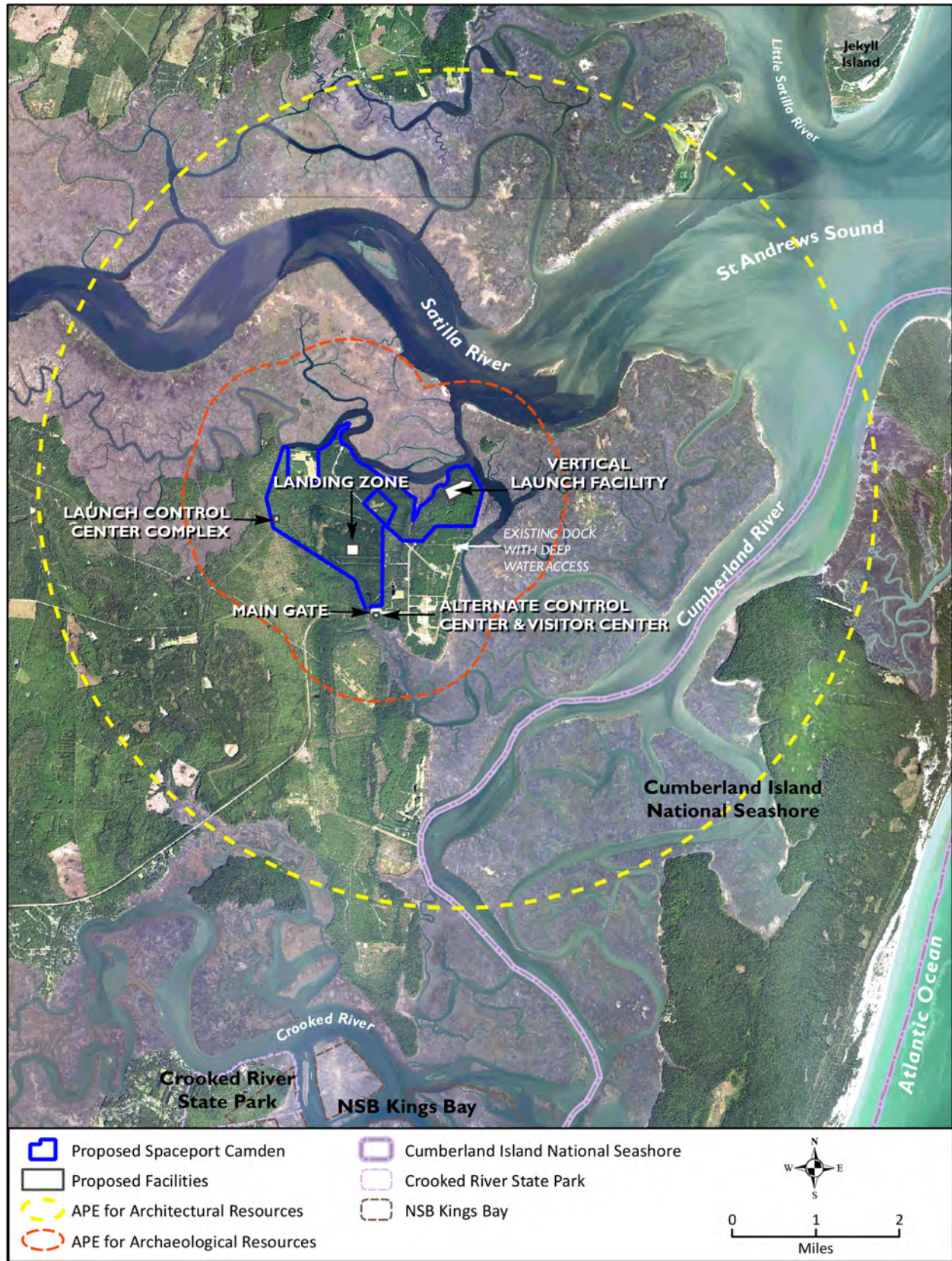


Exhibit 3.8-1. Area of Potential Effect for Proposed Spaceport Camden

1 FAA established a cooperating agency relationship with the NPS under NEPA because of the NPS's
2 special expertise in areas relevant to the NEPA process for the Proposed Action, including cultural
3 resources. NASA has a similar cooperating agency role.

4 FAA also invited the following Native American tribes to participate in Section 106 consultation in
5 compliance with the NHPA, and in government-to-government consultation in compliance with EO
6 13007, EO 13175, and NEPA: Cherokee of Georgia Tribal Council, Chickasaw Nation, Choctaw Nation of
7 Oklahoma, Georgia Tribe of Eastern Cherokee, Lower Muskogee Creek Tribe, Muskogee (Creek) Nation,
8 Poarch Band of Creeks, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and Thlopthlocco Tribal
9 Town. The Gullah Geechee Commission on the Gullah Geechee Cultural Heritage Corridor was invited to
10 participate in Section 106 consultation, as well. As of April 2017, only the Choctaw Nation of Oklahoma
11 has responded, saying that the Spaceport is "outside of the Choctaw Nation of Oklahoma's area of
12 historic interest. The Choctaw Nation of Oklahoma respectfully defers to the other Tribes that have
13 been contacted" (e-mail dated February 3, 2016). All correspondence is included in Appendix A, *Public*
14 *Involvement/Agency Coordination and Consultation*.

15 **FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures***

16 With FAA as the lead Federal agency for this NEPA project, FAA regulations pertain to the Proposed
17 Action. Relevant FAA regulations and guidelines include FAA Order 1050.1F, *Environmental Impacts:*
18 *Policies and Procedures*, and the explanatory guidance provided by the FAA 1050.1F Desk Reference.
19 FAA interaction with Native American tribes is outlined in FAA Order 1210.20, *American Indian and*
20 *Alaska Native Tribal Consultation Policy and Procedures*.

21 **Georgia Historic Preservation Act of 1980 and other State Regulations for Cultural Resources**

22 This subsection describes State or local statutes, regulations, or guidelines that must be considered
23 when analyzing the effects of the Proposed Action. Georgia has a number of pertinent planning and
24 environmental laws that dovetail with the Federal laws mentioned above (Reap, 2013). These include
25 the Georgia Historic Preservation Act of 1980, Georgia Planning Act of 1989, the Georgia Environmental
26 Policy Act, and the 1991 Cemetery and Burial Ground Protection Policy Act. Title 12, Chapter 3, Georgia
27 Code protects and regulates exploration of archaeological resources on State lands and in State waters.
28 Programs and regulated actions include the 1998 State Agency Historic Property Stewardship Program,
29 the 1992 Georgia Council on American Indian Concerns, demolition of pre-1905 courthouses and other
30 designated properties, and transfer of authority governing development rights to local communities.

31 **3.8.3 Existing Conditions**

32 **Area of Potential Effect**

33 The ROI for cultural resources is equivalent to the APE as defined under the NHPA's Section 106
34 regulations (36 CFR §800.16(d)). The APE of an undertaking is defined as "the geographic area or areas
35 within which an undertaking may directly or indirectly cause changes in the character or use of historic
36 properties, if any such properties exist" (36 CFR §800.16(d)). The APE accounts for potential direct and
37 indirect effects resulting from the proposed undertaking and considers both the construction and
38 operation of the proposed project. Because of the nature of the proposed action, FAA developed two
39 APEs in consultation with the SHPO. The APE for direct effects addresses primarily archaeological
40 resources, the resource type that may be most affected by construction-related activities, including
41 ground disturbance. For archaeological resources, integrity of location (i.e., lack of ground disturbance)
42 is often the key element in determining NRHP eligibility. The APE for indirect effects, which is associated
43 with operational activity (i.e., launches) covers a greater geographical area than the APE for direct

1 effects and includes architectural resources. Because architectural historic properties often rely heavily
2 on other key elements of integrity, including location, setting, workmanship, feeling, design, and
3 association, to convey their NRHP eligibility, noise and visual effects are the primary cause of impacts to
4 this resource type. The APE for indirect, or audible and visual effects, extends in a circle with a radius of
5 5 miles from the center of the proposed spaceport.

6 The APE for direct effects is defined as the boundary of the proposed Spaceport Camden (Exhibit 3.8-1),
7 and consists of areas where there would be direct ground disturbance, including construction of
8 facilities, installation or upgrading of utilities, access roads or other routes, and staging areas, as well as
9 the location of maintenance and operations activities. NRHP eligibility for archaeological sites is based
10 primarily on integrity of location and materials, whereas setting has less importance. The APE for direct
11 effects considers not only the horizontal extent of ground disturbance but the depth of ground
12 disturbance as well, in consideration of the potential for buried archaeological resources to be present
13 in the APE. Architectural resources, traditional cultural resources, and landscapes may also be affected
14 by ground disturbance or other aspects of construction.

15 The APE for audible and visual effects covers a greater geographical area than the APE for direct effects
16 and consists of the area within a 5-mile radius of the proposed Spaceport Camden, extending around
17 the proposed project limits (Exhibit 3.8-1). It includes archaeological resources as well as architectural,
18 traditional, and landscape historic properties. However, these resource types often rely heavily on other
19 key elements of integrity, including location, setting, workmanship, feeling, design, and association. The
20 APE for audible and visual effects also takes into account potential impacts caused by noise and
21 vibration that may extend farther than the area of direct ground disturbance. The APE for the proposed
22 project is consistent with precedents set by NEPA analyses for other commercial launch facilities. The
23 Georgia Historic Preservation Division concurred with the APE in a letter dated June 12, 2016 (see
24 Appendix A, *Public Involvement/Agency Coordination and Consultation*).

25 Summaries of the state of knowledge of historic properties and other properties considered within the
26 APEs are presented in this section under the subheadings of *Archaeological Resources*, *Architectural*
27 *Resources*, *Cumberland Island Resources*, *Traditional Cultural Resources*, and *Historic Landscapes*.

28 This description of existing conditions relies primarily on the cultural resources surveys conducted in
29 2016, which included consultation with knowledgeable sources (Cultural Resources Analysts, Inc.,
30 2017a; 2017b). The cultural resources investigations included a detailed records search that
31 encompassed previous archaeological survey work within the proposed Spaceport Camden boundary
32 plus a 1-mile radius, as well as previous architectural survey work within the proposed Spaceport
33 Camden boundary plus an APE with a 5-mile radius. Fieldwork consisted of an archaeological and
34 architectural survey of the APE that covers direct ground disturbance. The Bayer-owned parcel, located
35 inside the APE for direct effect (within the proposed Spaceport Camden boundary), but has not been
36 surveyed for archaeological resources; therefore, identification of archaeological historic properties is
37 not complete. If the Proposed Action goes forward, a Section 106 Programmatic Agreement will allow
38 phasing of identification and eventual survey of this area in the event of ground disturbance. Fieldwork
39 also included an inventory of architectural resources within the APE that encompasses architectural
40 resources, landscapes, and historic districts on Cumberland Island. Consultation with the Georgia SHPO,
41 Indian tribes, and other traditional cultural groups provides information regarding traditional cultural
42 resources.

43 **Historic Context**

44 Background information useful for understanding the importance of cultural resources by placing known
45 historic properties into their historic context can be found in Appendix F, *Cultural Resources*. The

1 analyst uses this information to determine the presence or absence of effects based on known aspects
 2 of the project. The material contained in Appendix F is summarized from the comprehensive cultural
 3 resources studies conducted for FAA (Cultural Resources Analysts, Inc., 2017a; 2017b), which contain
 4 complete citations and reference lists.

5 Table 3.8-1 lists a summary of recorded cultural resources within the APE that are listed on, or eligible
 6 for listing on, on the NRHP.

Table 3.8-1. Historic Properties Within the Spaceport Camden Areas of Potential Effect

Resource Number	Resource Description	NRHP Eligibility	Location in APE
Cultural Resources in the APE for Direct Effects: Construction Areas			
9CM30	Shell scatter & pottery, pre-contact	Potentially eligible, Criterion D	Vertical Launch Facility
9CM64	Shell midden & pottery, Mississippian	Potentially eligible, Criterion D	Vertical Launch Facility
9CM570	Shell midden & pottery, Woodland	Potentially eligible, Criterion D	Vertical Launch Facility
9CM571	Shell midden & pottery, Woodland	Potentially eligible, Criterion D	Vertical Launch Facility
Historic Properties in the APE for Direct and Audible and Visual Effects: Proposed Spaceport Camden Boundary			
9CM24	Shell scatter, Late Archaic - Mississippian	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary
9CM25	Shell midden, Woodland, Mississippian	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary
9CM26	Shell mounds, Woodland	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary
CM-CO 31	Floyd's Fairfield & Bellevue Plantations, c. 1804-c. 1877	Eligible, Criteria B, C, & D, Criteria Consideration C & D	Outside of construction area, within proposed Spaceport Camden boundary
CM-CO 31, Resource A	Anchor House ruins, early 19 th century	Eligible, Criterion C	Outside of construction area, within proposed Spaceport Camden boundary
CM-CO 31, Resource B	Charles Rinaldo Floyd Burial Site, 1845	Eligible, Criteria B & C, Criteria Consideration C	Outside of construction area, within proposed Spaceport Camden boundary
CM-CO 31, Resource C	Floyd Family Cemetery, early to mid-19 th century	Eligible, Criteria A & C, Criteria Consideration D	Outside of construction area, within proposed Spaceport Camden boundary
Cultural Resource in APE for Audible and Visual Effects: 5-mile Radius			
[No number for historic district]	Dover Bluff Club Historic District (DBC HD)	Eligible HD, Criterion C	Dover Bluff
CRA #1	Linear Ranch, 1960	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 9	Southern Bungalow, c. 1930	Contributing to DBC HD, Criterion C	Dover Bluff

Table 3.8-1. Historic Properties Within the Spaceport Camden Areas of Potential Effect

Resource Number	Resource Description	NRHP Eligibility	Location in APE
CM-DB 10	Single-story, hip-roof residence, c. 1890	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 11	Single-story, front-gable residence, c. 1940-1950	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #2	One-and-one-half-story, side-gable residence. 1967	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #3	Linear Ranch, 1971	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 12	Southern Bungalow, c. 1940	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #4	Single-story, front-gable residence, 1950	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #5	Single-story, front-gable residence, 1950	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #6	Compact Ranch, 1970	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 13	Southern Bungalow, c. 1900-1918	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #7	Single-story, front-gable residence, c. 1938-1961	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 14	Single-story, front-gable residence, c. 1944	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #8	Single-story, front-gable residence, c. 1938	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #9	Compact Ranch, 1960	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 16	Southern Bungalow, c. 1940	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 17	Single-story, front-gable residence, c. 1940	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #10	Linear Ranch, 1953	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #11	Compact Ranch, 1973	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #12	Single-story, front-gable residence, 1936	Contributing to DBC HD, Criterion C	Dover Bluff
CM-DB 19	Single-story, front-gable residence, c. 1936-1939	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #13	Single-story, side-gable secondary residence, 1970	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #14	Single-story, side-gable residence, c. 1900-1915	Contributing to DBC HD, Criterion C	Dover Bluff
CRA #16	Tabby Ruins	Contributing to Black Hammock Plantation (outside APE, of unknown NRHP eligibility), Criteria A & D	Dover Bluff

Table 3.8-1. Historic Properties Within the Spaceport Camden Areas of Potential Effect

Resource Number	Resource Description	NRHP Eligibility	Location in APE
CRA #15	Cabin Bluff Cumberland River Retreat HD (CBCRR HD), c. 1920s-1930s	Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource A	Main lodge, 1928	Contributing to CBCRR HD, Criteria A & C	Cabin Bluff
CRA #15, Resource B	Cabin Bluff Outfitters, c. late 1920s-early 1930s	Contributing to CBCRR HD, Criteria A & C	Cabin Bluff
CRA #15, Resource C	Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource D	New Hope Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource E	Pine Tree Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource F	Heritage Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource G	Shellbine Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource H	Cumberland Cabin c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource I	Coolidge Tavern c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource N	Bocce Ball Court, c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource O	Picnic Area, c. 1960s-2000	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource P	Floyd Cabin, c. late 1920s-early 1930s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource Q	Wharf/Boat House, c. 1990s	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource T	Tennis Court and Gazebo, c. 1960-1980	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource U	Golf Course, c. 1960-1980	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
CRA #15, Resource X	Landing Strip, c. 1930s-1958	Contributing to CBCRR HD, Eligible, Criteria A & C	Cabin Bluff
#78000265	High Point-Half Moon Bluff Historic District (HP-HMB), c. 1700-mid-20 th century	Listed as HP-HMB HD, Criteria A & D	CUIS: High Point-Half Moon Bluff Historic District (HD)
#78000265, Resource A	First African Baptist Church, 1937	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff
#78000265, Resource B	Rischarde Red Barn, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff
#78000265, Resource C	Alberty House, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff
#78000265, Resource D	Trimmings House, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff

Table 3.8-1. Historic Properties Within the Spaceport Camden Areas of Potential Effect

Resource Number	Resource Description	NRHP Eligibility	Location in APE
#78000265, Resource I	Cemeteries, c. 1880	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff
#78000265, Resource J	High Point Road, c. 1880	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff to High Point
#84000941	Main Road, c. 1800-1870	Listed individually (no HD), Criterion A	North end of CUIS
[no number]	Cumberland Island Cultural Historic Landscape	Eligible as Historic Landscape (no HD), Criteria A, B, C & D	CUIS

Notes: CBCRR = Cabin Bluff Cumberland River Retreat; CUIS = Cumberland Island National Seashore; c. = circa; DBC = Dover Bluff Club; HD = historic district; HP-HMB = High Point-Half Moon Bluff; n/a = not applicable; NRHP = National Register of Historic Places.

¹ If project design cannot avoid this resource, then further investigations will determine if it is eligible for listing on the NRHP; if eligible then there will be an adverse effect on historic properties.

Archaeological Resources

Known archaeological resources are found in the APEs, which include historic properties from the pre-contact (often described as prehistoric) era; Table 3.8-1 summarizes resources.

The portions of the APE for direct effects where ground disturbance would occur, consisting of the four construction zones, laydown areas, and utility corridors, have been intensively surveyed. Seven archaeological sites and three isolated finds have been recorded within the proposed Spaceport Camden that also includes a portion of the APE for audible and visual effects. All seven sites date from the pre-contact era, and include shell, either in the form of scattered shell or in shell middens. Most of the archaeological sites that include dateable material appear to be from the Woodland (3,000 to 1,000 years before present [B.P.]) and/or Mississippian (1,100 to 500 B.P.) eras. Four of the sites are located within the APE for direct effect from ground disturbance, within the Vertical Launch Facility; all four sites have not been evaluated for NRHP eligibility, and the SHPO concurs that they should be treated as if they are “potentially eligible” (SHPO letter dated April 3, 2017), until such time that a formal evaluation is completed for each site for listing on the NRHP. If found to be eligible, it would most likely be under criterion D, for their potential to yield information important in prehistory. The isolated finds, two of which are within the Vertical Launch Facility and one within the Launch Control Center Complex, are not considered eligible for listing on the NRHP as they lack integrity and are unlikely to make a significant contribution to our understanding of history or prehistory. Three sites outside of the construction area, but within the proposed Spaceport Camden boundary have not been evaluated for NRHP eligibility, and thus are treated as if they are eligible until such time as there could be an effect, at which time compliance with Section 106 of the NHPA would include NRHP eligibility evaluation.

Architectural Resources

Known architectural resources are found in the APE for direct effects and the APE for audible and visual effects outside of Cumberland Island (Cumberland Island resources are discussed in the following subsection). This category includes historic properties (i.e., those that are listed on, or eligible for listing on the NRHP) within the proposed Spaceport Camden boundary and within the 5-mile radius APE for audible and visual effects, to aid in the analysis found in Chapter 4, *Environmental Consequences*. Refer to Table 3.8-1 for a summary of information on individual resources discussed in this section.

No architectural resources are located within the construction areas of the APE for direct effects. Within the proposed Spaceport Camden boundary, but outside of the construction areas, architectural inventory identified and recorded nine architectural resources as individual features within the Floyd's Fairfield and Bellevue Plantations/Union Carbide Property. These date to two eras: the Floyd Plantations of Fairfield and Bellevue, circa 1805 to circa 1877, and the Thiokol Chemical Company, circa 1960s. From the plantation era, the ruins of the Anchor House, the Charles Rinaldo Floyd Burial Site, and the Floyd Family Cemetery are eligible for listing on the NRHP. The Anchor House ruins (Resource A of CM-CO 31) is eligible under Criterion C because of its unique design as an example of antebellum architecture in Georgia. Although lacking integrity as a complete structure, the ruins retain integrity of location, design, materials, and workmanship. The ruins still convey the original dwelling's unique anchor-shaped floor plan, and the walls retain their original tabby construction material. The Charles Rinaldo Floyd burial site (Resource B of CM-CO 31) is eligible based on its integrity, particularly of location, design, and material and under NRHP Criterion B for its association with Charles Rinaldo Floyd, whose historical significance lies in his exploration of Okefenokee Swamp and subsequent writing about the antebellum era, and Criterion C as a good and representative example of the family cemetery type. Criteria Consideration C, which states that a birthplace or grave of a historical figure is eligible if the person is of outstanding importance and if there is no other appropriate site or building directly associated with his or her productive life, also applies regarding the eligibility of his burial site. The Floyd Family Cemetery dates to the mid-19th century and is one of the oldest remaining cemeteries in the region that has not been modernized. It is eligible for listing on the NRHP based on its integrity, particularly of location, design, and material; under Criterion A for its association with Camden County's early history on a local level, Criterion C as a good and representative example of the family cemetery type and Criteria Consideration D, which requires that a cemetery derive its primary significance (in part) from age.

None of the resources related to development and operation of Thiokol are considered to be eligible for listing on the NRHP. They lack integrity of setting and significant associations, and do not meet any of the NRHP criteria.

Outside of the proposed Spaceport Camden but within the 5-mile radius of the architectural APE, architectural inventory of the entire APE for audible and visual effects identified three groups of resources. Table 3.8-1 lists the structures within the APE for audible and visual effects. Cabin Bluff, Cumberland River Retreat, south of the spaceport proposed Spaceport Camden boundary, was part of the Camden Hunt Club, founded by C.R. Floyd. The remaining 23 structures include the main lodge, the Cabin Bluff Outfitters, numerous named cabins, and various associated outbuildings (e.g., garages, recreation structures). Sixteen of these resources are considered part of a historic district that is eligible for listing on the NRHP under Criterion A as good and representative illustrations of recreational trends in the United States and under Criterion C for the architectural embodiment of those trends. Dover Bluff, north of the proposed Spaceport Camden boundary, had a similar origin, as the location of a hunting club and associated housing. The remaining Dover Bluff structures are within the 5-mile APE, but outside of Cumberland Island. These are also considered to be eligible for listing on the NRHP as contributing elements of the Dover Bluff Club Historic District under Criterion C as good and representative examples of coastal versions of vernacular house types. Also located on Dover Bluff, Tabby Ruins associated with the Black Hammock Plantation Historic District (which is outside the APE) are eligible under Criterion A for the Black Hammock association and Criterion D for information potential.

Cumberland Island National Seashore

Several structures on Cumberland Island, south of the APE for audible and visual effects, are from the 1880s and are associated with the Carnegie occupation. A few resources pre-date this period, such as the tabby house associated with the Greene-Miller occupation, a handful of cemeteries, the slave chimneys associated with the Stafford plantation, and archaeological sites.

The historic resources on Cumberland Island are contained within the following five historic districts, two archaeological districts, and three individual sites, all of which are listed on the NRHP:

- High Point-Half Moon Bluff Historic District, located at the island's north end, within the APE for audible and visual effects (#78000265, listed on the NRHP 12/22/1978)
- Little Cumberland Island Lighthouse, privately owned within privately held property, located at the island's north point, outside the APE for audible and visual effects (#89001407, listed on the NRHP 08/28/1989)
- Dungeness Historic District, located on the island's south end, outside the APE for audible and visual effects (#84000920, listed on the NRHP 02/13/1984)
- Greyfield Historic District, privately owned and located on the south within privately held property, outside the APE for audible and visual effects (#03000675, listed on the NRHP 07/24/2003)
- Stafford Plantation Historic District, located mid-island, outside the APE for audible and visual effects (#84000265, listed on the NRHP 11/23/1984)
- Plum Orchard Historic District, located mid-island, outside the APE for audible and visual effects (#84000258, listed on the NRHP 11/23/1984)
- Table Point Archaeological District, located mid-island, outside the APE for audible and visual effects (#84000260, listed on the NRHP 11/23/1984)
- Rayfield Archaeological District, located mid-island, outside the APE for audible and visual effects (#84000924, listed on the NRHP 02/13/1984)
- Duck House, outside the APE for audible and visual effects (#84000938, listed on the NRHP 02/13/1984)
- Main Road, within the APE for audible and visual effects (#84000941, listed on the NRHP 02/13/1984)

The NRHP-listed High Point-Half Moon Bluff Historic District contains two complexes of buildings: (1) an African-American Settlement at Half Moon Bluff and (2) a former resort at High Point. The African-American Settlement at Half Moon Bluff is located in the current project's APE, as is a portion of the NRHP-listed Main Road. The remainder of these historic districts and properties are outside the APE for audible and visual effects.

At Cumberland Island, the NPS has documented 91 historic structures and 64 archaeological sites. Most of these resources are considered contributing historic properties to the island's historic districts and date from the early 19th century to mid-20th century. Archaeological resources on the island may be as old as 4,000 years. Those archaeological sites within the defined historic districts are contributing resources to each district, while additional archaeological sites are located outside the districts. Five NRHP historic districts and two archaeological districts have been documented within Cumberland Island National Seashore. Only the NRHP-listed High Point-Half Moon Bluff Historic District, located on

the north end of Cumberland Island, lies within the APE for audible and visual effects; no archaeological resources have been documented in this area of the APE.

Shown in Table 3.8-1, contributing elements of the NRHP-listed High Point-Half Moon Bluff Historic District that are also within the APE for audible and visual effects, include portions of the African-American Settlement, the First African Baptist Church, Rischarde Red Barn, Alberty House, Trimmings House and Outbuildings, three cemeteries, and High Point road. The Historic District and its contributing elements are listed on the NRHP, under Criterion A, representing the evolution of an African-American community transitioning from slavery to a community without property rights to landowners who transferred their land to their descendants. The buildings and structures retain sufficient integrity of location, setting, feeling and association to convey their meaning (NPS, 1978).

Outside of the Historic District, the NRHP-listed Main Road is listed separately on the NRHP (#84000941), eligible under Criterion A for significance in the area of transportation.

Cultural Landscape

The Cumberland Island Cultural Historic Landscape, a Historic Vernacular Landscape, has been identified as eligible for listing on the NRHP under Criterion A for association with events that have made a significant contribution to the broad patterns of history. This extensive resource may also be eligible under Criteria B, C and D. This resource runs nearly the entire length of Cumberland Island, and overlaps with the APE for audible and visual effects.

Traditional Cultural Resources

When the Spanish first arrived in the region, the interior portions of what is now Camden County were inhabited by the Mocoma Native Americans, followed by the Creek Native Americans. The Tacatacura tribe of the Timucua Native Americans lived on Cumberland Island. They spoke the Mocamo dialect of Timucuan. These tribes disappeared from the region centuries ago, but numerous tribes continue to have interests in Camden County. FAA continues to consult with the following State and federally recognized tribes: Cherokee of Georgia Tribal Council, Chickasaw Nation, Choctaw Nation of Oklahoma, Georgia Tribe of Eastern Cherokee, Lower Muskogee Creek Tribe, Muskogee Creek Nation, Poarch Band of Creeks, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and Thlopthlocco Tribal Town. As of January 2018, the Choctaw Nation of Oklahoma responded that they did not want to participate in the consultation. FAA has also invited the Gullah Geechee Commission on the Gullah Geechee Cultural Heritage Corridor to participate in Section 106 consultation. No traditional cultural resources have been identified with the APE for direct effects or within the APE for audible and visual effects. If consultation with tribes or other identified groups results in the identification of traditional cultural resources, FAA will continue to consult with the appropriate groups to determine the nature of the resource. All relevant correspondence is provided in Appendix A, *Public Involvement/Agency Coordination and Consultation*.

3.9 Land Use

3.9.1 Definition and Description

Land use is the classification of activities occurring at a given location whether the land is in a natural state or has been modified or developed. Land uses are often identified by general plans, management plans, and land use policies that determine the type and extent of land use allowable in specific areas and protect specially designated or environmentally sensitive areas. Ordinances (e.g., zoning) regulate the types of activities determined to be acceptable within the identified land uses.

The Wilderness Act of 1964 (Public Law 88-57) was passed “to assure that an increasing population accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition.” *Wilderness Area* is defined in Public Law 88-57 (16 U.S.C. §§1131–1136) as “an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain” and “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions.” Based on this legal definition, five qualities of wilderness character have been identified and defined as:

- **Untrammelled** – Wilderness is essentially unhindered and free from the actions of modern human control or manipulation.
- **Natural** – Wilderness ecological systems are substantially free from the effects of modern civilization.
- **Undeveloped** – Wilderness is essentially without permanent improvements or the sights and sounds of modern human occupation.
- **Solitude or primitive and unconfined recreation** – Wilderness provides opportunities for people to experience natural sights and sounds, solitude, freedom, risk, and physical and emotional challenges of self-discovery and self-reliance. This quality focuses on the tangible aspects of the setting that affect the opportunity for people to directly experience wilderness.
- **Other features of value** – This quality captures ecological, geological, or other features of scientific, educational, scenic, or historical value that are not covered by the other four qualities but may not occur in all wilderness areas (Landres et al., 2015).

There is no record in the legislative history of the Wilderness Act as to what the framers meant by the phrase “outstanding opportunities for solitude or a primitive and unconfined type of recreation” (Landres et al., 2008). Meanings for the term “solitude” range from a lack of seeing other people to freedom from societal constraints and management regulations. Holistic views of “solitude” involve providing inspiration for an awakening of the senses, connection with the beauty of nature, and allowing one to let go of everyday obligations and to go at one’s own pace (Landres et al., 2015). Similarly, meanings for “primitive” and “unconfined” recreation are wide-ranging. The term *primitive recreation* implies traveling by non-motorized and non-mechanical means and relying on personal skills rather than facilities or outside help (Roggenbuck, 2004). “Unconfined” refers to attributes including self-discovery, exploration, and freedom from societal or managerial controls (Dawson & Hendee, 2009). Combined together, this wilderness quality provides opportunities for physical and mental challenges associated with adventure, real consequences of mistakes, and personal growth resulting from encountering and overcoming obstacles (Landres et al., 2015).

No national standards have been developed that define an acceptable degree of solitude or primitive and unconfined recreation, because each wilderness is unique in its legislative, administrative, social, and biophysical setting (Landres et al., 2005). Dawson (2004) suggests that outstanding opportunities for solitude require some degree of separation in sight, sound, and distance between visitors in the wilderness from people and activities occurring outside the wilderness. Signs of human activity and development outside wilderness that can degrade the wilderness experience include (1) automobiles and off-road vehicles, (2) aircraft overflights, (3) development and use of inholdings, (4) air and light pollution, and (5) urbanization from high ridges and peaks (Landres et al., 2015).

1 Within wilderness areas, the desire is for human-produced noise to be substantially unnoticeable, thus it
2 is possible that even “quiet urban daytime” noise levels may be perceived as too loud and would detract
3 from solitude. Natural soundscapes within wilderness areas are composed of many natural sounds, near
4 and far, and may include the sounds of ocean waves, blowing wind, chirping birds, insects, and many
5 other sounds found in nature, including at times complete silence. The opportunity to experience the
6 natural soundscape of a wilderness area unimpaired by the sounds of human civilization is considered
7 an important part of the overall visitor experience, especially as it contributes to the solitude character
8 of the wilderness area. However, no noise thresholds have been established for wilderness.

9 Light pollution affects even otherwise pristine sites because it is easily observed during the night at great
10 distances from its source in landscapes that seem untouched by humans during the day. Specifically, it
11 can damage nighttime landscapes in protected areas such as national parks and wilderness areas (Falchi
12 et al., 2016). The view of a dark night sky can be interpreted as part of the intent of the Wilderness Act
13 of 1964 to provide all Americans access to primitive and unconfined recreation and opportunities for the
14 spiritual enlightenment and personal development from wilderness experiences.

15 **3.9.2 Regulatory Setting**

16 The following laws, executive orders, agency regulations, and other guidance apply to the Proposed
17 Action.

18 **National Environmental Policy Act and Implementing Regulations**

19 Specific guidance relevant to land use is given in the CEQ NEPA implementing regulations (40 CFR
20 §1502.16(c)), which requires the discussion of environmental impacts including “possible conflicts
21 between the Proposed Action and the objectives of Federal, regional, State, and local land use plans,
22 policies and controls for the area concerned.” Where an inconsistency exists, the NEPA document
23 should describe the extent to which the agency would reconcile its action with the plan (see 40 CFR
24 §1506.2(d)).

25 **Georgia Planning Act of 1989**

26 The Georgia Planning Act of 1989 provides a framework for local, regional, and State comprehensive
27 planning. The Act enables, but does not require, Georgia municipalities and counties to develop
28 comprehensive plans and land use regulations. Only qualified local governments, which have met the
29 minimum local planning requirements established by the State, are eligible for certain State funding
30 programs and permits. Additionally, development impacts fees may only be enacted by qualified local
31 governments that have adopted State-approved capital improvement elements. The Georgia
32 Department of Community Affairs establishes minimum local planning requirements and provides
33 guidance and assistance to local governments to support planning needs.

34 In compliance with Georgia Department of Community Affairs requirements, Camden County developed
35 a local Joint Comprehensive Plan along with the City of Kingsland, City of St. Marys and City of Woodbine
36 (Coastal Georgia Regional Development Center, 2007). Although the Joint Comprehensive Plan did not
37 specifically consider the proposed spaceport, it did acknowledge that the Bayer CropScience area would
38 remain used for industrial development.

39 **Camden County Unified Development Code and Policies**

40 Land use is regulated by all levels of government. Typically the most immediate governmental
41 jurisdiction, such as county or local municipalities, is most likely to control land use and have site-
42 specific stipulations. The proposed Spaceport Camden would be located entirely within Camden County.
43 Land use planning for Camden County is primarily guided by the following:

- Camden County, City of Kingsland, City of St. Marys, *City of Woodbine Joint Comprehensive Plan 2007 – 2027* (Coastal Georgia Regional Development Center, 2007)
- *Camden Kings Bay Joint Land Use Study* (AMEC, 2014)
- *Camden County Strategic Plan 2018, 2023, 2032* (Camden County, 2015)
- Camden County Unified Development Code (UDC) & Amendments (www.co.camden.ga.us/548/UDC-Amendments)

The Wilderness Act of 1964

Congress provided for a system of wilderness lands that shall be administered for the “use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” The Act also describes these areas as “places where the earth and its community of life are untrammelled by man”... and where “the imprint of man’s work (is) substantially unnoticeable.” Refer to Section 3.2.2, *Biological Resources, Regulatory Setting*, Section 3.11.2, *Noise and Noise-Compatible Land Use, Regulatory Setting*, and Section 3.13.2, *Visual Effects, Regulatory Setting*, for laws, regulations, and other guidance associated with those resource areas as they relate to wilderness.

3.9.3 Existing Conditions

The ROI for land use includes the 11,800-acre proposed Spaceport Camden industrial site (Exhibit 2.1-1 and Exhibit 2.1-2), areas immediately surrounding the proposed Spaceport Camden project area, areas within the proposed range of launch and landing trajectories (Exhibit 2.1-4), areas within the possible hazard and closure areas (Exhibit 2.1-10 and Exhibit 2.1-11) where public access would be limited or restricted, and Cumberland Island Wilderness and proposed wilderness areas. It also includes areas where noise-compatible land use impacts are expected (Sections 3.11 and 4.11, *Noise and Noise-Compatible Land Use*).

The proposed Spaceport Camden would be located in an unincorporated area of Camden County, approximately 11.5 miles east of the city of Woodbine (see Section 1.1, *Background*). Presently the entire project site is owned by the Union Carbide Corporation and Bayer CropScience and is a combination of uplands and marshlands. Camden County has entered into an option agreement to purchase about 4,000 acres of the Union Carbide Corporation property and is considering an option to purchase an additional 7,800 acres of Bayer CropScience property.

Historical land use of the property has included two plantations and a ship-building enterprise in the 1800s and between 1927 and 1942 was redeveloped and used as a hunting preserve. In the early 1940s it was used as a tree farm and source of fiber for a local paper mill. During the 1960s, the Thiokol Corporation (later Morton Thiokol) produced and tested solid rocket motors for NASA. After that, the site was converted to manufacture military hardware and supplies, including mortar ammunition, trip flares, tear gas, and assorted chemicals, during which time regular munitions testing occurred. In 1976, Union Carbide Corporation purchased the approximately 7,193-acre property from Morton and the facility was operated by a Union Carbide subsidiary from 1976 to 1986 for pesticide manufacturing. In 1986, Union Carbide sold the manufacturing plant and some of the adjacent land to Rhone-Poulenc, which was later renamed Aventis CropScience and then Bayer CropScience. Pesticide (Temik) manufacturing operations ceased in 2012, and most of the physical buildings and related infrastructure were removed by late 2015.

1 Most industrial activities on the site were on the southeastern portion of the current property or to the
2 north along Todd Creek. The industrial complex included numerous large and tall buildings, water
3 treatment facilities, storage facilities, dock complex, and the main manufacturing facility, which stood
4 over 300 feet tall and was surrounded by several conveyor ramps up to near the top of the facility. The
5 facility hosted 24-hour operations with three shifts of employees. Due to the nature of the pesticide
6 manufacturing operations, the site was well lit at night. A 58-acre closed RCRA landfill with buffer area is
7 on the site near Todd Creek and Bayer CropScience owns an outparcel within the Union Carbide
8 property that contains an inactive wastewater spray irrigation field. Other artifacts from the site's
9 industrial history include former and closed solid waste management units, an abandoned asphalt
10 airstrip and Loop Road, a rocket test pit, and several unimproved service roads (CH2MHill, 2015).

11 Adjacent to and west of the Union Carbide property and the former Bayer CropScience industrial area,
12 the site setting is rural and largely undeveloped. Properties southwest of the site are owned by Mead
13 Timber Company and Cabin Bluff, a private hunting, fishing, golf, and recreation retreat established in
14 1928 on the Cumberland River. The Stratford Land Company owns silvicultural and natural vegetation
15 land immediately west of the site. Land use to the north remains undeveloped marsh lands. The closest
16 residence is located approximately 2.5 miles west of the western boundary of the site and additional
17 low-density residential properties are located further to the southeast along Union Carbide Road near
18 Fancy Bluff Creek. Other land uses and recreational areas nearby to the proposed Spaceport Camden
19 include the communities of Woodbine, Kingsland, and St. Marys, Naval Submarine Base Kings Bay,
20 Crooked River State Park, the Intracoastal Waterway, Cumberland Island National Seashore (see Section
21 1.1, *Background*), and Little Cumberland Island.

22 Little Cumberland Island is located at the north tip of Cumberland Island. It is a 2,400-acre tract that is
23 separated from the Great Cumberland by Christmas and Brockington Creeks. Although part of
24 Cumberland Island National Seashore, Little Cumberland Island is privately owned and not open to
25 visitors without an invitation. There are 104 parcels within Little Cumberland Island where development
26 is allowed. The majority of the lots are 2 acres, and, according to county tax records, 52 houses have
27 been built. Some lots also have additional structures (e.g., garages, sheds, boat houses). There are no
28 full time residents of Little Cumberland Island, by their homeowners association charter. Little
29 Cumberland Island is only accessible by boat; a private ferry brings residents and their guests from a
30 dock in Glynn County (to the north). The Little Cumberland Island dock is open approximately 1.5 hours
31 per tide due to the depth of the water. A main feature of Little Cumberland Island is the Little
32 Cumberland Lighthouse, the southernmost beacon on the Georgia coast. Owned and maintained by the
33 Little Cumberland Island Association, the 60-foot-tall lighthouse began operation in 1838 (Sherpa
34 Guides, 2017). The lighthouse was placed on the NRHP in 1989.

35 Zoning and land use for Camden County is handled by the Camden County Planning and Development
36 Department under the UDC and Amendments. Exhibit 3.9-1 shows the current zoning for the proposed
37 Spaceport Camden and the surrounding area. Spaceport Camden includes two parcels (Parcel ID: 155
38 001 and 155 001A). The upland portion of the property is zoned I-G (general industrial), and the
39 adjacent marsh portion is zoned C-P (conservation preservation). The description and permitted uses in
40 each district can be found in Article 2 of the Camden County UDC. The Camden County UDC and zoning
41 map can be accessed at www.co.camden.ga.us/74/Planning-Development on the Planning and
42 Development website. The UDC was amended on September 23, 2014, to allow spaceport-related
43 manufacturing as a permitted use and spaceport-related aviation as a special use in I-G zoning. The
44 future land use designation for the upland portion of the property is shown as "Industrial" and the
45 marsh portion is shown as "Conservation." Parcels to the west and south of the proposed Spaceport
46 Camden site are zoned as PD (planned development) with the future land use designated as "Mixed
47 Use" and A-F (general agriculture-forestry) with the future land use designated as "Rural Residential."

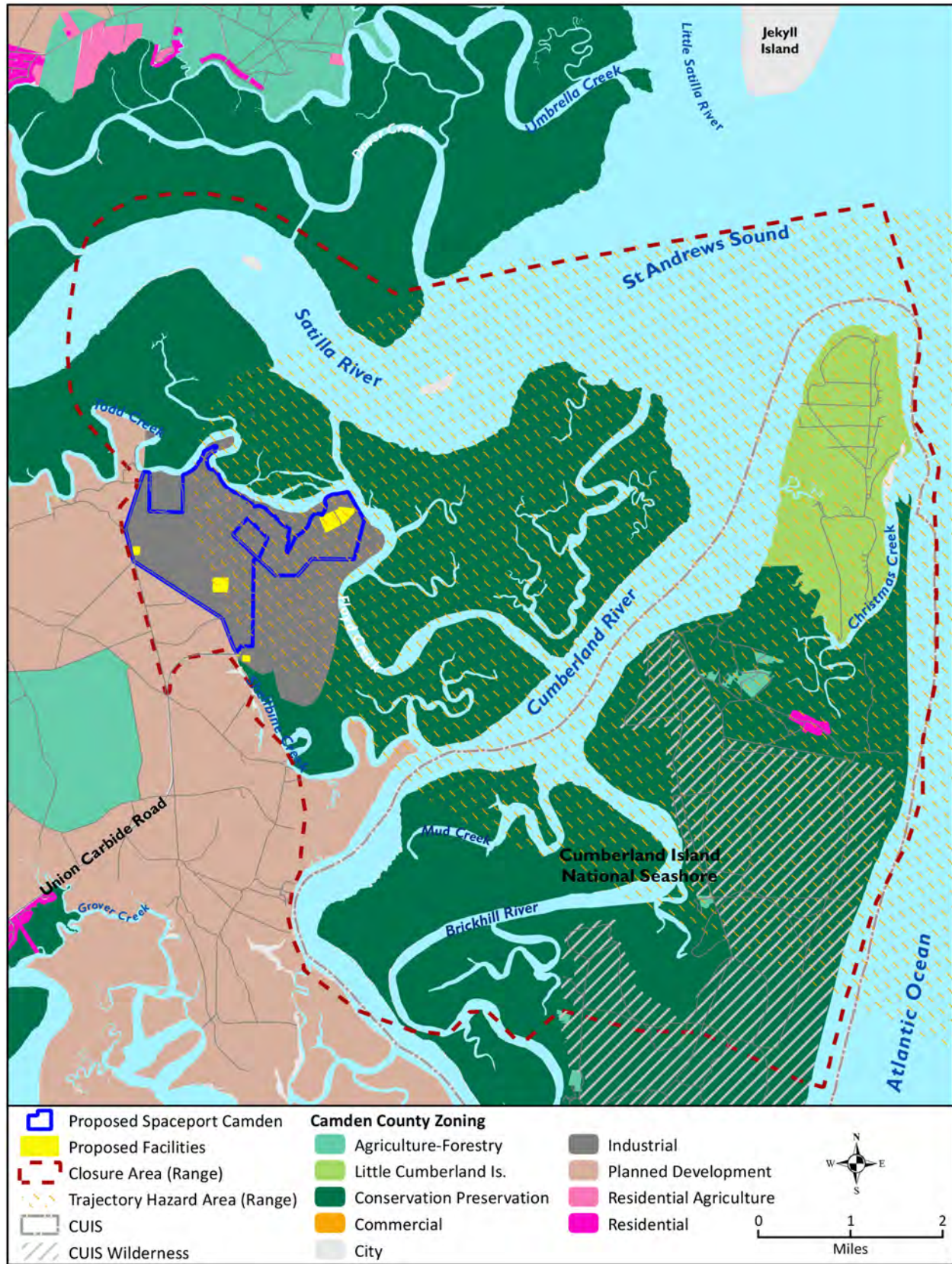


Exhibit 3.9-1. Camden County Zoning and Land Use

Table 3.9-1 shows that these designations are consistent with the zoning as required by UDC table 12.2 (Camden County, 2015).

Table 3.9-1. Future Land Use Categories and Zoning

Future Land Use Map Category	Consistent Zoning Districts	Comments
Industrial	I-R	In proximity to areas where compatibility with nearby residential or commercial uses is of concern.
	I-G	In areas where restrictions and compatibility issues are at a minimum.
Parks, Recreation and Conservation	C-P	Areas designated as public parks, the Cumberland Island National Seashore, marshes and other protected environmental areas.
Mixed Use	PD	Areas specifically approved for new or existing master planned and controlled development.
Rural Residential	A-R	Areas where agricultural uses and limited residential development on minimum 2-acre lots with public or community sewer is anticipated.

Cumberland Island Wilderness

Congress designated the Cumberland Island Wilderness in 1982 (Public Law 97-250) along the northern portion of Cumberland Island, and the boundaries were later modified in 2004 (Public Law 108-447, Cumberland Island Wilderness Boundary Adjustment Act of 2004) to remove Main Road, North Cut Road, and the Plum Orchard Spur from the wilderness designation and increase the overall acreage to 9,886 acres (Exhibit 3.9-1). The 2004 Act also designated approximately 10,500 acres as potential wilderness. Potential wilderness includes non-qualifying lands that are surrounded by or adjacent to the designated wilderness. Both designated wilderness and potential wilderness areas are managed by the NPS to protect the existing wilderness values. For the purposes of this EIS, references to the Cumberland Island Wilderness include both the designated and potential wilderness areas at Cumberland Island. A wilderness management plan for Cumberland Island Wilderness has not been developed; however, the Cumberland Island National Seashore General Management Plan (NPS, 1984) Cumberland Island Fire Management Plan (NPS, 2015) and the Transportation Management Plan (NPS, 2009) each contain measures that address managing and preserving the wilderness character of Cumberland Island.

The wilderness character of the Cumberland Island Wilderness is described below:

Untrammelled: The Cumberland Island Wilderness is allowed to function essentially unhindered and free from human manipulation; however, much of the upland portion of the wilderness is in transition from past human land-disturbing activities and historic fire suppression efforts. In addition, Cumberland Island Wilderness has multiple private inholdings, which impact the use of the island by private residents. Before 2004, the portion of Main Road that was included in the original wilderness designation was used by motorized vehicles of island residents. With the passage of Public Law 108-447 in 2004, which removed roads and right-of-ways from the designation, NPS was then authorized to provide motorized trips to access both the north and south ends of the island and to conduct management activities necessary for the administration and preservation of wilderness resources and reserved estates. Although these activities are typically viewed as beneficial, the following NPS management activities do impact the untrammelled quality of the wilderness, as they involve human actions to manipulate the components of ecological systems within the wilderness: monitoring and protecting endangered species, accessing and preserving cultural resources, managing invasive non-native species, setting prescribed fires, and managing wildfires. Vehicle use by private residents and NPS

management actions on the roads directly adjacent to wilderness degrades the untrammelled quality of Cumberland Island. Climatic and oceanic forces associated with climate change also influence the wilderness. Natural processes are degraded in some areas by existing development in proximity to the wilderness (i.e., fire regime) (NPS, 2013).

Natural: Cumberland Island Wilderness protects a diversity of natural habitats and species, many of which are protected under State and Federal law (i.e., sea turtles, piping plovers). Although these habitats and species now are largely free from the influences of modern civilization, much of the forested portion of the wilderness was historically grazed, cultivated, and logged. These influences, plus past exclusion of natural fire, have impacted the vegetative communities in the wilderness, but current prescribed burning efforts and invasive non-native plant species management are positive forces for restoring natural communities on the Island. Non-native feral animals (i.e., pigs and horses) do continue to negatively impact the natural quality of the wilderness through disturbance of natural successional processes and vegetative patterns (NPS, 2013). Refer to Section 3.2.3, *Biological Resources, Existing Conditions*, for additional descriptions of vegetative communities and wildlife species found within the wilderness.

Undeveloped: Although most of the Cumberland Island Wilderness is undeveloped, the island has a long history of human occupation, and some private property, improvements, and development still exist within the wilderness boundary. Development includes a small number of residential structures on reserved estates, along with dirt access roads. The Main Road, Plum Orchard Spur, and North Cut Road are technically outside of designated wilderness (25-foot right-of-way), but they do traverse through the wilderness, and provide access for more vehicular access than is typical for wilderness areas (NPS, 2013).

Solitude or Primitive and Unconfined Recreation: The Cumberland Island Wilderness provides an opportunity for visitors to directly experience wilderness, including solitude, risk, challenge, and freedom from societal pressures. Entrance to Cumberland Island National Seashore is only accessible via ferryboat or private boat, and the maximum number of visitors allowed access to Cumberland Island National Seashore per day is 300. Within the wilderness, camping is allowed only at three designated camping areas (Hickory Hill, Yankee Paradise, and Brickhill Bluff). The maximum number of campers allowed at each wilderness camping area is 24 (NPS, 2017c). To reach the wilderness portion of the Island, visitors must hike in from the ferry drop-off, and most visitors remain in the immediate vicinity of the drop-off area. This physical isolation and daily visitor cap provides visitors with outstanding opportunities for outdoor recreation and solitude. Although recreation is largely “unconfined” within the wilderness, visitors are subject to some restrictions (i.e., seasonal restriction from nesting areas of federally listed species). Access is also restricted to hunters only during certain times of year; bows, primitive weapons, and modern weapons are permitted during hunts. Visitors enjoy recreational activities such as hiking, camping, hunting, fishing, stargazing, photography, bird watching, beach combing, wildlife viewing, swimming, private boating, and biking. See Section 3.12.1.3, *Socioeconomics, Existing Conditions*, for additional information on recreational activities on Cumberland Island.

Alterations to the natural soundscape, lightscape, or viewshed can diminish a wilderness visitor’s perception of solitude, and in some cases may impact the natural quality of the wilderness. The natural soundscape of the island includes blowing wind, ocean waves, and chirping birds, frogs, and insects, and at times may include total silence. Anthropogenic noise sources within and adjacent to Cumberland Island Wilderness that alter the natural soundscape include other visitors, park management activities, silvicultural operations, residents of the reserved estates, vehicles on Main Road, Plum Orchard Spur, and North Cut Road, and operation of the Land and Legacies Tour. Beach driving, which is regulated by GDNR, can be seen and heard from the wilderness (NPS, 2013). Noise sources from the areas outside wilderness includes industrial and military facilities to the south and west, mid- and low-level aircraft

1 over-flights, and vessel traffic on the waterways around the island (NPS, 2013). Acoustic readings
2 recorded for the Cumberland Island National Seashore Travel Management Plan documented daytime
3 noise levels across the island ranging from 35 to 70 decibels (dBA) (NPS, 2009). More recently, NPS
4 estimates that median sound levels in the area are between 36 and 38 dBA, based on long-term
5 measurements in parks as well as urban and rural areas across the country (NPS, 2016c).

6 The lightscape is an important element of wilderness character. Although Cumberland Island National
7 Seashore is not a “dark skies park” as designated by the International Dark-Sky Association (IDA) (IDA,
8 2017b), there is no measurable nighttime radiance on the northern half of Cumberland Island and Little
9 Cumberland Island (Exhibit 3.13-4). Pockets of measurably noticeable night radiance are evident at the
10 Lodge at Cabin Bluffs (Exhibit 3.13-4 and Exhibit 3.13-3). Radiance levels increase around Naval
11 Submarine Base Kings Bay and St. Marys. To the north of the Satilla River, light is detectable near Dover
12 Road (see location on Exhibit 3.13-3) on Piney Bluff, continuing to intensify towards Jekyll Island and
13 Brunswick. To the west, the proposed Spaceport Camden site is essentially unilluminated by artificial
14 light sources, but light levels do increase around Woodbine. Section 3.13.3.2, *Visual Effects, Existing*
15 *Conditions, Light Emissions*, provides additional description of the current light emissions at the
16 proposed spaceport site and surrounding areas.

17 Viewsheds for the Cumberland Island Wilderness are dominated by vegetation, water, and sky,
18 depending upon the viewer’s location. From interior portions of the wilderness, views to the mainland
19 and proposed spaceport site are typically blocked by intervening terrain (i.e., remnant dune formations)
20 and forest. On the west shore of Cumberland Island, views toward the proposed site are intermittent
21 through gaps in screening vegetation and in some areas have fairly open views to the site over the low
22 salt marsh (Exhibit 3.13-3 and Table 3.13-1). The proposed spaceport site is predominantly vegetated,
23 with the imprint of industrial uses, infrastructure, forestry, and silviculture punctuating the landscape.
24 From Cumberland Wharf and Brickhill Bluff, there are open views to the eastern portion of the proposed
25 spaceport site as middle-ground marsh with a band of darker forest canopy beyond the marsh; sky and
26 water are the dominant elements of the view. The wide viewshed from Brickhill Bluff includes small
27 housing enclaves, Cabin Bluff resort, and Jekyll Island community, which is more noticeable at night
28 when lights are visible, but not glaring. Overall viewshed quality to the west of the wilderness from
29 Brickhill Bluff and Cumberland Wharf is moderate to high.

30 Exhibit 3.13-1 shows a series of photographs of the site and surrounding areas that illustrate the
31 prevalent views and visual character. Although some locations have no view or limited visual connection
32 to the proposed Spaceport Camden site, all the representative locations would have visibility to rocket
33 launches if oriented toward the flight path (see Section 4.13.1.2, *Operation*, and Table 4.13-1). Section
34 3.13.3, *Visual Effects, Existing Conditions*, provides additional detail on the existing visual character of
35 the proposed Spaceport Camden site and the surrounding areas and viewsheds.

36 **Other features of value – Cultural Resources:** Cultural features and remnants may be found throughout
37 Cumberland Island, which contributes to the area’s features of historic values. There are five historic
38 districts and two archaeological districts that are listed on the NRHP. Two historic districts, High Point-
39 Half Moon Bluff Historic District and Plum Orchard Historic District, occur either within or directly
40 adjacent to Cumberland Island Wilderness. The High Point-Half Moon Bluff Historic District is located on
41 the northern portion of the island and overlaps with Cumberland Island Wilderness. It contains two
42 structural complexes, a cemetery, three archaeological sites, and an archaeological zone on Terrapin
43 Point. These sites reflect Native American habitation, colonial occupation, an African American
44 community, and hotel/retreat periods on Cumberland Island. Plum Orchard Historic District is adjacent
45 to Cumberland Island Wilderness, located at approximately the island’s mid-point along the western
46 shoreline. This district contains 16 structures, cultural landscape features, a cemetery, and a large

archaeological site. Section 3.8.3, *Historical, Architectural, Archaeological, and Cultural Resources, Existing Conditions*, describes all other historic, architectural, archaeological, and cultural resources found on Cumberland Island.

3.10 Natural Resources and Energy Supply

3.10.1 Definition and Description

This section describes the natural resources (such as water, metal, asphalt, aggregate, etc.) and energy supplies (such as coal or diesel for electricity; natural gas for heating; and fuel for construction equipment and commercial space launch vehicles) that would be consumed under the alternatives evaluated in this EIS. Consumption of these resources would occur as a result of proposed construction and operational activities.

3.10.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action:

- EO 13693, *Planning for Federal Sustainability in the Next Decade* – Revokes EO 13514 and EO 13423 and establishes updated Federal sustainability and GHG emission reduction goals.
- EO 13123, *Greening the Government Through Efficient Energy Management* – Calls for Federal agencies to improve the energy efficiency of their buildings, promote the use of renewable energy, and reduce GHG emissions associated with energy use.
- *The Safe Drinking Water Act* – Authorizes USEPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water.

Georgia State Executive Order 04.24.08.02

Executive Order 04.24.08.02, signed in 2008, requires Georgia State departments and agencies to reduce energy consumption by 15 percent by 2020 compared to a 2007 baseline on a per square foot basis. The State would accomplish this through energy efficiency or through a combination with renewable energy. The Executive Order also encourages local governments, schools, individuals, and businesses to match the State's commitment.

Georgia State Minimum Standard Energy Code and Georgia Safe Drinking Water Act of 1977

Other Georgia statutes and Executive Orders related to natural resources and energy include the following:

- *Georgia State Minimum Standard Energy Code* – The State of Georgia adopted the energy standards listed in the 2009 International Energy Conservation Code with some amendments and modifications as described in *Georgia State Supplements and Amendments to the International Energy Conservation Code (2009 Edition)*.
- *Georgia Safe Drinking Water Act of 1977* – Establishes policies, procedures, requirements, and standards to carry out the purposes and requirements of the Federal *Safe Drinking Water Act*.

Camden County Unified Development Code Article 9: Environmental Protection

The Camden County UDC Article 9: Environmental Protection defines the minimum requirements and standards for the protection of the natural environment within the county. It includes restrictions on the use of land near certain rivers and streams, within groundwater recharge areas susceptible to pollution and in wetlands. The objective of this Code is to protect the drinking water quality of the aquifers that supply water to the residents of the jurisdiction and the state, protect the natural habitat of animal and plant life relative to water resources, and protect valuable water-related and other natural resources.

3.10.3 Existing Conditions

The ROI for natural resources and energy supply would include local and municipal sources of water and electricity, which would be supplied by providers and sources in Camden County. Resources such as building materials, aggregate, and fuel supplies required for the construction and operation of Spaceport Camden would be transported to the site from suppliers within the broader southeastern Georgia and northeastern Florida region. Other fuel and fuel-related materials could be provided by suppliers in the southeastern and eastern United States.

3.10.3.1 Natural Resources

Due to the lack of improvements and limited infrastructure available at the proposed project site, all facilities and much of the infrastructure would be newly constructed. Natural resources required for the construction and operation of Spaceport Camden would include fuels, industrial gases, building materials, and water (aggregate [concrete] and asphalt supply are discussed in Section 3.10.3.2, *Aggregate and Asphalt Supply*). Wood is expected to be a minor material used during spaceport construction. Natural gas is not expected to be used for heating or other energy needs during construction and operation of the spaceport.

Building materials are readily available from multiple suppliers in Southeastern Georgia and northeastern Florida. All building materials would be purchased from these suppliers and then transported to the proposed project site. Suppliers of building materials for the construction of Spaceport Camden would include, but are not limited to:

- **Pre-engineered metal:**
 - Pre-Engineered Steel Inc., Jacksonville, Florida (39 miles from the site)
 - American Eagle Steel Buildings, Jacksonville, Florida (67 miles from the site)
- **Metal roofing and siding:**
 - Century Metal Roofing Supply, Waverly, Georgia (32 miles from the site)
 - Metal Sales Manufacturing Corporation, Jacksonville, Florida (52 miles from the site)

As discussed in Section 3.14, *Water Resources*, the major sources of usable groundwater in Camden County are one of three aquifers: the Floridan, the Brunswick, and one unnamed surficial aquifer. There is currently no potable or other water supply available at the proposed site of Spaceport Camden. The nearest municipal water supplies are located in the cities of Woodbine and Kingsland. The nearest available water comes in the form of two existing deep wells located on the Bayer CropScience portion of the property. These wells could be used to provide both potable water (well water would be treated onsite prior to entry into distribution system) and any water required for operational needs via pipelines. Although not in use at this time, the wells have been authorized to withdraw a combined

1.7 million gallons of water daily from the Floridan Aquifer and would be ready for use when project activities begin.

There are no sewage disposal utilities/septic systems currently available at the proposed project site. The nearest active septic system is located at the main gate building that provides access to the current Union Carbide Corporation and Bayer CropScience site.

3.10.3.2 Aggregate and Asphalt Supply

Construction of new facilities and infrastructure on Spaceport Camden would require large amounts of concrete (sand and gravel [aggregate]) and asphalt. There are currently a number of aggregate and asphalt suppliers in the vicinity of Camden County, some of which include:

- Seaboard Construction – Brunswick, Georgia (44 miles from the site)
- Duval Asphalt – Jacksonville, Florida (55 miles from the site)
- Preferred Materials – Jacksonville, Florida (45 miles from the site)

3.10.3.3 Energy Supply

Resources required for the supply of energy include electricity and fuels. No electrical power is currently available on the proposed Spaceport Camden site. Power is supplied to Camden County by Georgia Power, which serves over 2,450,000 customers and over 292,000 in the Coastal Region, where Camden County is located. Georgia Power generates power using oil and gas (39 percent), coal (34 percent), nuclear (25 percent), hydroelectric (2 percent), and “other sources” including biomass, landfill, gas, and solar (less than 1 percent) (Georgia Power, 2016).

The existing electrical infrastructure nearest to the Spaceport Camden site is a dedicated Georgia Power 115 kV transmission line routed from U.S. 17 through Harrietts Bluff/Union Carbide Road to the power substation on the property currently owned by Bayer CropScience. The primary electrical distribution nearest to the Spaceport Camden site is an aerial construction using wood poles and, while the line is currently unused, it is in good condition and ready for use (Mcdill, 2016). Electric power is available at the main gate building for the Union Carbide Corporation and Bayer CropScience properties and would be provided by the installation of power lines on wooden poles and connected to existing offsite power lines to each of the proposed new facilities.

The operation of Spaceport Camden would require the use of various fuels, propellants, and pressurants for launch vehicles. Small quantities of diesel fuel and gasoline would be needed during the construction of Spaceport Camden and could be provided by any of multiple local suppliers (less than 50 miles from the site). Diesel fuel and kerosene required for the operation of the spaceport are available from multiple regional suppliers in Southeastern Georgia and northeastern Florida. Industrial gases are available from regional suppliers in Georgia and Florida. Pressurants and other propellants could be provided by regional suppliers in Florida, Alabama, and Texas. Payload fuels are typically specialized materials and could be provided by suppliers some distance from the site (New York and Illinois) Suppliers of fuels and other resources for spaceport operation include, but are not limited to:

- Kerosene (RP-1):
 - Ocean Petroleum, Inc., Brunswick, Georgia (41 miles from site)
 - Paul Murray Oil Company, Inc. Jacksonville, Florida (48 miles from site)

- Diesel Fuel:
 - J D Moore, Inc, Brunswick, Georgia (40 miles from site)
 - Ocean Petroleum, Inc., Brunswick, Georgia (41 miles from site)
- Industrial Gases (Pressurants) and Liquid Oxygen:
 - Compressed Gas Solutions, Orlando, Florida (185 miles from site)
 - Praxair, Augusta, Georgia (230 miles from site)
 - Air Liquide, Houston, Texas (920 miles from site)
- Payload Fuels (e.g., UDMH, MMH, NTO):
 - BOC Sciences, Shirey, New York (970 miles from site)
 - Ox-Chem Corporation, Wood Dale, Illinois (1,075 miles from site)
- Hydrazine:
 - Alchem Laboratories Co., Alachua, Florida (135 miles from site)
 - Laysan Bio, Inc., Arab, Alabama (505 miles from site)

3.11 Noise and Noise-Compatible Land Use

3.11.1 Definition and Description

Noise is considered unwanted, extraneous, or annoying sound that interferes with or disrupts normal human activities. Although exposure to very high noise levels can cause hearing loss, the principal human response to noise is annoyance. The response of different individuals to similar noise events is diverse and is influenced by the type of noise, perceived importance of the noise, its appropriateness in the setting, time of day, type of activity during which the noise occurs, and sensitivity of the individual. Because noise affects several resource areas, it is discussed in several sections of this EIS. This section will concentrate general noise impacts to humans and structures. Noise impacts on biological resources are discussed in Section 4.2, *Biological Resources*, impacts on historical, architectural, and cultural resources are discussed in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*, and impacts on socioeconomics, environmental justice, and children's environmental health and safety risks are discussed in Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and are sensed by the human ear. Sound is all around us. The perception and evaluation of sound involves three basic physical characteristics:

- Duration—the length of time the sound can be detected
- Magnitude—the acoustic energy, which is expressed in terms of sound pressure, in decibels (dB)
- Frequency—the number of cycles per second the air vibrates, in Hertz (Hz)

The duration of a noise source can be continuous (constant), transient (short-duration), or impulsive (typically less than 1 second) (USACHPPM, 2005). Launch noise and sonic booms (i.e., shock waves created from supersonic flight when a launch vehicle travels faster than the speed of sound) are classified as transient noise events. A transient noise event has a beginning and an end where the sound

temporarily rises above the background and then fades away. Transient sounds are typically associated with a sound source that moves, such as, an aircraft overflight (USACHPPM, 2005).

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. This vast range means that using a linear scale to represent sound level is not feasible. The dB is a logarithmic unit used to represent the magnitude of a sound, also referred to as the sound level.

All sounds have a spectral content, which means their magnitude or level changes with frequency, where frequency is measured in cycles per second or Hz. To mimic the human ear's non-linear sensitivity and perception of different frequencies of sound, the spectral content is weighted. For example, environmental noise measurements are usually on an "A-weighted" scale that filters out very low and very high frequencies in order to replicate human sensitivity. It is common to add the "A" to the measurement unit (dB) in order to identify that the measurement has been made with this filtering process (dBA). Exhibit 3.11-1 provides a chart of A-weighted sound levels from typical noise sources. Some noise sources (e.g., air conditioner, vacuum cleaner) are continuous sounds that maintain a constant sound level for some period of time. Other sources (e.g., automobile, heavy truck) are the maximum sound produced during an event like a vehicle pass-by. Other sounds (e.g., urban daytime, urban nighttime) are averages taken over extended periods of time.

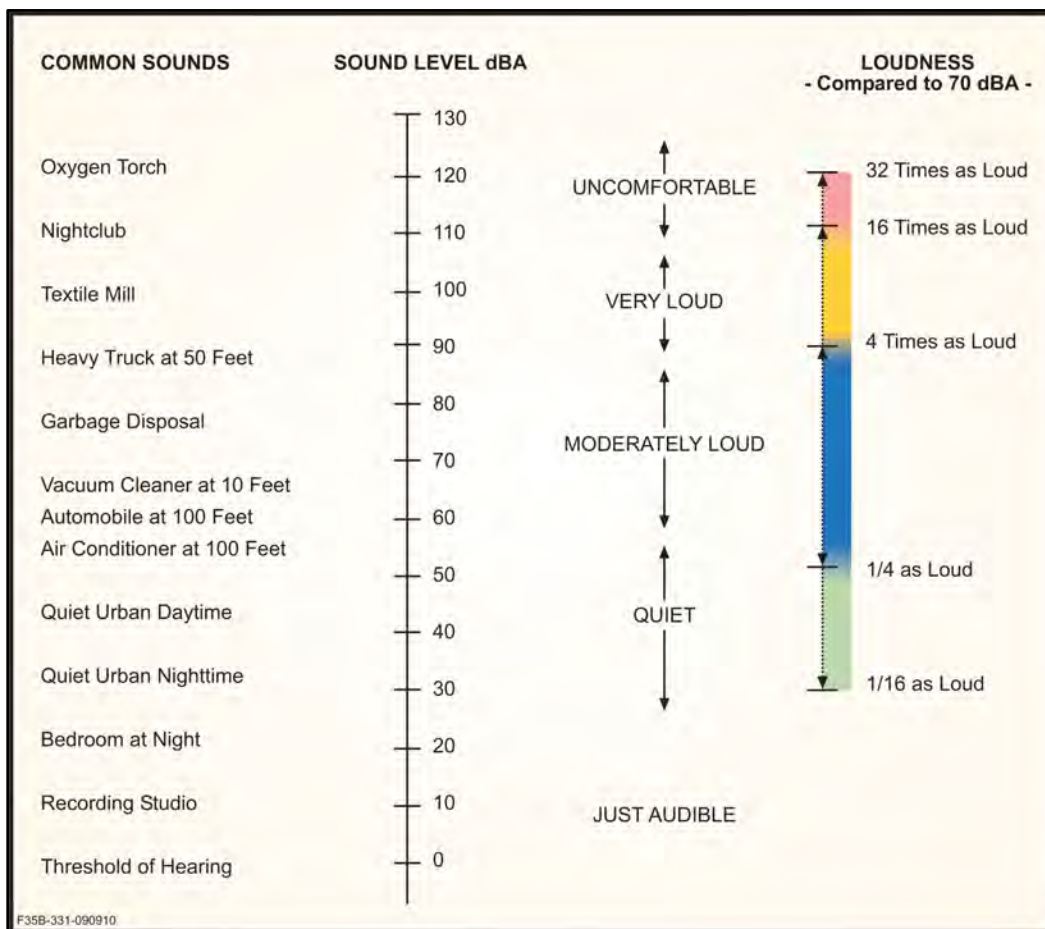


Exhibit 3.11-1. Typical A-Weighted Levels of Common Sounds

A metric is a system for measuring or quantifying a particular characteristic of a subject. Since noise is a complex physical phenomenon, different noise metrics help to quantify the noise environment and describe impacts from noise. The selection of particular metrics for noise analysis is based on the nature of the noise event and who or what is affected by the sound. For example, noise metrics used to evaluate the highest sound level occurring during a single event are different than those used for evaluating long-term average sound levels. The noise metrics discussed below are discussed in greater detail in Appendix C, *Noise*.

Overall sound pressure level (OASPL). The OASPL provides a measure of the sound level at any given time.

Maximum OASPL ($L_{\max}$). The $L_{\max}$ indicates the highest OASPL over the duration of the noise event. The $L_{\max}$ is a single-event metric that is useful for analyzing short-term responses to noise exposure (FICON, 1992). OASPL can be presented as either unweighted or A-weighted. The maximum unweighted OASPL ($L_{\max}$) is used for the analysis of noise impacts to structures.

Maximum A-weighted OASPL ($L_{A,\max}$). The $L_{A,\max}$ represents the maximum A-weighted OASPL during the noise event. A-weighting approximates the natural range and sensitivity of human hearing (USACHPPM, 2005). The $L_{A,\max}$ is used for the analysis of noise impacts to humans and wildlife.

Sound Exposure Level (SEL). The SEL represents both the magnitude of a sound and its duration. SEL provides a measure of the cumulative noise exposure of the entire acoustic event, but it does not directly represent the sound level heard at any given time. Mathematically, it represents the sound level of a constant sound that would, in 1 second, generate the same acoustic energy as the actual time-varying noise event. For sound generated by rocket launches, which last more than 1 second, the SEL is greater than the $L_{\max}$ because an individual launch can take minutes and the $L_{\max}$ occurs instantaneously.

Time Above A-weighted OASPL threshold. During times when OASPL is above 66 dBA, normal conversation becomes difficult. Specifically, studies have shown that background sound levels must remain below 66 dBA to maintain a sentence intelligibility of 95 percent for two people standing outside approximately 3 feet apart (USEPA, 1974). Sentence intelligibility of 95 percent usually permits reliable communication because of the redundancy in normal conversation.

Day-Night Average Sound Level (DNL). The DNL metric represents an average sound level over the course of an average annual day. In order to account for increased human sensitivity to noise at night, a 10-dB penalty is applied to events occurring between the hours of 10:00 p.m. and 7:00 a.m.

Sonic Boom Overpressure measured in Pounds per Square Foot. A sonic boom is the sound associated with the shock waves created by a vehicle moving through the air faster than the speed of sound. When heard at ground level, a sonic boom consists of a positive pressure change associated with air particles being pushed out of the way by the front of the vehicle and then a negative pressure change of equal magnitude after the vehicle and its rocket plume have passed by. The magnitude of the changes in air pressure is typically expressed in pounds per square foot (psf).

3.11.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action. Noise criteria have been developed in order to protect the public health and welfare of surrounding communities. The following paragraphs describe noise criteria that address human annoyance, hearing conservation, and structural damage.

FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*

Human Annoyance. The metric DNL has been found to correlate well with the human annoyance for regularly-occurring transportation noise (Schultz, 1978; Finegold, 1994), and several Federal agencies have adopted DNL as the primary noise metric for prediction of community reaction to noise (FICAN, 1997; FAA, 2015; FICON, 1992). FAA Order 1050.1F states that, in most locations, a significant noise impact would occur if the Proposed Action would cause noise sensitive areas to experience a 1.5 dBA DNL increase when compared to the no action alternative during the same time frame and the end-state noise level would be at or above 65 dBA DNL. The FAA Order notes that the 65 dB DNL threshold does not fully address the effects of noise on visitors to areas such as national parks or designated wilderness areas where a quiet setting is a generally recognized purpose and attribute. In wilderness areas in particular, there is a strong expectation that anthropogenic noise intrusions will be infrequent. In this EIS, supplemental noise metrics are used in the evaluation of the significance of noise impacts within national parks, national wildlife refuges, and historic sites including traditional cultural properties (see Section 3.5, *Department of Transportation Act, Section 4(f)*, and Section 3.8, *Historical, Architectural, Archaeological, and Cultural Resources*).

The correlation between DNL and human annoyance has only been thoroughly studied for regularly occurring transportation noise sources including highways, rail corridors, and airports. Studies used to develop DNL annoyance dose-response relationships have not included rocket noise which has historically been an irregularly occurring event. Thus, it is acknowledged that the suitability of DNL for the prediction of impacts associated with infrequent rocket and sonic boom events is uncertain. DNL contours are provided in the impacts analysis of this EIS to estimate the potential annoyance as FAA considers DNL the best available metric for prediction of long-term human annoyance.

Because the ROI includes noise sensitive areas where existing noise levels are very low and where a quiet setting is a generally recognized purpose and attribute, DNL analysis is supplemented in this EIS with additional noise level metrics that predict activity interference. Activity interference, including interference with speech (or listening to the radio, television, or natural sounds) and sleep, is often the direct cause of annoyance. When background noise levels increase to above 66 dBA, sentence intelligibility between people conversing in normal voices at a distance of 3 feet drops below 95 percent, making continued communication difficult. Although speakers could theoretically raise their voices to continue communicating, the amount of time during which noise levels are above 66 dBA is an indicator of the prevalence of speech interference. The likelihood of sleep disturbance depends on several factors that are specific to the sleeper such as depth of sleep, and it is impossible to accurately predict whether any given individual will be awakened by any particular noise event. However, the American National Standard Institute has developed a dose-response relationship between indoor A-weighted SEL and the average probability of awakening (ANSI, 2008). The dose-response relationship referenced in this EIS was derived based on the results of several sleep studies involving individuals in a laboratory setting and is thought to represent the high end of potential sleep disturbance for individuals sleeping in an unfamiliar setting and exposed to unfamiliar sounds.

Structural Damage. FAA Order 1050.1F does not give specific instructions on the assessment of potential structural damage caused by noise. In this EIS, potential impact criteria are established based on the results of past studies. The likelihood of damage is unique to the characteristics of the sound experienced (e.g., intensity, duration, and frequency), the materials of which the structure is built, and the condition of the structure. Most damage claims are for brittle objects such as glass and plaster.

A NASA study examined the relationship between sound levels generated during Saturn V rocket stationary ground test and the number of structural damage claims received (Guest & Slone, 1972). It was found that, at an average continuous sound level of 120 dB, one damage claim per 100 households

could be expected and, at an average 111 dB, one damage claim per 1,000 households could be expected. The study did not report whether the reported damage claims were eventually found to be valid. The Saturn V rockets were run stationary for several minutes generating steady and intense noise levels. Rocket launch and recovery noise, on the other hand, is variable as the rocket ascends or descends and only maintains its maximum noise level at any particular location on the ground for a short time. For this reason, the likelihood of structural impacts caused by stationary rocket tests is somewhat higher than the likelihood associated with rocket launches. Nevertheless, Guest and Sloan's damage claim study is the most relevant dataset linking rocket noise with potential structural damage, although it will slightly overestimate the likelihood of impacts associated with launch and recovery maximum noise levels.

Sonic booms are also commonly associated with structural damage. Table 3.11-1 summarizes the types of damage that may be expected at various overpressures. A large degree of variability exists in the possible effects of a sonic boom. For example, the probability of a window breaking when exposed to a sonic boom of 1 psf ranges from one in a billion to one in a million (Sutherland, 1990) with much of the variability depending on the condition of the glass. At 10 psf, the probability of glass breaking is between 1 in 100 and 1 in 1,000. Laboratory tests involving glass have shown that properly installed glass will not break at overpressures below 10 psf, even when exposed to repeated sonic booms (White, 1972). Damage to plaster has the potential to occur in the same range of overpressures as damage to glass. Plaster often cracks due to shrinkage over time or due to structural settling. Sonic boom damage to plaster often occurs when internal stresses are already high as a result of these processes. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf, below which damage is unlikely (Haber & Nakaki, 1989).

Table 3.11-1. Possible Damage to Structures from Sonic Booms

Sonic Boom Overpressure Nominal (psf)	Type of Damage	Item Affected
0.5 – 2	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
	Glass	Rarely shattered; either partial or extension of existing.
	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 – 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 – 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.

Table 3.11-1. Possible Damage to Structures from Sonic Booms

Sonic Boom Overpressure Nominal (psf)	Type of Damage	Item Affected
	Walls (in)	Inside ("party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Notes: psf = pounds per square feet.
Source: (Haber & Nakaki, 1989)

14 CFR Part 150: Appendix A

Land Use Compatibility. FAA land use compatibility guidelines published in 14 CFR Part 150: Appendix A, indicate that all of the listed land use categories are compatible at noise levels below 65 dB DNL. However, FAA Order 1050.1F states that special consideration needs to be given to noise sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR Part 150 are not relevant to the value, significance, and enjoyment of the area in question. In this EIS, land use compatibility considerations will recognize areas in which a quiet setting is a recognized attribute and part of the purpose of the area.

Occupational Safety and Health Administration and National Institute for Occupational Safety and Health Standards

Hearing Conservation. Multiple Federal government agencies have provided guidelines on permissible noise exposure limits to protect human hearing. The most conservative workplace noise level limit has been set by the Occupational Safety and Health Administration (OSHA) at 115 dBA for non-impulsive noise over an allowable exposure duration of 15 minutes (OSHA, 2008). The National Institute for Occupational Safety and Health (NIOSH) limits for non-impulsive noise are less conservative (NIOSH, 1998). For impulsive noise, such as sonic booms, OSHA and NIOSH have both established maximum allowable peak noise levels of 140 dB, which equates to an overpressure of about 4 psf. Workplace noise level recommendations are designed such that, even with steady near-daily exposures over the course of an entire career, the excess risk of developing occupational NIHL is minimized.

3.11.3 Existing Conditions

The property that would become Spaceport Camden is located in an unincorporated area of Camden County approximately 11.5 miles due east of Woodbine, Georgia. Until 2012, the proposed spaceport site was an active pesticide manufacturing plant and industrial site, but is currently under-utilized after approximately three years of demolition (until 2015); discussions of current and historical land use for

both the launch site and adjacent land areas are provided in Section 3.9, *Land Use*. Anthropogenic noise sources include vehicles and equipment associated with silvicultural operations and vehicular traffic. Aircraft, including those associated with nearby Naval Submarine Base Kings Bay are an occasional noise source. The NPS estimates, based on long-term measurements in parks as well as urban and rural areas across the country, that median sound levels in the area are between 36 and 38 dBA (NPS, 2016c). A separate set of measurements corroborates this estimate, finding that noise levels in rural areas are typically in the range of 30 to 40 dBA (Harris, 1979; USEPA, 1974).

3.12 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

3.12.1 Socioeconomics

3.12.1.1 Definition and Description

Socioeconomics refers to features or characteristics of the social and economic environment. This section describes the elements of the human environment (e.g., population, employment, income, housing, public services, and finances) that could be affected by the Proposed Action and alternatives.

3.12.1.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

Uniform Relocation Assistance and Real Property Acquisitions Policy Act of 1970

Uniform Relocation Assistance and Real Property Acquisitions Policy Act of 1970 (49 CFR Part 24,) ensures the fair treatment of those displaced by federally funded programs, federally assisted programs, or state and local agencies receiving Federal funds.

3.12.1.3 Existing Conditions

The ROI for this socioeconomics analysis is Camden County, Georgia. Camden County would be the area in which the majority of direct and indirect effects on socioeconomic variables arising from the Proposed Action would likely occur. The State of Georgia and the United States serve as the geographic regions for comparative analysis.

Employment and Income

In 2015, the total employment (number of jobs) in Camden County was 25,584 (BEA, 2016). The largest industries in terms of employment in Camden County were government and government enterprises (34.4 percent), professional, scientific, and technical services (14.7 percent), and retail trade (10.8 percent) (BEA, 2016) (see Table 3.12-1).

Table 3.12-1. Employment by Industry in Camden County, 2015

Industry	Number of Employees	Percent of Total Employment
Farm Employment	63	0.2%
Forestry, fishing, and related activities	NA	NA
Mining, quarrying, and oil and gas extraction	17	0.1%

Table 3.12-1. Employment by Industry in Camden County, 2015

Industry	Number of Employees	Percent of Total Employment
Utilities	NA	NA
Construction	NA	NA
Manufacturing	764	3.0%
Wholesale trade	422	1.6%
Retail trade	2,765	10.8%
Transportation and warehousing	NA	NA
Information	216	0.8%
Finance and Insurance	703	2.7%
Real estate and rental and leasing	720	2.8%
Professional, scientific, and technical services	3,757	14.7%
Management of companies and enterprises	73	0.3%
Administrative and support	965	3.8%
Educational services	179	0.7%
Health care and social assistance	1,292	5.1%
Arts, entertainment, and recreation	286	1.1%
Accommodation and food services	1,918	7.5%
Other services (except public administration)	1,264	4.9%
Government and government enterprises	8,789	34.4%
Total Employment	25,584	100.0%

Notes: NA = not available.
Source: (BEA, 2016)

Unemployment rates in Camden County were adversely impacted by the national recession and experienced an increase from 4.0 percent unemployment in 2007 to 9.9 percent in 2010. Since 2010, unemployment rates have declined annually (see Table 3.12-2). The Bureau of Labor Statistics (BLS) reports that in 2015, the average annual unemployment rate was 5.5 percent, down from 6.6 percent in 2014 (BLS, 2016a). The unemployment rate in Camden County has remained below the state average but above the national average between 2010 and 2015 (BLS, 2016a; 2016b). As of March 2017, unemployment rates for Camden County in 2016 were not available from the BLS but state and national data were available and indicate that the unemployment rates have declined further from 2015 levels (BLS, 2017).

Table 3.12-2. Unemployment Rates (%)

Location	2010	2011	2012	2013	2014	2015	2016
Camden County	9.9	9.6	8.6	7.8	6.6	5.5	NA
Georgia	10.5	10.2	9.2	8.2	7.1	5.9	5.4
United States	9.6	8.9	8.1	7.4	6.2	5.3	4.9

Notes: NA = not available.
Source: (BLS, 2016a; BLS, 2016b; BLS, 2017)

The top 10 largest employers in Camden County are listed in Table 3.12-3. The largest employer in Camden County is the Naval Submarine Base Kings Bay with over 8,000 employees (Camden County Chamber of Commerce, 2016). The economic impact of Naval Submarine Base Kings Bay to the local community is estimated at over \$855 million (Camden Partnership, 2017).

During the 2010-2014 American Community Survey (ACS) survey period, Camden County had a lower per capita income than both the state and the nation (Table 3.12-4). The state of Georgia had the lowest median household income compared to the county and the nation (USCB, 2014a).

Table 3.12-3. Top Ten Largest Employers in Camden County

Employer
Naval Submarine Base Kings Bay
Camden County School System
Express Scripts
Lockheed Martin
Camden County Government
Walmart Supercenter
Southeast Georgia Health System Camden Campus
Kings Bay Support Services
Winn Dixie
Publix

Table 3.12-4. Per Capita Income and Median Household Income

Location	Per Capita Income	Median Household Income
Camden County	\$23,856	\$52,473
Georgia	\$25,737	\$49,620
United States	\$28,930	\$53,889

Note: inflation-adjusted dollars

Source: (USCB, 2015a; 2015b)

Economic Activity

Tourism

Tourism is the fifth largest employer in the state of Georgia and has an economic impact of over \$53 billion and supports more than 411,000 jobs (10.2 percent) of all payroll employment in the state (Georgia Department of Economic Development, 2016). Cumberland Island National Seashore is an important economic contributor to the local city of St. Marys and to Camden County, contributing approximately \$3 million to the local economy in 2014 (Jackson, 2015). The maximum number of individuals allowed access to Cumberland Island National Seashore per day is 300. The number of recreation visitors annually to Cumberland Island National Seashore over the past 10 years has fluctuated, with a low of 40,291 visitors in 2005 and a high of 91,996 visitors in 2010. Some of the variation during the 10-year span could have resulted from a change in the method of calculating the number of visitors. Prior to 2007, visitor counts were determined by the number of people going to Cumberland Island, whereas at the beginning of 2007, visitor counts were determined by the number of people who visited the mainland (i.e., visitor center and museum) in addition to those going to Cumberland Island (NPS, 2018a). In 2015, there were 59,859 visitors, a decline of 2.51 percent, from the 61,401 visitors in 2014 (see Exhibit 3.12-1) (NPS, 2016a). The most popular months for visitors to Cumberland Island National Seashore are typically March, April, and July. The least popular months for visitors are January, December, and August.

Entrance to Cumberland Island National Seashore is only accessible via ferryboat or private boat. Entrance fees for adults without a valid annual pass are \$7 and are good for one week. Round-trip passage aboard the ferry (excluding taxes) are \$18 for children (12 and under), \$26 for seniors (65 and

over), and \$28 for adults (NPS, 2016b). The ferry runs seven days per week during the spring, summer, and fall with two departure times and three return times each day. During the winter, the ferry runs five days per week (there is no scheduled service on Tuesday and Wednesday) with two departure times and two return times on those days. Reservations for the ferry and campgrounds can be made up to six months in advance.

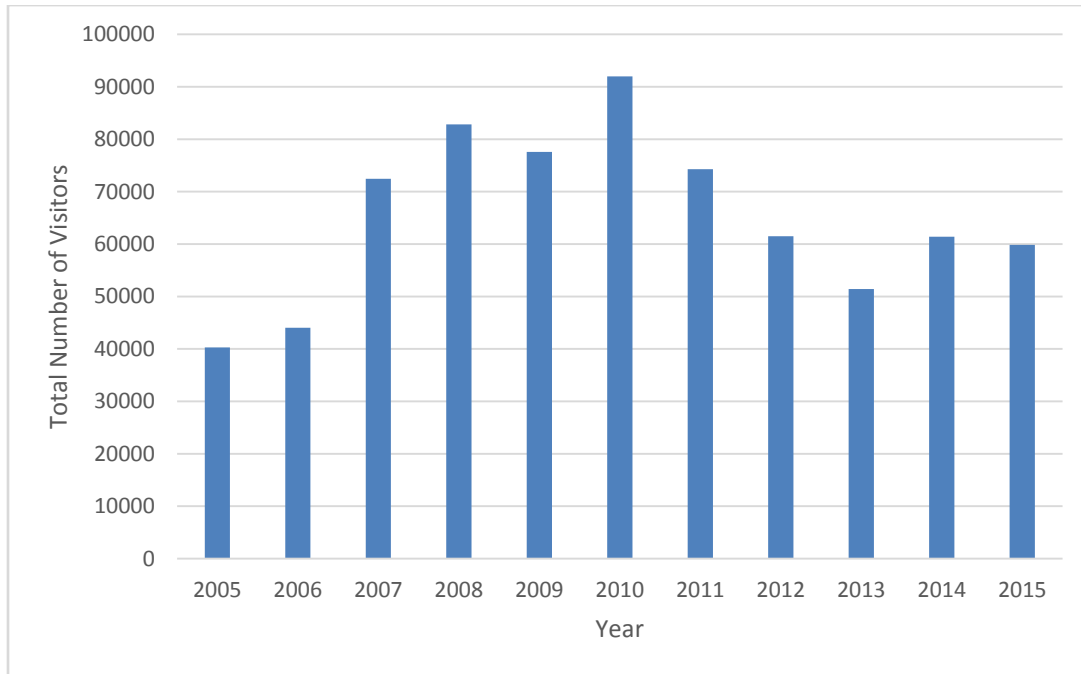


Exhibit 3.12-1. Annual Recreation Visitors to Cumberland Island National Seashore, 2005–2015

Source: (NPS, 2016a)

Recreational activities on and surrounding Cumberland Island include hiking, camping, hunting, fishing, stargazing, site tours, photography, bird watching, beach combing, wildlife viewing, swimming, private boating, and biking. There are 50 miles of hiking trails throughout Cumberland Island. There are five campground sites available at Cumberland Island, including Sea Camp Campground, Stafford Beach Campground, Hickory Hill, Yankee Paradise, and Brickhill Bluff. The total capacity at each site is 60 campers at Sea Camp Campground and 20 campers per site at the other four locations. Reservations for campsites can be made up to six months in advance. Brickhill Bluff is located within the hazard and closure areas in the 115-degree trajectory range shown in Exhibit 2.1-11.

Cumberland Island hosts several managed hunts each year. Six managed hunts on Cumberland Island are scheduled each year from October through January. Each hunt lasts for two to three days. Hunters are required to camp at Hunt Camp near Plum Orchard Historic District or Brickhill Bluff Campground.

There are numerous fishing opportunities, including stream fishing, freshwater fishing, shore and deep sea fishing, and gathering shrimp and crabs from marsh areas. Popular species caught in the Cumberland River, a channel located 11.4 miles from St. Marys, include striped bass, rainbow trout, and brown trout.

Forestry

The Georgia Forestry Commission compiles economic benefits of the forest industry in Georgia. Due to data limitations on the number of employees and wages and salaries data for forestry, fishing, and related activities industry, the Georgia Forestry Commission quantifies economic impacts of the forest

industry according to 12 different jurisdictions consistent with the state's regional commission (Georgia Forestry Commission, 2015). Camden County is one of 10 counties that make up the Coastal Regional Commission in Georgia. In 2015, the forestry industry's regional impact in the Coastal Regional Commission was \$1.69 billion in output, 4,434 jobs, and over \$401.5 million in wages and salaries (Georgia Forestry Commission, 2015). Timber industry and forestland are located in the western part of Camden County, west of Highway 17. Approximately 251,208 acres, or 66.07 percent, of existing land uses in Camden County are categorized as agricultural/forest. This category refers to land dedicated to farming, agriculture, or commercial timber or harvesting (Coastal Georgia Regional Development Center, 2016).

Maritime Transportation

There are two deepwater ports in Georgia including the Port of Savannah and the Port of Brunswick. Both deepwater ports along with two inland ports in Bainbridge and Columbus make up the Georgia Port Authority. The deepwater ports combined had an employment impact of 1,058 jobs in Camden County (Georgia Port Authority, 2015). Both port terminals are located more than 15 miles north of the proposed Spaceport Camden site.

Military

Naval Submarine Base Kings Bay was established in Camden County in 1978 and has a significant economic impact on the county and the surrounding region. The total economic impact of Naval Submarine Base Kings Bay in direct revenues is estimated at \$855 million (Camden Partnership, 2017). When considering the direct revenue with indirect purchases and induced transactions, the total economic output of Naval Submarine Base Kings Bay is estimated at \$1.142 billion. The total direct and indirect workforce at Naval Submarine Base Kings Bay is estimated at 8,882 (Camden Partnership, 2017).

Aerospace

Another important economic industry throughout the state is the aerospace industry. There are over 500 aerospace-related firms with the majority concentrated around Cobb, Fulton, and DeKalb County in the northwestern portion of the state. During calendar year 2011, the aerospace industry employed 88,873 people with \$8.4 billion in total wages paid and an economic output of \$30.7 billion throughout the state (Georgia Institute of Technology, 2013). During the same year, the aerospace industry generated \$1.6 billion in revenues for the state budget, approximately 10 percent of the state's tax revenue in fiscal year 2012 (Georgia Department of Economic Development, 2016). The employment multiplier and income multiplier of the aerospace industry are higher than many other industries due to the high output and wages in Georgia. The employment and income multipliers in the state have been estimated at 2.27 and 1.88, respectively (Georgia Institute of Technology, 2013).

Population and Housing

The most recent five-year population estimate from the 2011-2015 American Community Survey from the U.S. Census Bureau for Camden County was 51,445 people. This represents an annual increase of 0.4 percent since 2010 Census estimates. There are three cities in the county including Woodbine, St. Marys, and Kingsland. The city of Woodbine is the county seat of Camden County. In 2015, the population in Woodbine was estimated at 1,552 people. The largest city in terms of population in Camden County is St. Marys. In 2015, St. Marys had a total population of 17,675 while Kingsland had a total population of 16,239. Both cities had a higher population density than the county, state and the nation (see Table 3.12-5).

Table 3.12-5. Population Estimates in the Region of Influence

Location	Population Density (Persons per square mile) 2010	2010 Census Estimates	2015 Estimates	Annual Percent Change (%)	2020 Estimates	2030 Estimates
Camden County	82.4	50,513	51,445	0.4	65,453	70,997
Woodbine City	NA	1,412	1,552	1.9	1,826	1,980
St. Marys City	760.7	17,121	17,675	0.6	20,825	22,589
Kingsland City	373.2	15,946	16,239	0.4	17,513	18,996
Georgia	168.4	9,687,653	10,006,693	0.7	11,326,787	13,154,530
United States	87.4	308,745,538	316,515,021	0.5	NA	NA

Note: NA = not available.

Source: (AMEC, 2014; USCB, 2015c)

The number of housing units in the ROI totaled approximately 21,366 units in 2015 (see Table 3.12-6). The rental vacancy rate in Camden County is higher than the state and the nation. Kingsland City had the lowest rental vacancy rate in Camden County while Woodbine City had the highest.

Table 3.12-6. Housing in the Region of Influence

Location	Total Housing Units	Total Vacant Units	Homeowner Vacancy Rate	Rental Vacancy Rate
Camden County	21,366	2,728	2.1	8.8
Woodbine City	613	107	1.3	14.0
St. Marys City	7,384	955	2.5	9.5
Kingsland City	6,667	623	2.8	8.7
Georgia	4,133,065	558,703	2.7	8.7
United States	133,351,840	16,425,535	1.9	6.4

Source: (USCB, 2015d)

The launch site is located in the unincorporated area of Woodbine City approximately 11 miles east of the city of Woodbine. The closest residence is located approximately 2.5 miles due west from the western edge of the property. There are structures associated with the Lodge at Cabin Bluff, a resort facility located approximately 2.5 miles due south of the main gate. There are no residential properties located on the Proposed Spaceport Camden launch site or within the DNL noise footprint as shown in Exhibit 3.12-2.

There are approximately 56 structures located on the northern portion of Census Tract 106.02 on Cumberland Island and Little Cumberland Island in the 83-degree trajectory hazard and closure area (Exhibit 2.1-10) and approximately 35 structures located on Cumberland Island and Little Cumberland Island in the 115 degree trajectory hazard and closure area (Exhibit 2.1-11), for a total of 91 structures on Census Tract 106.02 within the trajectory hazard area shown in Exhibit 3.12-2. Structures principally include houses (some permanent or semi-permanent residences), with some sheds, out buildings, and vacation cottages(NPS, 2018a) and Little Cumberland Island in the 83-degree trajectory hazard and closure area (Exhibit 2.1-10), and approximately 35 structures located on Cumberland Island and Little Cumberland Island in the 115 degree trajectory hazard and closure area (Exhibit 2.1-11), for a total of 91 structures on Census Tract 106.02 within the trajectory hazard area shown in Exhibit 3.12-2. Structures principally include houses (some permanent or semi-permanent residences), with some sheds, out buildings, and vacation cottages(NPS, 2018a).

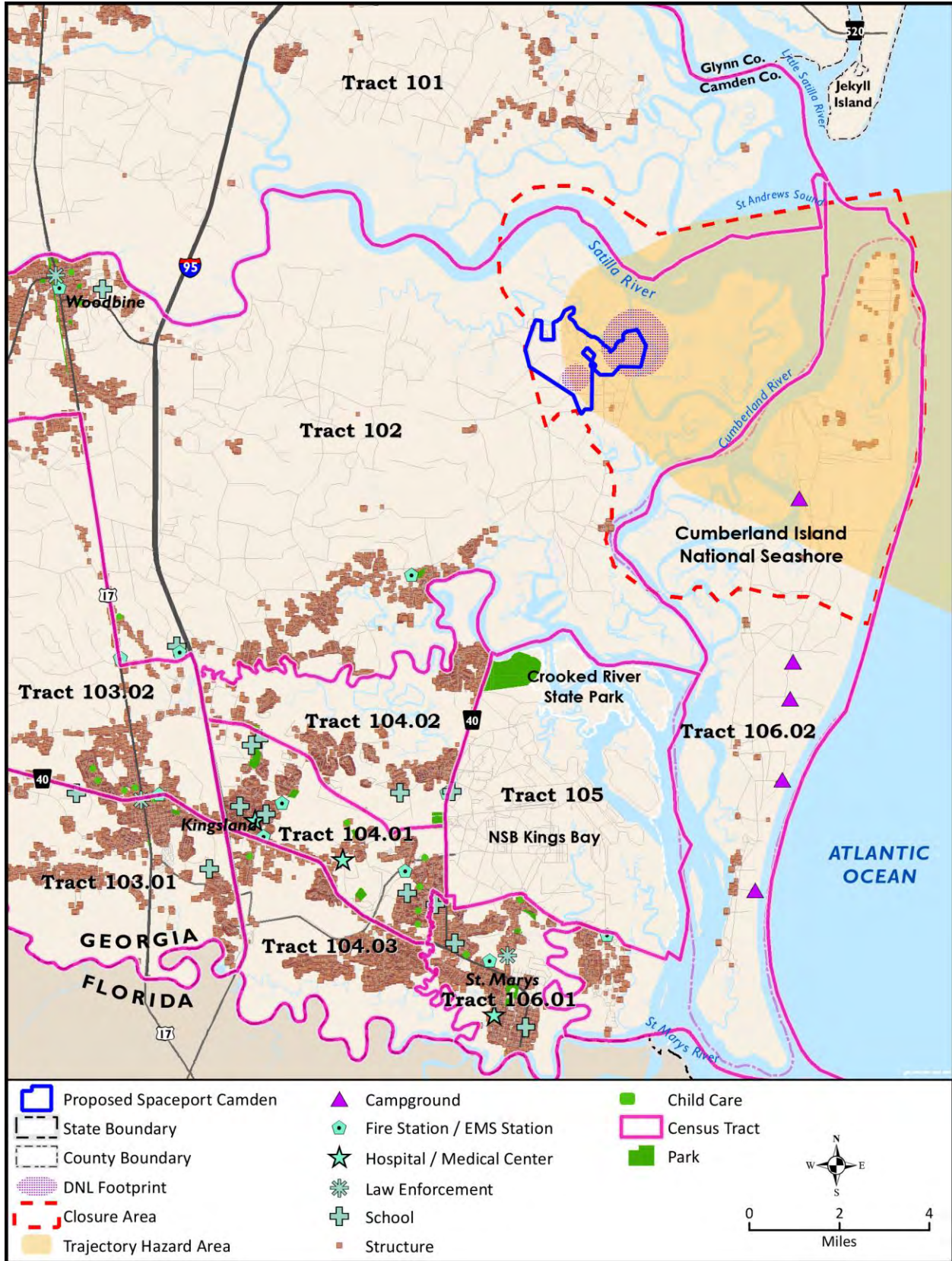


Exhibit 3.12-2. Public Services in the Region of Influence

Public Services and Social Conditions

Emergency response services in Camden County include the Camden County Sheriff's Office, the Kingsland Police Department, the St. Marys Police Department, the Georgia State Patrol, Camden County Fire Rescue, Kingsland Fire Rescue, St. Marys Fire Department, Georgia Forestry, Animal Control, and Search & Rescue. The Kingsland Police Department provides law enforcement services to citizens and visitors of the city of Kingsland. The Kingsland Police Department employs 42 people, including 40 sworn law enforcement professionals and 2 nonsworn clerical employees (Kingsland, 2016). The St. Marys Police Department serves the city of St. Marys. The St. Marys Police Department employs 35 sworn law enforcement professionals and 4 non-sworn personnel (St. Marys, 2016). The Camden County Fire and Rescue Department provides advanced life support and fire services to Camden County. There are 12 fire stations (including Station 14 in Kingsland, which is closed) throughout Camden County that the fire rescue department utilizes (Camden County, 2017b). Station 20 is located at the Greyfield Inn on Cumberland Island and is made up of volunteer staff (Camden County, 2017c). Fire protection responsibilities for the private tracts located on Little Cumberland Island and Cumberland Island are shared by the Georgia Forestry Commission and the Camden County Fire and Rescue. In addition to a limited number of qualified fire fighters, logistical issues, and the need for boat transportation for personnel and equipment, emergency and fire response times can vary between two to four hours, depending on the location of the incident, availability of firefighters, tide tables, and availability of boat operators (NPS, 2015).

The closest emergency response services to the proposed spaceport site include the Woodbine Police Department located 10.6 miles from the site and the Camden County Fire Rescue Station #16 located 5.3 miles from the site. The Southeast Georgia Health Systems Hospital's Camden Campus is approximately 12 miles southwest of the proposed spaceport site. The Camden Campus is a 40-bed acute-care hospital located in St. Marys (Southeast Georgia Health System, 2016). Additional medical services are offered at Amelia Medical Care Urgent Care, located approximately 30 miles southwest of the site in Kingsland.

The Camden County School District is the public school district in Camden County. There are nine elementary schools, two middle schools, and one high school in the district. The total enrollment for all schools was 9,050 during the 2015 to 2016 school year. The student-teacher ratio in the Camden County public school district is approximately 17:1 in grades pre-kindergarten through elementary school, 16:1 for middle schools, and 15:1 for the high school (Public School Review, 2016) compared to the maximum student-teacher ratio in Georgia which is 18:1 for kindergarten, 21:1 for grades 1 to 3, 28:1 for grades 4 to 8, and between 32:1 and 35:1 for grades 9 to 12 depending on the class subject (Georgia Department of Education, 2015). The closest school to the site is the Crooked River Elementary located 9 miles from the site. There are no schools located within the trajectory hazard area range as shown in Exhibit 3.12-2.

3.12.2 Environmental Justice

3.12.2.1 Definition and Description

Environmental justice is defined by USEPA as, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA, 2017e).

3.12.2.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

- Title VI of the Civil Rights Act of 1964 as amended
- EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations (Environmental Justice)
- Memorandum of Understanding on Environmental Justice and EO 12898 (August 4, 2011)
- DOT Order 5610.2(a), Environmental Justice in Minority and Low-Income Populations
- CEQ Guidance: *Environmental Justice: Guidance Under the National Environmental Policy Act* (December 10, 1997)
- Revised DOT Environmental Justice Strategy

3.12.2.3 Existing Conditions

Table 3.12-7 provides a summary of the percent minority and low-income population in Camden County and census tracts most likely to experience the majority of direct and indirect impacts caused by the construction and operation of the Proposed Action. As shown in Table 3.12-7, Camden County has a lower percentage of minority and low-income populations compared to the state and to the nation. Census tract 102.00 in Camden County has a higher percentage of minority than the county but lower than the state and the nation (USCB, 2015c). Census tracts 106.02 and 101.00 have a lower percent minority compared to the county, state, and nation. Census tracts 102.00 and 101.00 have a higher percent low-income than the county, while census tract 106.02 has a lower percentage of low-income than the county. As described in Section 3.12.1.3, *Existing Conditions*, there are approximately 56 structures located on the northern portion of Census Tract 106.02 on Cumberland Island and Little Cumberland Island in the 83-degree trajectory hazard and closure area and approximately 35 structures located on Cumberland Island and Little Cumberland Island in the 115-degree trajectory hazard and closure area for a total of 91 structures on Census Tract 106.02 within the trajectory hazard area shown in Exhibit 3.12-2.

Table 3.12-7. Environmental Justice Populations

Location	Minority		Low Income	
	Number	Percent	Number*	Percent
United States	119,256,743	37.7%	47,749,043	15.5%
Georgia	4,546,292	45.4%	1,788,947	18.4%
Camden County	15,167	29.5%	6,365	12.8%
Census Tract 106.02	252	28.4%	110	12.5%
Census Tract 102.00	1,672	32.7%	757	15.4%
Census Tract 101.00	620	24.4%	332	13.0%

Notes: *Estimate below poverty level based on the population for whom poverty status is determined which may differ from the total population.

Source: (USCB, 2015b; 2015d)

3.12.3 Children's Environmental Health and Safety Risks

3.12.3.1 Definition and Description

Children's environmental health and safety risks include any risks to the health or safety that may disproportionately affect children that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products they might use or be exposed to.

3.12.3.2 Regulatory Setting

The following laws, executive orders, agency regulations, and other guidance apply to the Proposed Action.

- EO 13045, Protection of Children From Environmental Health Risks and Safety Risks, issued in 1997, requires that Federal agencies place a high priority on identifying and assessing environmental health and safety risks that may disproportionately affect children.

3.12.3.3 Existing Conditions

Table 3.12-8 provides a summary of the age distribution for the population in Camden County and census tracts most likely to experience the majority of direct and indirect impacts caused by the construction and operation of the Proposed Action. As shown in Table 3.12-8, Camden County has a higher percentage of the population under the age of 5 and under the age of 18 compared to the state and the nation and a lower percentage of the population 65 years of age or older compared to the state and the nation. Census Tracts 106.02, 102.00, and 101.00 in Camden County have an equal or lower percentage of children under the age of 5 and under the age of 18 compared to the county, state, and the nation. All three census tracts have a higher percentage of the population 65 years and over than the county.

The closest school to the proposed location of Spaceport Camden is Crooked River Elementary School, located 9 miles from the proposed site in St. Marys. During the fiscal year 2016, the school had a total enrollment of 548 students enrolled in grades pre-kindergarten through fifth grade (Georgia Department of Education, 2015). Schools, childcare centers, parks, and hospitals represent areas where there would be high concentration of children. These areas located in the ROI are shown in Exhibit 3.12-2.

Table 3.12-8. Population Distribution by Age

Location	Total Population	Under 5 Years		Under 18 Years		65 Years and Over	
		Number	Percent	Number	Percent	Number	Percent
United States	316,515,021	19,912,018	6.3%	73,683,825	23.3%	44,615,477	14.1%
Georgia	10,006,693	665,305	6.6%	2,491,080	24.9%	1,190,467	11.9%
Camden County	51,445	3,897	7.6%	13,145	25.6%	5,443	10.6%
Census Tract 106.02	888	52	5.9%	221	24.9%	100	11.3%
Census Tract 102.00	5,114	264	5.2%	1,072	21.0%	716	14.0%
Census Tract 101.00	2,545	52	2.0%	405	15.9%	512	20.1%

Source: (USCB, 2014b)

3.13 Visual Effects

3.13.1 Definition and Description

Visual resources are the natural and manmade features that give a particular environment its aesthetic qualities. In undeveloped areas, landforms, water surfaces, and vegetation are the primary components that characterize the landscape. In predominantly natural areas, manmade features (such as buildings, fences, powerlines, piers, and wharves) can contrast with the forms and colors of natural landscape. In developed areas, the natural landscape is more likely to become a background for more obvious manmade features. Visual character refers to the overall visual makeup of the existing environment where a proposed action and alternative(s) would be located. Potential visual impacts are determined by estimating the degree of change to the visual character and attributes of a viewshed that would result from a proposed action. This considers the visual quality or value of the affected landscape or viewshed, as expressed by viewers, and any State and Federal visual management objectives for resources under their jurisdiction. The value of visual resources also reflects the intrinsic attributes of the landscape and its cultural and social relevance. Visual quality is a function of this intrinsic value and the level of current degradation, or lack thereof.

Light emissions include any light that emanates from a light source into the surrounding environment. Sources of light emissions include outdoor site lighting, employee/visitor parking lighting, airborne and ground-based vehicle operations, and roadway lighting. Glare is any strong or dazzling light and light emissions redirected off of a reflective surface, such as window glass in a facility. In recent years, diminishing darkness of the night sky has become a growing concern as expanding areas of urbanization cause an overall glow in the sky. This results from dispersed light in the night sky that reflects off of atmospheric particles and water vapor, and redirects back to the earth's surface. "Sky glow" has been associated with ecological changes and human health effects, since natural circadian rhythms are driven by light patterns, and are foundational for the functions of biota in any given context. Diminishing dark skies is a concern not just in developed areas, but also in pristine areas where the absence of light is valued for the experience of darkness and higher visibility of the sky and stars.

Visual effects analysis considers the extent to which a proposed action or alternative(s) would either: (1) contrast with, or detract from, or change the visual resources and/or the visual character of the existing environment; or (2) produce light emissions that create annoyance or interfere with other (non-project) activities. Visually-protected coastal areas, rivers protected under the Wild and Scenic Rivers Act, sensitive wildlife species, and Section 106 and Section 4(f) properties are discussed in detail under the appropriate environmental impact categories and cross-referenced in this section, as applicable.

3.13.2 Regulatory Setting

There are no Federal laws directly regulating visual impacts or light emissions from a proposal. However, there are State and Federal laws governing the impact of visual changes on protected and valued resources. There are also Federal and State policies and procedures pertaining to visual resources, and particularly for controlling light emissions. The following are the primary laws, executive orders, agency regulations, and other guidance apply to visual resources and light emissions associated with the Proposed Action.

The Wilderness Act of 1964

Congress provided for a system of wilderness lands that shall be administered for the “use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” The act also describes these areas as “places where the earth and its community of life are untrammelled by man”... and where “the imprint of man’s work (is) substantially unnoticeable.”

Section 106 of the National Historic Preservation Act, Section 4(f) of the Department of Transportation Act, the Wild and Scenic Rivers Act, National Historic Trails, and National Historic or Heritage Sites

These Acts address preservation of various protected resources. Physical changes to visual resources or the visual environment (including light emissions) can affect the context that is essential to protected resources under each of these Acts.

U.S. Forest Service, Bureau of Land Management Handbooks, and Federal Highway Administration

The U.S. Forest Service’s Landscape Aesthetics: A Handbook for Scenery Management, Handbook 701 (U.S. Forest Service, 1995), BLM’s Handbook H-8431-1, Visual Resource Contrast Rating (BLM, 1986), and the Federal Highway Administration (FHWA) Guidelines for the Visual Impacts of Highway Projects (FHWA, 2015) use descriptive and systematic rating systems to classify the existing character and value of the visual resources on their respective land. These handbooks provide approaches and methods for assessing the impact of actions that change the visual environment.

The Coastal Zone Management Act of 1972

This Act encourages coastal states to develop coastal zone management plans. Under the Georgia Coastal Zone Management program, major actions within the coastal counties (including Camden County) require a Consistency Determination that demonstrates that a proposal is consistent with (or would not impede) the Georgia Coastal Management program goals (see Sections 3.4 and 4.4, *Coastal Resources*). The aesthetic qualities of coastal areas are one of the management goals.

The National Park Service Management Policies (2006)

This policy document provides specific guidance on lightscape management and protection of wilderness resources within areas of their jurisdiction. These policies also address the need and use of cooperative conservation beyond park boundaries in order to manage and protect park resources pertaining to lightscape management.

FAA Order 1050.1F, Environmental Impacts; Policies and Procedures, and the associated Desk Reference

These complementary documents provide guidance for considering the effects of actions on visual resources and visual character, with particular concern for light emissions. Evaluations should consider how light and visual impact can affect other activities (including aviation) and visually-sensitive land uses. These documents state that visual resources are inherently difficult to define because of the subjectivity involved. Aesthetic impacts deal with the extent that a new project or undertaking contrasts with the existing environment and whether the jurisdictional agency or public consider this contrast objectionable. The Order specifically states that annoyance from lighting and measures to minimize the effects should be documented in the EIS. These documents outline the concepts for evaluating light emissions and visual impacts. FAA considers how light emissions may affect the visual character of the area, particularly for important or sensitive visual resources.

National Wild and Scenic Rivers Act (1968)

This Act protects rivers with outstanding scenic, wild and/or recreational qualities. It also protects rivers that are listed on the Nationwide Rivers Inventory (NRI) but have not gained congressional designation. Rivers on the NRI require protection and consultation with the NPS for any actions that could impair outstanding qualities.

National Park Service, Cumberland Island National Seashore General Management Plan, 1984

This plan identifies several zones within the park and describes suitable activities, development, and general management directions to support the values and purpose of each zone. Even though this plan is relatively old, the concept of zones with specific purposes implies a practical and reasonable approach to land management based on varied attributes over an entire park.

Camden County Unified Development Code, Article 2, Use of Land and Structures; Article 4, Buffers, Landscaping and Tree Conservation; Article 9, Environmental Protection

The referenced UDC articles have the purpose of improving aesthetic qualities in Camden County and of protecting and preserving the appearance, character, and value of neighborhoods, business areas, and sensitive environments. The UDC establishes clear requirements for buffers, landscaping and tree conservation depending on land use and zoning. These are focused on interactions between residential, office/institutional, commercial and industrial uses. Specific limitations apply to river corridors, wetlands, and conservation areas.

3.13.3 Existing Conditions

This section provides a description of the existing visual character of the proposed Spaceport Camden site and the surrounding areas and viewsheds. It also provides an overall value of these visual resources using a basic assessment of visual attributes. Section 3.13.3.2, *Light Emissions*, provides a description of the current light emissions at the proposed spaceport site and surrounding areas.

To support the narrative for Section 3.13.2, *Regulatory Setting*, and Section 4.13.1, *Proposed Action*, Exhibit 3.13-1 shows a series of photographs of the site and surrounding areas that illustrate the prevalent views and visual character. Most of the photographs (excluding M and O) were taken during a site visit for the EIS in September 2015. Exhibit 3.13-2 illustrates the points in the region and direction of the viewer for all the photographs presented in Exhibit 3.13-1.

The proposed Spaceport Camden site is located in a low-lying area in southern Georgia along the coast with a mixture of salt marsh, wetlands, and forest. Offsite areas to the west and south of the proposed Spaceport Camden site are forested and gradually transition from wetland and to upland characteristics as the terrain trends gently upwards to the west (inland from the coast). Roads, small pockets of residential land, and small communities have developed in the surrounding area. To the north of the site are the Satilla River delta and smaller waterways, small estuarine islands, freshwater wetlands and tidal salt marsh. To the east are water channels winding through the salt marsh along the coastal islands (photographs J, L, N, and O). The main channel is the Intracoastal Waterway. The Cumberland Island National Seashore and Little Cumberland Island are situated to the east and exhibit a mixture of coastal forest and salt marsh (photographs O and P). Sections 3.4, *Coastal Resources*, 3.5, *Department of Transportation Act, Section 4(f)*, and 3.9, *Land Use*, address the multiple values of the Cumberland Island National Seashore.

Exhibit 3.13-1. Photographs of the Proposed Spaceport Camden Site and Surrounding Area



A-Existing structures near proposed main gate location



B-Site Deep Water dock



C-Existing footprints of former industrial buildings on Bayer CropScience site



D-Former rocket silo sit with forest background



E-Typical view of existing road through forest vegetation on site



F-Existing power lines and road corridor



G-Historic relics of Anchor House



H-Fairfield Cemetery

(continued on the next page)

Exhibit 3.13-1. Photographs of the Proposed Spaceport Camden Site and Surrounding Area



I-Planted pine forest on Union Carbide site



J-Typical coastal marsh and forest background



K-Mixed Oak and Hardwood forest with palmetto and wax myrtle understorey



L-Proposed Vertical Launch Vehicle site looking east



M-10th Street Overcrossing of Interstate 95 looking east



N-Planted pine forest looking north over Satilla Creek and marshland



O-Typical Salt Marsh view from Coastal Waterway near Cumberland Island



P-North end of Cumberland Island looking south

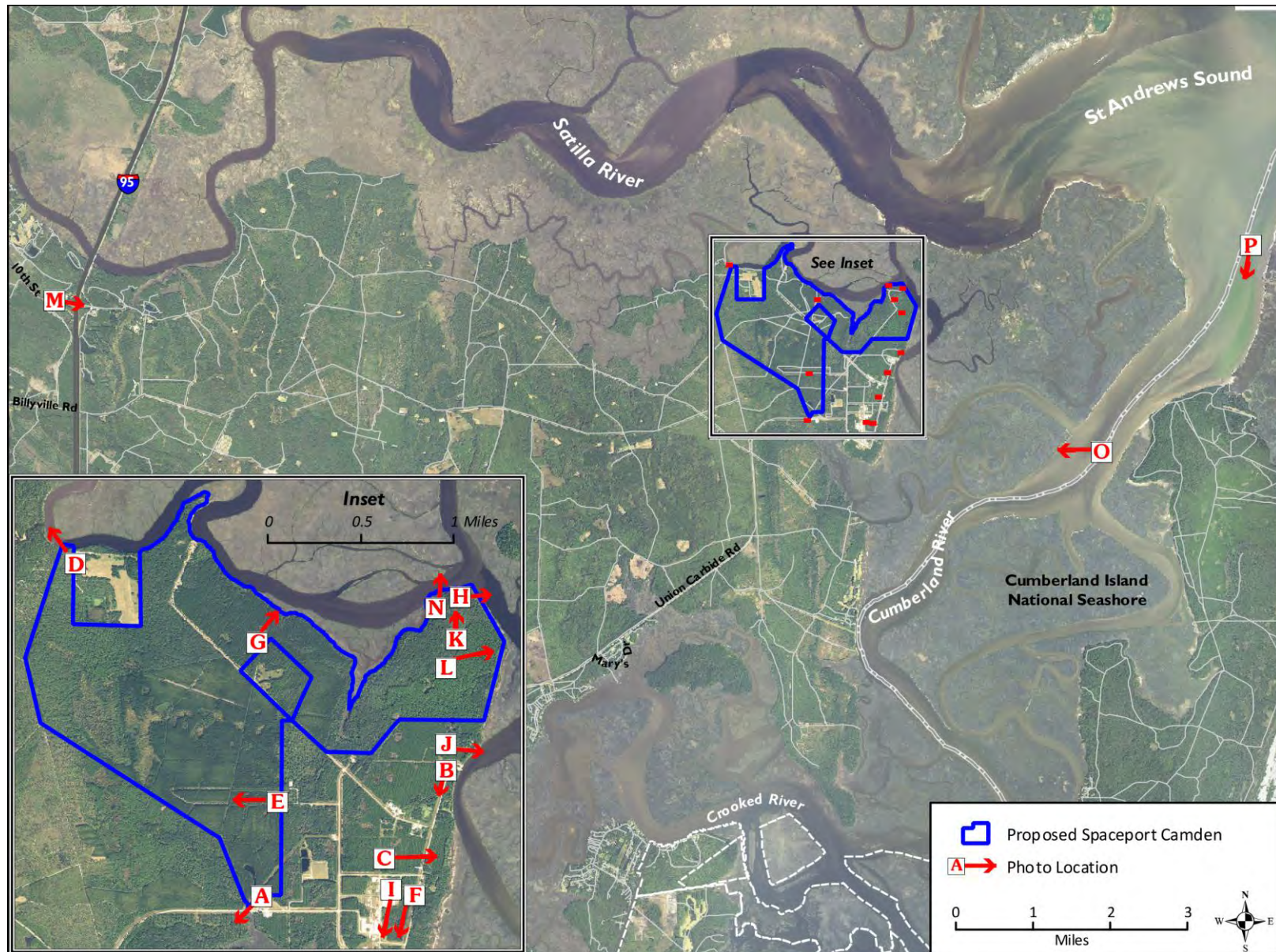


Exhibit 3.13-2. Location and Direction of Viewer for Photographs of Proposed Spaceport Camden Site and Surrounding Area

3.13.3.1 Visual Resources

Project Site Visual Character. The primary sources for describing current visual conditions at the site are derived from photographs, supplemented by information in previous studies and reports for the Bayer and Union Carbide Corporation properties and by examination of Google Earth satellite imagery (CH2MHill, 2015; Tetra Tech, 2013). The dominant visual character of the site is defined by vegetation and anthropogenic modifications. The land is generally flat with only minor elevation changes. The proposed site (including its potential buffer parcels) is predominantly vegetated with the imprint of industrial uses, infrastructure, forestry, and silviculture punctuating the landscape. Landforms are not the primary defining component of the landscape. Viewsheds are dominated by vegetation, water, and sky, depending upon the viewer's location.

Vegetation types on the site are delineated in Exhibit 3.2-1 and described in Section 3.2.3.1, *Terrestrial Vegetation and Habitats*. There are two broad types of vegetative environments: wetland/tidal marsh and upland. These are briefly described below:

- **Wetland/tidal marsh.** Most of the proposed site outside of the land under current option to purchase (see Exhibit 3.2-1) falls within the wetland category. These are low-lying areas of wetland vegetation types consisting of:
 - Low salt marsh with canopy density of 10 to 80 percent and vegetation height up to 10 feet. Exhibit 3.13-1, photograph N, shows typical low-lying salt marsh;
 - Freshwater wetlands with both cypress/hardwood trees dominated by gum trees and red maples with wax myrtle and ferns in the understory with canopy height up to 80 or 90 feet; and
 - Non-forested emergent wetlands with dominant ground-cover vegetation of maidencane, yell-eyed grass, piperwort, and some wax myrtle along the waterway edges up to about 5 to 10 feet in height (CH2MHill, 2015). Exhibit 3.13-1, photograph J, shows low-lying emergent wetlands.
- **Upland.** Most of the land with a current purchase option and the former industrial portion of the Bayer CropScience land are categorized as upland. These areas are relatively flat but slightly higher than the low lying tidal marsh. Vegetation in the upland areas is comprised of the following:
 - Mixed oak/hardwood natural forest with high canopies of live oak and red cedar trees (ranging from about 60 to 80 feet high) with dense saw palmetto and wax myrtle in the understory.
 - Upland areas now predominantly support planted pine forest of loblolly and slash pines, where the understory has been cleared. The trees are planted in rows and blocks of trees have uniformity in size reflecting planting in the same year. These vary in height depending on the age of the stands, but can achieve heights of up to about 100 feet tall at maturity. In Exhibit 3.13-1, photographs G, H, I, K, and L exhibit upland vegetation and pine forests, with some anthropogenic features.
 - Interspersed small pockets that were cleared for agriculture and pasture in the past, but later abandoned. These areas now have weedy herbaceous and woody species and more open habitat (CH2MHill, 2015).

- Scrubby flatwood communities are found along the edges of Floyd and Todd Creeks, with high open canopies of oaks and longleaf pines, and understory of low oaks, saw palmetto and diverse grassy ground cover.

Although the site is mostly forested, areas have been cleared to support previous industrial development, access roads, and utility easements. These anthropogenic features are mostly found interspersed in the upland areas and modify the natural visual character of the site. Overall, these elements cover a small portion of the total acreage, and are generally clustered in discrete locations that are cleared of forest vegetation. Most facilities have been demolished so that only concrete footprints remain. The Bayer CropScience facilities included over 20 buildings, a water treatment facility, and various roads, overhead electrical and communications services, and in ground water distribution lines (see Exhibit 3.13-1, photograph C). The primary feature of the property was the central Temik manufacturing facility, associated conveyors and related structures. The principal building rose above 300 feet, and was well lit for safety and security purposes. It was a prominent feature on the Camden County skyline in the direction of the proposed site, and visible both in the day and at night.

These structures were removed by the year 2012, and are not part of the current viewshed towards the proposed site (see Exhibit 3.13-1, photographs A, B, C and D). The former industrial facilities are essentially abandoned and not generally open to the public. Currently, the number of viewers onsite is low and their purpose is usually for site maintenance, study, monitoring, or restoration.

Beyond these clusters of development on the site, the photographs show how corridors have been cleared through the forest (for infrastructure such as roadways and powerlines) and traverse the site (see Exhibit 3.13-1, photographs E and F). Most of these features are largely unnoticeable to offsite viewers due to intervening trees and understory vegetation except for viewers at the deep water dock and along Floyd Creek and at the site's main entry along Union Carbide Road, where limited views are possible for persons passing in boats, on foot, or in vehicles.

Site Visibility from Off-site Viewing Locations. Off-site viewing locations were selected to include a variety of middle ground and background viewing distances toward the site; a variety of viewer contexts (residential, park/protected area, recreation, roadway, shoreline); and locations with higher elevations than the surrounding area. Exhibit 3.13-3 shows the location of the 15 representative off-site viewing locations in the surrounding area. Table 3.13-1 provides a brief summary of the current view toward the proposed Spaceport Camden site at each of the locations considering the effects of existing vegetative screening and includes a brief assessment of the viewshed quality considering the intrinsic visual character and context. The following provides general parameters for ratings of low, moderate, and high for this analysis:

- **Low:** Natural context is noticeably modified by anthropogenic features. The viewshed is composed of non-distinctive landscape forms, lacking contrast or variation in color, texture, or shapes. The wildlife and ecological setting is not distinctive. The visual character is typical and pervasive in the surrounding region.
- **Moderate:** Natural context has some evident anthropogenic features, but is subordinate to the overall viewshed. The viewshed has some variation in landscape form, texture, color, and shapes. The views of wildlife and ecology provide some visual interest. The visual character is generally pleasing but not distinctive.
- **High:** The natural context is dominant with few or unnoticeable anthropogenic intrusions. The viewshed offers high contrasts, variations in form, texture, and color and is very pleasing to most viewers. Natural surroundings provide excellent opportunities for viewing wildlife and ecology. The visual character is exceptional to most viewers and is regionally important.

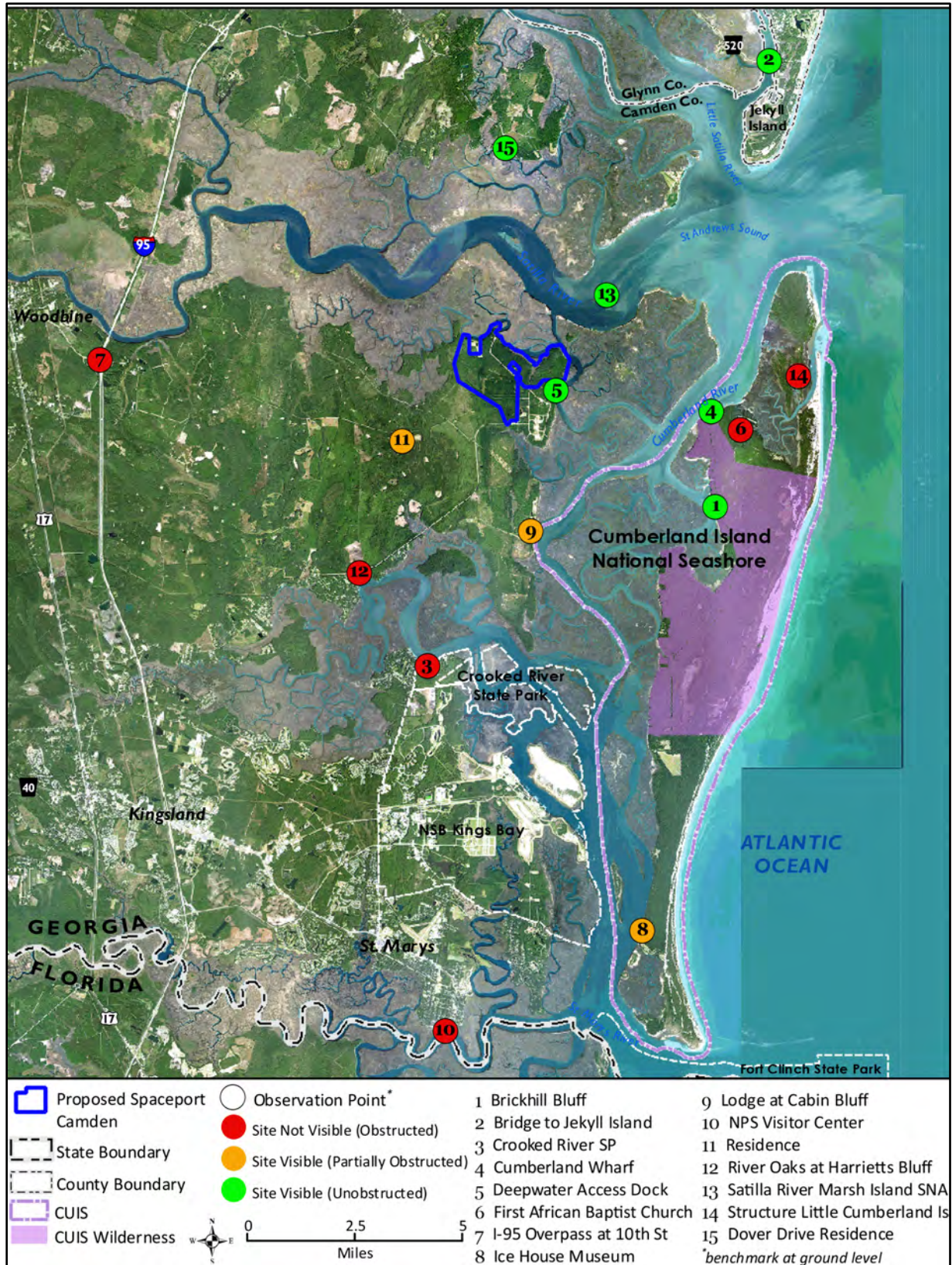


Exhibit 3.13-3. Representative Observation Points in the Area Surrounding Proposed Spaceport Camden

The descriptions in Table 3.13-1 consider visibility at the ground level, and for two notional building heights of 45 feet and 250 feet above ground level (representing potential structures constructed as part of the proposed spaceport), which was achieved by using geographic information system visibility analysis tools and a digital elevation model for the Earth's surface. The digital elevation model includes data on ground height only and does not depict vegetation and structures. Therefore, the visibility analysis is considered a "bare earth" line of sight analysis that identified whether the representative locations had line-of-sight to the proposed Spaceport Camden site. If visibility was occluded simply by ground height alone, real world conditions, including the added height of vegetation and structures, would definitely prevent visibility.

Table 3.13-1. Representative Observation Points in Area Surrounding Proposed Spaceport Camden

ID No./Observation Point	Distance (miles) ¹	Current Viewshed Conditions
1. Brickhill Bluff	5.1	From Cumberland Island west shoreline, unobstructed line of sight to east side of proposed Spaceport Camden site. View of foreground salt marsh and waterways with low strip of dark forest canopy in middle-distance with large sky area above. Wide viewshed includes small housing enclaves, Cabin Bluff resort, and Jekyll Island community, more noticeable at when lights are visible, but not glaring. Viewshed quality: Views westward moderate to high, mostly natural but lacking distinctive landforms.
2. Bridge to Jekyll Island	8.8	From vantage points along the bridge, Spaceport Camden site visible but not distinguishable from surrounding forest for most viewers; powerline corridors form noticeable lines through natural and planted forests, but are subordinate to the overall view. Viewshed includes middle-ground waterways and salt marsh vegetation. Viewshed quality: Moderate to high due to panorama vantage point, but highly modified in fore and middle-ground, with natural character in distant views to north, west, and south, and views to ocean to east.
3. Crooked River residences and State Park	7.7	Line of sight to Spaceport Camden property interrupted by intervening land and vegetation. Narrow views north from the State Park may have visual connection to east side of the proposed Spaceport site, mostly over salt marsh and pine forest of the proposed Vertical Launch Facility. These views to the site are distant and appear as bands of vegetation and water in the distance. The context also includes low-density rural residential housing along the shorelines. Viewshed quality: From shoreline, moderate to high views to surrounding waterways, with mostly natural settings dominated by marsh and sky, with distant treeline canopies.
4. Cumberland Wharf, CUIS	3.8	Open views to the east side of the proposed site visible as middle-ground salt marsh with band of darker forest canopy beyond the marsh. Sky and water are dominant elements of the view. Viewshed quality: Similar to observation point 1. Historic context of ruins.
5. Deep Water Access Dock	0.7	From the dock and Floyd Creek, former facilities and infrastructure directly visible. Areas cleared of vegetation with small buildings visible and former building concrete pads and power lines also visible. Forested background to west and north. Viewshed quality: Low to moderate due to industrial use and existing modifications in foreground. Surrounding waterways are natural with little intrusion from human-made features.

Table 3.13-1. Representative Observation Points in Area Surrounding Proposed Spaceport Camden

ID No./Observation Point	Distance (miles) ¹	Current Viewshed Conditions
6. First African Baptist Church, CUIS	4.7	Views to the mainland and the Spaceport Camden site blocked by intervening terrain (remnant dune formations) and forest. Viewshed quality: The immediate viewshed is defined by naturalness and surrounding historic structures, but views are limited due to foreground vegetative screening and local terrain.
7. I-95 Overpass from 10 th Street	10.5	Views to the spaceport site blocked by intervening terrain, trees, and distance. Viewshed quality: Low quality due to modification to landscape by roadway. Generally narrow views along area roadways due to bordering forests.
8. Ice House Museum, CUIS	13.4	To the northwest, view toward the east and southeast edge of the proposed Spaceport Camden site visible as low dark band of forest canopy and not distinguishable from other shoreline vegetation in the far distance. Land is narrow band, subordinate to the dominant water and salt marsh in fore- and middle-ground and overarching sky. Viewshed quality: Moderate due to modifications in the wide viewshed eastward that include closer built up areas including NSB Kings Bay and St. Marys.
9. Lodge at Cabin Bluff (resort)	3.5	Middle-distance views northward to the Spaceport Camden site screened by trees, landscaping and facilities at the Cabin Bluff. From open fairways on golf course, there may be line of sight to forest canopy on the Spaceport property in the middle-ground. Viewshed quality: Mostly pleasing natural views, altered by forestry and some anthropogenic features (roads, utility lines); moderate quality. Attractive landscaping in the foreground at the resort.
10. NPS CUIS Visitor Center, St. Marys	15.7	No view to the proposed Spaceport Camden property from the CUIS mainland Visitor Center. Viewshed quality: Mixture of small town urbanscape with views of natural waterways to south from the Visitor Center. Mostly pleasing visual character.
11. Residence west of proposed Spaceport Camden property	3.9	Views to the Spaceport Camden property mostly blocked by surrounding forest at ground level and lower elevations of the site. Natural and planted forest surroundings modified by small scale rural residential development, fences, structures, back county roads, with relatively dark sky context. Viewshed quality: Moderate visual quality.
12. River Oaks residences and State Park at Harrietts Bluff	6.6	Views to the Spaceport Camden property mostly blocked by intervening forest and structures. Mixture of natural forest and small-scale rural enclaves, generally appealing and typical of surrounding inner shoreline and estuarine visual character; views over natural waterways from shoreline, pleasing quality. Park mostly forested with limited views except at the shoreline. Viewshed quality: Moderate visual quality, typical of inner coastal shore, with evident human modifications.
13. Satilla River Marsh Island SNA	2.0	Close views to south and southwest to proposed Spaceport Camden property dominated by sky and foreground water and marshland with forest canopy behind. Viewshed quality: High due to natural, quiet surroundings, riparian habitat and wetlands and tidal marsh.

Table 3.13-1. Representative Observation Points in Area Surrounding Proposed Spaceport Camden

ID No./Observation Point	Distance (miles) ¹	Current Viewshed Conditions
14. Structure Little Cumberland Island	5.7	Views to the Spaceport Camden property blocked by intervening forest and terrain. Views eastward over ocean, dominated by seascape, horizon and sky. Views south, west and north of surrounding foreground natural dunes and coastal island habitat. Few human intrusions except for home sites. Viewshed quality: Moderate to high due to naturalness.
15. Residence on Dover Drive	5.1	Residences along the shoreline have open views over Satilla River and marshland to the south in foreground and middle-ground towards the proposed Spaceport Camden property. Views dominated by water and marsh with darker band of middle distance forest, with sky above. Immediate foreground context modified by small-scale rural residential development. Similar to No. 13, but further away from the proposed site. Viewshed quality: Moderate to high quality views towards the site, mostly natural with protected Satilla River corridor.

Notes: CUIS = Cumberland Island National Seashore; NSB = Naval Submarine Base; SNA = State Natural Area.

¹ Measured from observation point to proposed Vertical Launch Facility water tower site.

The model found that three points (6, 7, and 10) had no line-of-sight to a 45-foot elevation above the site and point 7 had no line-of-sight to a 250-foot feature. This study found that existing views of the site from land-based observation points are generally limited due to intervening vegetation and lack of elevated vantage points in relations to the site. Several of the representative observation points have wholly obstructed views due to vegetation, structures and terrain (points 7, 10, 12, and 14), or partially obstructed (points 3, 6, 8, 9, 11, and 14). For example, most roadways are bordered by natural and planted forests so that views to the site are obstructed (see Exhibit 3.13-1, photograph M, and Exhibit 3.13-2, point 7).

Exceptions include elevated points with a vantage point, such as the bridge to Jekyll Island (point 2), close up and bordering locations, such as the current entry location to the site on Union Carbide Road, and along the bordering logging roads and bordering estuarine creeks (such as Todd Creek, Floyd Basin, and Floyd Creek). Viewing locations to the north and east of the site in the salt marsh and along the Satilla River delta and coastal waterways (Exhibit 3.13-2, observation points 5, 13, and 15), and intermittent spots on the west shore of Cumberland Island (points 1 and 4) have fairly open views to the proposed site over the low salt marsh. Exhibit 3.13-1, photographs J and O (also see Exhibit 3.13-2, observation points 1 and 4), show typical views from the Intracoastal Waterway of low-lying marshes and backgrounds of higher tree canopies formed by natural and planted forest. These locations have unobstructed middle-ground and distant views to the eastern side of the proposed site. The dominant elements of these views are water and sky with only a narrow horizon of vegetation. The dominant views on Cumberland Island and Little Cumberland Island are towards the ocean from the east shore and over the salt marsh from the west shoreline (Exhibit 3.13-2, observation points 1, 4, and 8). In many situations, views toward the site are intermittent through gaps in screening vegetation, depending on where the viewer is standing (as at Exhibit 3.13-2, observation points 8, 9 and 11).

Protected areas (including Cumberland Island National Seashore and the Satilla River) with views to the proposed site include observation points 1, 4, 8, 13, and 15. Points 4 and 8 have middle-ground and distant views, respectively. Point 13, in the Satilla River delta, has middle distance views. Point 15, on

1 the north side of the Satilla River, has a middle distant view. Although some locations have no view or
2 limited visual connection to the proposed Spaceport Camden site, all the representative locations would
3 have visibility to rocket launches if oriented toward the flight path (see Section 4.13.1.2, *Operation*, and
4 Table 4.13-1).

5 Current viewers at the proposed spaceport site are limited to only a few workers who perform
6 maintenance, studies, monitoring, and restoration. The general public does not have access to the site
7 and the deconstructed former industrial areas. From offsite, viewers can see some of the remnants of
8 the former site development from bordering logging roads (with little traffic) and the main gate access
9 point on Union Carbide Road. Boaters on Todd Creek, Floyd Basin, and Floyd Creek can directly observe
10 the periphery of the site but vegetation forms a visual barrier. Viewers include recreationists, sports
11 fishers, tourists on the more distant Cumberland Island National Seashore west shoreline, a few
12 residents on the west shore of Little Cumberland Island, and boaters on the Intracoastal Waterway,
13 Satilla River, and estuarine creeks. Some residents on the north side of the Satilla River have open views
14 to the site, and also some residents to the south and southeast have partial views from local parks and
15 housing enclaves (such as Exhibit 3.13-2, observation points 3, 9, and 11). In all situations, views are
16 limited by intervening vegetation, especially when in close proximity to the viewer.

17 **Visual Resource Value.** The proposed Spaceport Camden site's pre-existing industrial use and current
18 and former infrastructure has modified the visual context. While most of the site is still vegetated,
19 much of this vegetation is planted forest, with interspersed areas with natural vegetation. Away from
20 the sites of former industrial facilities, the visual character is appealing. The Camden County UDC
21 provides protection for the Satilla River corridor, wetlands, and designated conservation areas (see
22 Exhibit 3.2-1 for location of salt and brackish tidal marsh), reflecting a community value for the visual
23 surroundings and ecosystems in the county. The upland portion of the site (where former facilities and
24 the proposed spaceport facilities would be located) is zoned for industrial use, and was amended in
25 2014 to allow for spaceport development. The Camden County UDC Article 2, *Use of Land and*
26 *Structures*; Article 4, *Buffers, Landscaping and Tree Conservation*; and Article 9, *Environmental*
27 *Protection*, provide the local regulatory framework for new development on the site. The low-lying
28 marsh areas of the site are defined as conservation areas. Similarly, the land bordering the Satilla River
29 is a protected river corridor area where physical development is restricted in a 100-foot wide buffer
30 zone along the river channel (Camden County, 2014).

31 The surrounding coastal area has moderate to high visual value, largely due to the relatively undisturbed
32 natural landscape. The Cumberland Island National Seashore, which includes a designated wilderness
33 area, is frequented by visitors, many with expectations of enjoying the natural setting. The visual quality
34 of the viewshed from the shoreline and waterways of Cumberland Island National Seashore is an
35 important attribute of this protected area. The Satilla River (on the NRI) possesses outstanding scenic,
36 wild or recreational qualities. The tidal waterways and creeks bordering the proposed site on the north
37 are part of the Satilla River delta. Although the river was never formally designated as a national wild
38 and scenic river, its status on the NRI requires protection to preserve its values until a decision on its
39 status is made. The quality of the natural environment and the interface between land and water make
40 this area popular for outdoor recreation and sporting activities, vacationing, and appreciation of nature.
41 The natural qualities of the visual environment and viewsheds are, therefore, a valuable regional
42 resource. The visual setting of several historic sites both onsite and offsite in the local area is important
43 due to the intrinsic values of the historic and cultural resources. Table 3.8-1 lists historic sites and
44 indicates potential for visual effects, although vegetation and slight changes in terrain screen most of
45 the offsite locations from direct visual line-of-sight to the proposed Spaceport Camden site. Additional

information on recreational, historic and natural value of these assets is found in Sections 3.4, *Coastal Resources*, 3.5, *Department of Transportation Act, Section 4(f)*, 3.8, *Historical, Architectural, Archaeological, and Cultural Resources*, and 3.14, *Water Resources*.

Little Cumberland Island is a part of the protected Cumberland Island National Seashore. Views to the mainland and to the project site are partially visible to residents and tourists from Little Cumberland Island depending on vegetation and terrain near the viewer (which can block direct views). Water-based viewers and viewers on Cumberland Island trails and roads also have views to both the island and the mainland and project site. These views are also intermittent and dependent upon elevated terrain (such as dunes) and vegetation at the viewing location. The setting is predominantly natural. The island has some historic sites for which the visual setting is important, and the visual quality of the viewshed from the shoreline and waterways is an important attribute of the Cumberland Island National Seashore protected area. There are a few residences along the western shoreline with unobstructed views across the Intracoastal Waterway to the mainland and the proposed site.

3.13.3.2 Light Emissions

Onsite Light Emissions. Currently, the proposed Spaceport Camden site is essentially unilluminated by artificial light sources. Any incidental lights near the main entry point on Union Carbide Road are minimal. This is reflected in Exhibit 3.13-4, where the site shows as very low on the radiance scale.

Light Emissions in Surrounding Areas. The immediate surrounding areas are also mostly unilluminated natural areas. Rural roadways near the site do not have overhead lights. Intermittent locations of isolated residences and small businesses, especially along the waterway shorelines, generate some light in an otherwise dark landscape. However, many local light sources are screened by trees and vegetation, or are low intensity due to low wattage and distance. Pockets of measurably noticeable night radiance are evident in Exhibit 3.13-4 at the Lodge at Cabin Bluffs (see location in Exhibit 3.13-3). Radiance levels increase around Naval Submarine Base Kings Bay and St. Marys. To the north of the Satilla River, light is detectable near Dover Road (see location on Exhibit 3.13-3) on Piney Bluff, continuing to intensify towards Jekyll Island and Brunswick. To the west, light levels increase around Woodbine. The northern half of Cumberland Island and Little Cumberland Island exhibit no measurable nighttime radiance as shown in Exhibit 3.13-4. Cumberland Island National Seashore is not a “dark skies park” as designated by the IDA (2017b). Nighttime radiance is affected by local weather conditions, with low cloud cover often radiating light back to the earth, increasing perceptible glow. Humidity, fog, low clouds, and rain can absorb and obscure nighttime radiance, depending on the distance of the viewer relative to light emitting sources and the amount of moisture in the air.

Dark Skies Initiatives. There is growing awareness and concern over the global and local effects of the increasing amounts of light emanating from the earth surface at night. Effects may range from disruption to biota from changes in the annual and daily light patterns on the earth surface, loss of visibility of the night sky, potential health effects on humans from high nighttime light levels in urban areas. In the social context, the impact of unwanted light emissions ranges from annoyance to individuals (such as residents or visitors to isolated natural locales) to major incompatibility with specific uses (such light in pristine settings, or glare disrupting aviation or astronomical observation). Related concerns are the cost and waste of energy, particularly resulting from over-illumination and undesired light trespass. “Light pollution” is a term for excessive, misdirected, or obtrusive artificial light.

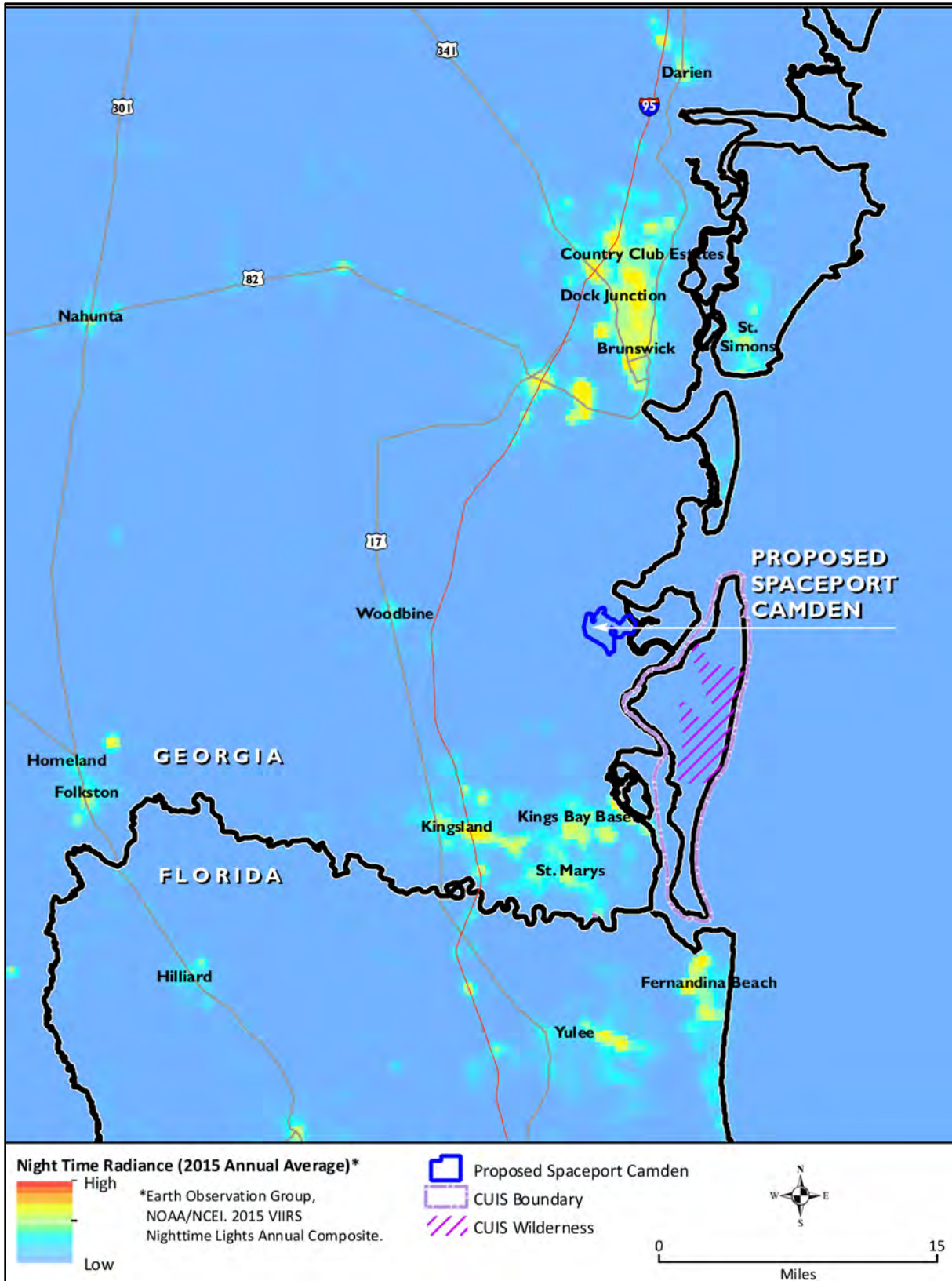


Exhibit 3.13-4. Distribution of Night Radiance in the Region Surrounding Proposed Spaceport Camden Site

1 In recent years several organizations and research institutions have been monitoring and tracking the
2 degree of light in the night sky. Exhibit 3.13-4 is a map showing the agglomerated measurement of
3 night radiance from the earth's surface in the region surrounding the proposed Spaceport Camden. This
4 map, prepared by the NOAA, illustrates how radiance is focused around population centers in the
5 greater region including Brunswick, St. Simons, Kingsland, Woodbine, Naval Submarine Base Kings Bay,
6 St. Marys, Fernandina Beach, and Yulee.

7 The IDA is one of the primary organizations leading efforts to study and improve nighttime lighting. IDA
8 has developed educational material and sample ordinances to help communities define and implement
9 measures for controlling light pollution in outdoor settings. The IDA also promulgates and adopts
10 outdoor lighting standards to lead the construction industry and the public at large towards best
11 management practices for conserving dark skies. The NPS Natural Sounds and Night Skies Division also
12 specializes in night skies and quantifying sky glow, light pollution, and natural skies for national parks
13 and surrounding areas.

14 **3.14 Water Resources**

15 **3.14.1 Definition and Description**

16 Water resources include wetlands, floodplains, surface waters, groundwater, and Wild and Scenic
17 Rivers. Wetlands are areas of transition between terrestrial and aquatic systems where the water table
18 is usually at or near the surface, or the land is covered by shallow water (Mitsch & Gosselink, 2000).
19 USACE defines wetlands (33 CFR §238.3(b)) as "those areas that are inundated or saturated by surface
20 or ground water at a frequency and duration sufficient to support, and that under normal circumstances
21 do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The
22 definition excludes non-vegetated areas such as streams, ponds, and mudflats.

23 Floodplains are lowland areas adjacent to surface water bodies (i.e., lakes, rivers, oceans), where
24 flooding events periodically cover areas with water. Floodplains provide value by serving as natural flood
25 and erosion control, maintaining surface water quality by filtering nutrients and impurities, increasing
26 biological productivity, and providing societal benefits such as open space for recreational opportunities
27 and enhanced agricultural lands. Floodplains were often discussed in terms of the 100-year flood and
28 500-year flood. The 100-year flood (or base flood) is a flood having a 1 percent chance of occurring in a
29 given year, and are areas where Federal floodplain development regulations are enforced. The 500-year
30 flood is a flood that has a 0.2 percent chance of occurring in any given year.

31 Surface-water resources include streams, rivers, lakes, ponds, estuaries, and oceans and are important
32 for a variety of reasons, including economic, ecological, recreational, and human health factors.

33 Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The
34 term aquifer is used to describe the geologic layers that store or transmit groundwater, such as to wells,
35 springs, and other water sources.

36 Wild and Scenic Rivers are rivers that have remarkable scenic, recreational, geologic, fish, wildlife,
37 historic, or cultural values as defined by the Wild and Scenic Rivers Act.

38 **3.14.2 Regulatory Setting**

39 The following laws apply to the Proposed Action and Alternatives.

Clean Water Act, Executive Order 11990, Protection of Wetlands, and DOT Order 5660.1A, Preservation of the Nation's Wetlands

The CWA of 1977 (33 U.S.C. §§1251 et seq.) was established to regulate discharges to surface waters, including wetlands. Pollutants regulated under the CWA are “priority” pollutants, including various toxic pollutants, such as biochemical oxygen demand, total suspended solids, fecal coliform, oil and grease, and pH. Section 404 of the CWA regulates development activities in jurisdictional surface waters²⁶ and wetlands. Executive Order 11990, Protection of Wetlands, states that Federal actions must avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. DOT has implemented EO 11990 through policies and procedures documented in DOT Order 5660.1A, Preservation of the Nation's Wetlands. EO 11990 and DOT Order 5660.1A do not apply to projects such as this one where FAA is issuing a license to a private party on non-Federal property (FAA, 2015). Potential development actions that may affect streams and/or wetlands require a permit from USACE for dredging and filling in wetlands. In addition to USACE, USEPA and the states regulate dredge and fill operations and dredge material disposal. Section 303(d) of the CWA requires states, territories, and authorized tribes to develop a list of impaired waters. Waters are considered impaired when they do not meet water quality standards that the state, territories, and authorized tribes have set. States, territories, and authorized tribes are required to create a priority ranking system for these waters, as well as the development of total maximum daily loads. Section 402 of the CWA created the NPDES and Section 401 of the CWA includes requirements that a project does not violate State water quality standards.

Executive Order 11988, Floodplain Management, and DOT Order 5650.2, Floodplain Management and Protection: and the National Flood Insurance Act

EO 11988, Floodplain Management requires Federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or location within floodplains. DOT has implemented EO 11988 through policies and procedures documented in DOT Order 5650.2, Floodplain Management and Protection.

The National Flood Insurance Act established the National Flood Insurance Program, which is a voluntary floodplain management program for local communities. The National Flood Insurance Program is based on a mutual agreement between the Federal Government and communities. Communities that participate agree to regulate floodplain development according to certain criteria and standards.

The Safe Drinking Water Act and other Federal Regulations for Water Resources

Other Federal regulations that may relate to water resources include the Safe Drinking Water Act, the Fish and Wildlife Coordination Act, the Rivers and Harbors Act, and the Wild and Scenic Rivers Act. The Safe Drinking Water Act protects public health through the regulation of the nation's public drinking water supply. This includes protecting sources of public water and setting national standards for pollutants that may be present within public drinking water. The Fish and Wildlife Coordination Act requires consultation with the USFWS when proposed projects may result in modification of water

²⁶ Jurisdictional surface waters and wetlands are considered *Waters of the United States*, as defined by the USACE at 33 CFR 328.3 and USEPA at 40 CFR 230.3

resources such as surface water bodies, stream, or wetlands. The Rivers and Harbors Act was established to protect the navigability of waters used for commerce.

The Wild and Scenic Rivers Act established the National Wild and Scenic Rivers System to preserve rivers with outstanding natural, cultural, and recreational values. Rivers that are designated to the system gain protection from certain alterations. The NPS also maintains the Nationwide Rivers Inventory (i.e., the NRI), which lists river segments that potentially qualify as wild, scenic, or recreational river areas but are not listed as a National Wild and Scenic River. A presidential directive issued in 1979 requires Federal agencies to consult with the NPS prior to taking actions that could effectively foreclose wild, scenic, or recreational status for rivers on the NRI. A river segment may be listed on the NRI if it is free-flowing and has one or more outstandingly remarkable values. Outstandingly remarkable values that can qualify a river for listing include: exceptional scenery, recreation, unusual geological formations, rare plant and animal life, and cultural or historical artifacts that are judged to be of more than local or regional significance.

Georgia's Coastal Marshland Protection Act

The State of Georgia regulates coastal wetlands through the Georgia's Coastal Marshland Protection Act. This act applies to tidal wetlands and requires additional State permits to ensure the protection of these resources.

Chapter 391-3-6-.03 of the Rules and Regulations for Water Quality Control

Georgia's water quality standards are found in Chapter 391-3-6-.03 of the Rules and Regulations for Water Quality Control. These standards are used by the Georgia Environmental Protection Division to develop total maximum daily loads, issue water quality permits, and assess the water quality of State waters as part of the 303(d) listing process.

Georgia's Erosion and Sedimentation Act of 1975

Georgia's Erosion and Sedimentation Act complies with mandates in the CWA, strengthens erosion and sedimentation control activities in the Georgia, and implements a state-wide comprehensive soil and erosion control program.

Georgia's Scenic River Act of 1969

Georgia's Scenic River Act defines scenic rivers in the state and protects these rivers by preventing the construction of dams, reservoirs, or other structures that would impede the natural flow of the river.

Camden County Unified Development Code

Development projects within the 100-year flood zone are regulated under the Camden County UDC per Division 4-0 Flood Damage Prevention Section 1130 Provisions for Flood Hazard Reduction.

3.14.3 Existing Conditions

The ROI for water resources includes the 11,800 acre industrial site currently owned by Bayer CropScience and Union Carbide (Exhibit 3.14-1). This area includes the areas proposed for construction or infrastructure improvements within the proposed Spaceport Camden and along existing roadways within the Bayer CropScience Property. The ROI for water resources also includes surface waters bordering the property boundary and surface water resources within the proposed launch trajectories (Exhibit 3.14-1). Waters bordering the property boundary are included in the ROI for consideration of

indirect effects, and waters within the proposed trajectory are included for the consideration of effects should a launch failure occur.

Wetlands

Large areas of estuarine wetlands or tidal marshes are present in the portions of the site north and east of Todd Creek and the Floyd Creek. These wetlands areas, as mapped by the National Wetland Inventory, are shown on Exhibit 3.14-1 and are characterized by plants such as soft rush (*Juncus effusus*), salt-marsh cord grass (*Spartina alterniflora*), and broad-leaf cat tail (*Typha latifolia*).

Additional information was collected on wetlands within the proposed Spaceport Camden site, as this portion of the ROI has a greater potential for wetland impacts related to the construction of facilities.

Additional field surveys were conducted in 2016. These field survey areas (see Exhibit 3.14-2) were delineated in the summer of 2016 using the USACE methodology found in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* (USACE, 2010).

Wetland functions were assessed using the Wetland Rapid Assessment Procedure (WRAP). The WRAP is a rating index developed to assist in the regulatory evaluation of wetland sites that have been created, enhanced, preserved, or restored. This standardized rating index can be used in combination with professional judgment to provide an accurate and consistent evaluation of wetland sites (Miller & Gunsalus, 1999).

WRAP uses six variables to determine the functional condition of the wetland. These variables are wildlife utilization; wetland overstory/shrub canopy; wetland vegetative ground cover; adjacent upland support/wetland buffer; field indicators of wetland hydrology; and water quality input and treatment systems evaluation. These variables are assigned a score from 0 to 3 and then the variables are summed and divided by the maximum potential score for each variable to result in a WRAP index score. The WRAP index score ranges from 0 to 1, with a higher score representing higher functionality and a lower score representing poorer functionality. Wetlands delineated in Proposed Spaceport Camden have WRAP scores ranging from 0.48 to 0.72, with most wetlands falling between the 0.60 and 0.72 range.

The delineation's field survey areas focused on those areas proposed for facility construction and roadway improvements (Exhibit 3.14-2). Eighteen wetlands (ID #3 through #20 in Exhibit 3.14-2) totaling approximately 3.61 acres were delineated in the field survey areas. These wetlands are comprised of non-tidal, freshwater (palustrine) habitat types including palustrine forested (PFO), palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine unconsolidated bottom (PUB). Three surface water features were also mapped during the wetland delineation. These surface water features are discussed more in the following surface water section. The complete wetland delineation, including an assessment of function and values for wetlands within the proposed Spaceport Camden site, is included in Appendix H, *Wetland Delineation*.

Floodplains

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps categorize floodplains into different flood zones based on the levels of flood risk. Flood zones derived from the 2015 preliminary FEMA Flood Insurance Rate Maps (FEMA, 2015) are shown in Exhibit 3.14-1. The 2015 preliminary FEMA Flood Insurance Rate Maps were undergoing review during the preparation of the Draft EIS and are anticipated to replace the current 2008 edition of the maps.

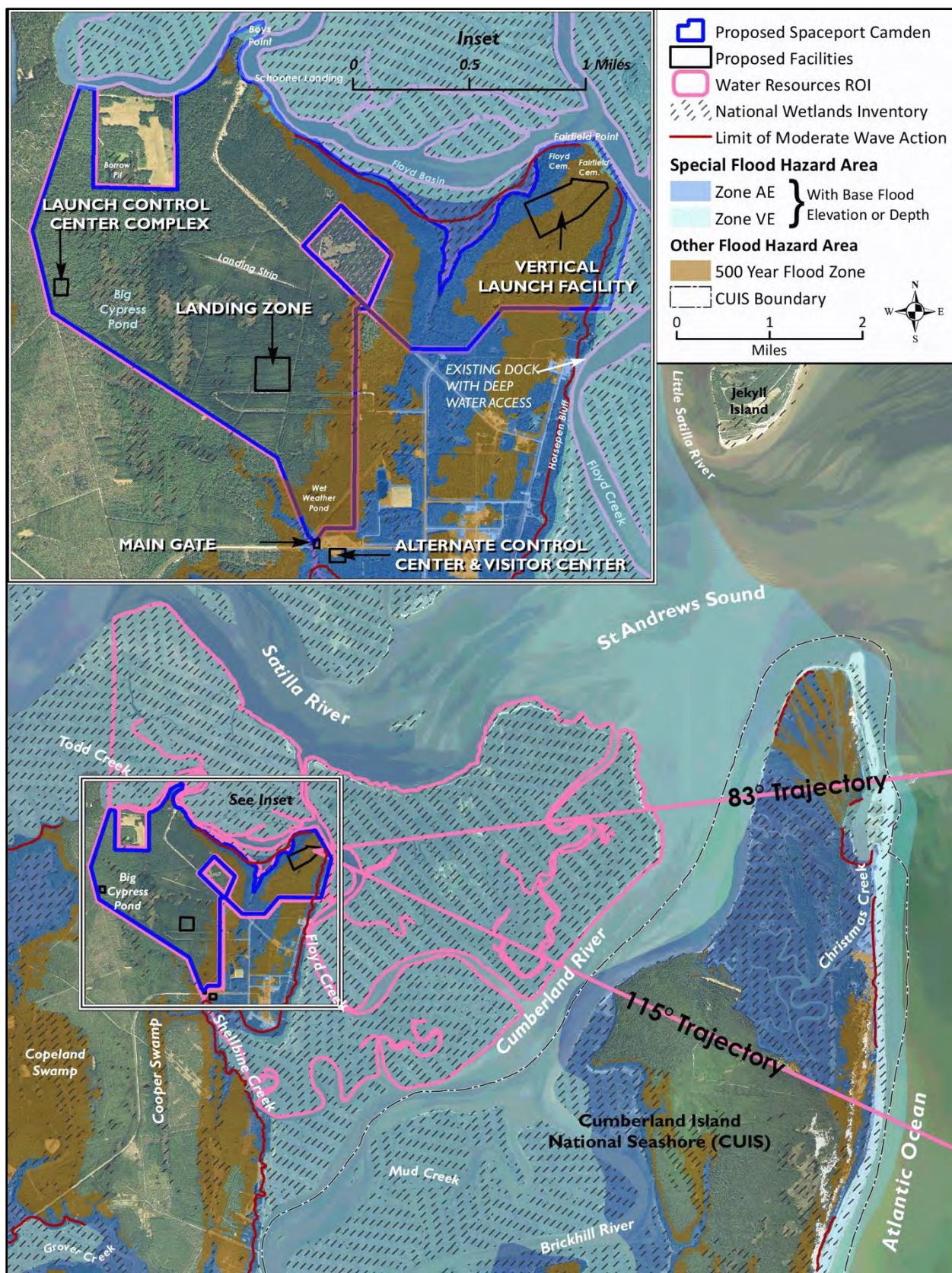


Exhibit 3.14-1. Floodplains and Regional Surface Water Resources

The zones in the map are based on the base flood elevation which is the surface elevation of a flood event having a 1 percent chance of occurring in any given year or the 100-year flood and flood events having a 0.2 percent chance of occurring in any given year or the 500-year flood. The 500-year flood zone can also include an area of 1 percent annual chance flood with average depth less than 1 foot or with drainage areas of less than 1 square mile. "Zone AE" areas are subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Maps with AE Zones have base flood elevations shown. "Zone VE" areas are subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. Base flood elevations derived from detailed hydraulic analyses are shown. Exhibit 3.14-1 also shows the limit of moderate wave action in the ROI. This linear demarcation defines the inland limit of the areas affected by waves greater than 1.5 feet. Research and post disaster damage assessments have demonstrated that waves 1.5 feet or greater can induce significant structural damage. All proposed facilities at the proposed Spaceport Camden are outside of the limit of moderate wave action.

Portions of the proposed Spaceport Camden site are located within the 100-year and 500-year flood zones. The primary benefit provided by flood plains at the proposed Spaceport Camden is the storage and moderation of flood events from the Satilla River and its tributaries. Floodplains in the ROI also provide some benefits to plant and animal habitat and water quality maintenance.

Surface Waters

The ROI for surface waters is located within the Cumberland-St. Simons (HUC 3070203) watershed. The Atlantic Ocean is located to the east under the proposed range of trajectories. The ROI around the proposed Spaceport Camden is bordered by two major tidal rivers, the Satilla River along the ROI's northern boundary and the Cumberland River along the eastern boundary (Exhibit 3.14-1). The Satilla River is a blackwater river (a deep, slow moving river with darkly stained acidic water) with limited fish species diversity due to extreme variations in flow and the relatively homogenous habitat within the river system. The river does support fisheries for redbreast sunfish and catfish (Coastal Council, 2011). The Cumberland River is part of the Intracoastal Waterway. The 15-mile long Cumberland River connects Cumberland Sound to the south with the Satilla River to the north (Exhibit 3.14-1).

Christmas Creek, which flows into the Atlantic Ocean, is located on Little Cumberland Island in the ROI under the proposed range of trajectories (Exhibit 3.14-1). A section of the Cumberland River is also located in the ROI under the proposed range of trajectories. Smaller resources located immediately adjacent to the proposed Spaceport Camden include two tidal creeks, Todd Creek/Floyd Basin located on the spaceport's northern boundary and Floyd Creek located along the spaceports eastern boundary. Shellbine Creek is located near the southwestern boundary of the proposed Spaceport Camden. Other significant surface water features located within the boundary of proposed Spaceport Camden include Big Cypress Pond and the wet weather pond located near the main gate (Exhibit 3.14-2). In addition to these features, three jurisdictional surface water features were mapped within the field survey areas (Exhibit 3.14-2). These features were mapped as part of the 2016 wetland delineation and were classified as ephemeral streams (see Appendix H, *Wetland Delineation*).

Section 305(b) of the CWA requires States to assess the quality of its waters every two years and summarize that assessment in a report called the 305(b) report. Section 303(d) of the CWA requires States to submit a list of all of the waters that have impaired water quality and cannot meet their designated uses (fishing, recreation, industrial, etc.). There are no Section 303(d) impaired waters in the project ROI (Georgia Environmental Protection Division, 2016).



Exhibit 3.14-2. Wetland and Other Surface Water Resources at Proposed Spaceport Camden

¹Source: (Leidos, 2016)

Groundwater

Three aquifers are located in Camden County. In order of depth below the ground surface these are the surficial, the Brunswick, and Floridan aquifers (Exhibit 3.14-3) (Peck & Painter, 2016). Only the Brunswick and Floridan aquifers are considered primary sources for potable groundwater in the ROI (Clark, Hacke, & Peck, 1990; Peck & Painter, 2016). The U.S. Geological Survey estimates that 6.4 million gallons of water per day is withdrawn from groundwater in Camden County (U.S. Geological Survey, 2010).

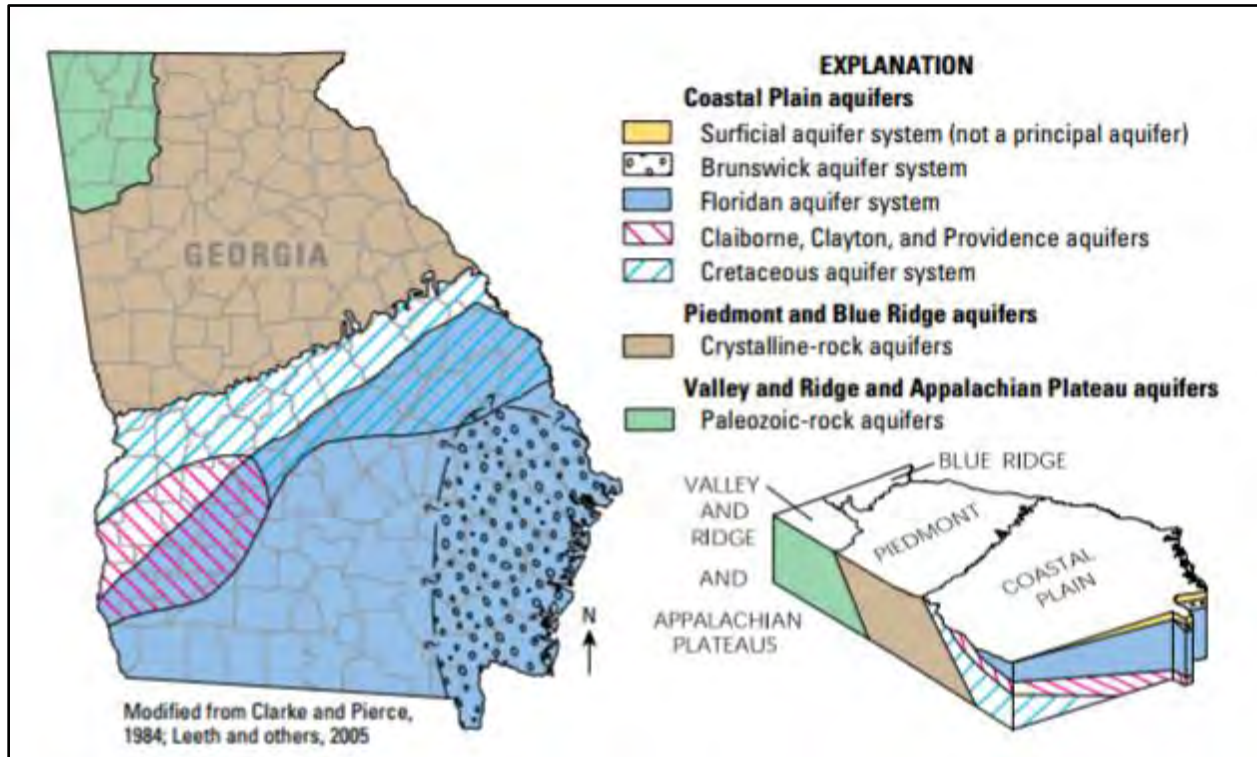


Exhibit 3.14-3. Georgia Aquifers

The surficial aquifer is composed of unconsolidated sand, clayey sand, shell, and thin limestone beds (Clark, Hacke, & Peck, 1990; Peck & Painter, 2016). Typical depths range from 11 to 300 feet below ground surface with project areas in the ROI having a depth of approximately 300 feet below the ground surface and having yields of 2 to 15 gallons per minute. The lower portion of this aquifer is confined within the ROI by an overlying layer of low permeability (Clark, Hacke, & Peck, 1990). The surficial aquifer has the highest potential to be contaminated by past historical activities within the ROI (see Section 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*) due to potential interactions with contaminated soil.

Monitoring conducted at the sites in the ROI (MRA-2/SWMU 9, Empty Drums Area, SWMU 6, MRA-1/SWMU 8, Loop Road Sit) and described in Section 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, has shown the presence of metals such as barium, chromium, lead, and arsenic in groundwater at some of these locations. A risk assessment conducted for these sites concluded that the levels of metals observed in the groundwater did not pose unacceptable risk to human or ecological receptors (CH2MHill, 2008). Ten additional potentially contaminated sites are also described in Section 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*. No formal investigation or survey of these sites has occurred, and detailed information on the presence of hazardous constituents in the groundwater is unavailable.

1 Once the land is acquired by Camden County, these potentially contaminated sites would likely be
2 managed under the Georgia Brownfields Program. The purpose of the program is to encourage
3 voluntary cleanup and reuse through redevelopment projects. The program makes it possible to acquire
4 contaminated property without assuming all of the liability, as the new owner is protected from third
5 party claims (lawsuits) resulting from prior contamination. In this case, the new owner (Camden
6 County) would be responsible for soil and groundwater investigations and cleanup of soil and source
7 material to Georgia risk reduction standards. This would involve preparing a CAP, which would work
8 like a contract for soil and source cleanup at these sites in accordance with State of Georgia
9 requirements.

10 The Brunswick aquifer is composed of phosphate and dolomitic quartz sand with depths ranging from
11 85 to 390 feet below ground surface. Depths in southeastern Camden County (i.e., the ROI) are
12 approximately 340 feet. Yields in this confined aquifer range from 10 to 30 gallons per minute. Recharge
13 areas for the Brunswick aquifers are located outside of the ROI to the north and west (Clark, Hacke, &
14 Peck, 1990; Peck & Painter, 2016).

15 The Floridan aquifer is composed of limestone, dolomite, and calcareous sand with depths ranging from
16 40 to 900 feet below ground surface. Depth to this aquifer at Kings Bay in Camden County is
17 approximately 530 feet. The aquifer is artesian (confined) in the ROI, and average yields range from
18 1,000 to 5,000 gallons per minute with some areas having yield as high as 11,000 gallons per minute
19 (Clark, Hacke, & Peck, 1990; Peck & Painter, 2016). Recharge to the confined ground-water-flow system
20 is from precipitation in and near parts of the outcrop areas of the confined aquifers. The recharge area
21 for the Floridan aquifer system is northwest and west of the ROI (Clark, Hacke, & Peck, 1990; Peck &
22 Painter, 2016).

23 The amount of groundwater available in aquifers varies according to recharge (how much water flows
24 back into the aquifer from sources such as precipitation and surface water infiltration) and how much
25 water is withdrawn from the aquifer from natural flow to streams, springs, leakage into adjacent
26 aquifers, and withdrawals from wells.

27 Groundwater from the Floridan aquifer is an important resource for the Georgia coastal region (Coastal
28 Council, 2011). The groundwater availability resource assessment (Georgia Environmental Protection
29 Division, 2010) analyzed groundwater resources in the Georgia coastal region and estimated the amount
30 of water that can be safely pumped from the region's aquifers. This amount of water or the sustainable
31 yield is greater in most regions of the coast than the forecasted demands on water resources. The study
32 recognized that in a few regions saltwater intrusion into groundwater aquifers can result from
33 withdrawing water from the aquifer. The Georgia Environmental Protection Division recommended that
34 no additional withdrawal beyond current permitted levels should occur in Chatham County, portions of
35 Effingham County and portions of Glynn County. Bryan and Liberty Counties have limited withdrawals
36 and the other counties in the region including Camden County have no limitation on groundwater
37 withdrawal (see Exhibit 3.14-4). These recommendations were the result of the Coastal Georgia Water
38 and Wastewater Permitting Plan for Managing Salt Water Intrusion, which indicated that regions outside
39 of the five counties listed above did not have a significant risk for saltwater intrusion (Georgia
40 Environmental Protection Division, 2006).

41 None of the aquifers located in Camden County are considered USEPA sole source aquifers. A sole
42 source aquifer is a unique aquifer that supplies at least 50 percent of the drinking water for its service
43 area and for which there is no reasonably available alternative drinking water source should the aquifer
44 become contaminated. The nearest sole source aquifer is located approximately 80 miles south of the
45 proposed Spaceport Camden near Daytona Beach, Florida.

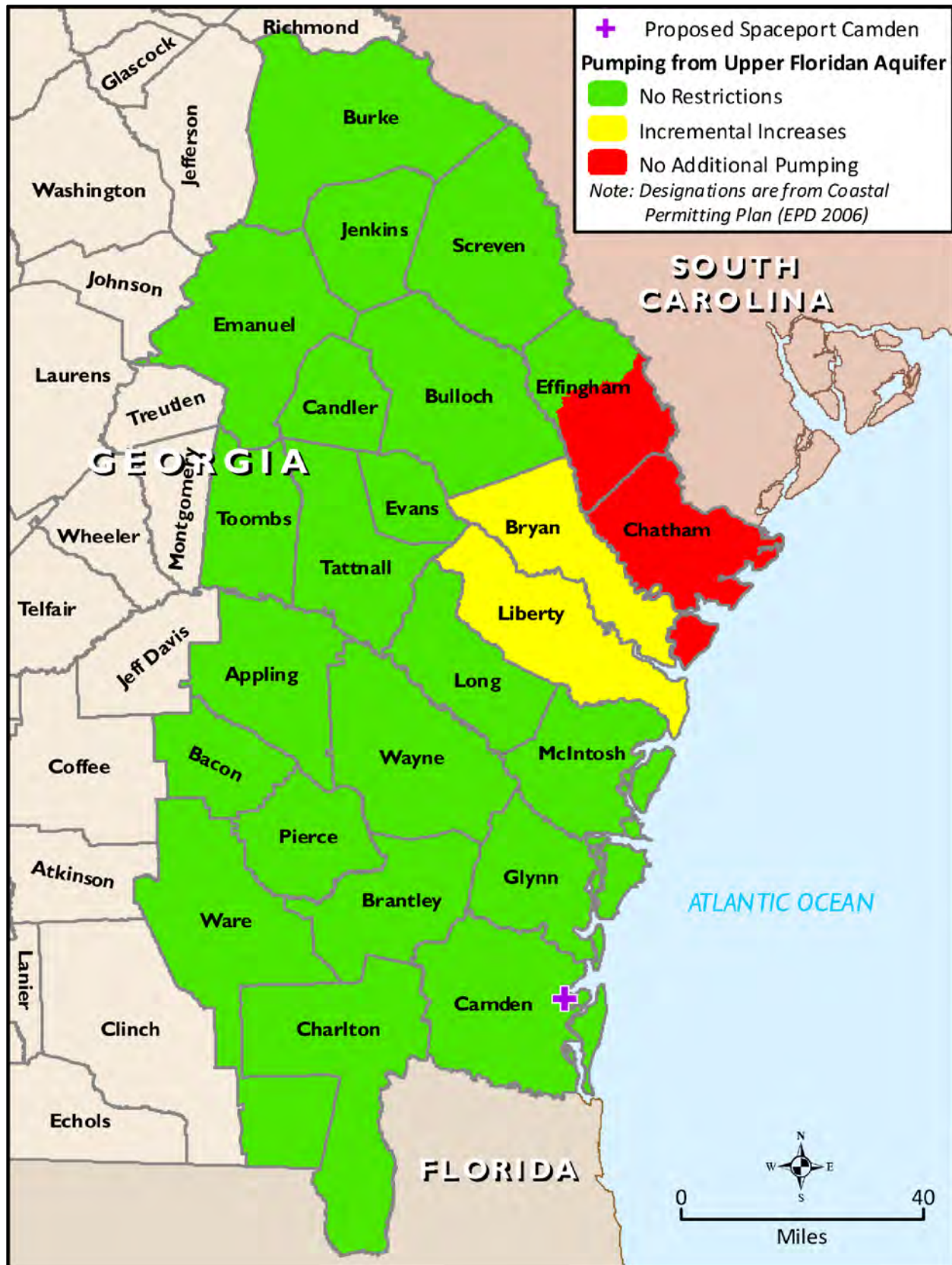


Exhibit 3.14-4. Groundwater Availability in the Georgia Coastal Region

Wild and Scenic Rivers

The Wekiva River, approximately 150 miles south of the proposed Spaceport Camden, is the closest Wild and Scenic River to the area. In addition to maintaining a list of Wild and Scenic Rivers, the NPS also maintains the Nationwide River Inventory. This list includes rivers or segments of rivers that may meet Wild and Scenic River Act eligibility but have not been categorized as a Wild and Scenic River. Section 7 of the Wild and Scenic Rivers Act does not apply to these rivers but Federal agencies are directed to avoid or mitigate actions that adversely impact these rivers. The Satilla River is the only river in the water resources ROI that is listed on the Nationwide River Inventory. The Satilla River was listed in 1982 listed for scenery, recreational opportunities, geologic features, fish and wildlife, and historical and cultural values. No Georgia Scenic Rivers are located in the project ROI.

4 ENVIRONMENTAL CONSEQUENCES

This chapter presents the environmental consequences associated with the proposed alternatives. Potential impacts on the existing environmental conditions (as defined in Chapter 3, *Affected Environment*) are assessed for both the construction and operational phases of the Alternatives, to include the No Action Alternative.

4.1 Air Quality

Potential impacts to air quality could result from the proposed construction and operation of the new facilities within the vertical launch area and control center area. Potential impacts were determined by estimating emissions generated from the proposed activities and assessing their impacts on air quality. Potential impacts were evaluated based on calculated direct and indirect emissions associated with implementation of the Proposed Action, Ocean-Landing Only Alternative, and the No Action Alternative. For criteria pollutant emissions, the emissions associated with the Proposed Action were compared to the 2014 NEI data for Camden County and the Jacksonville-Brunswick Interstate Air Quality Control Region (USEPA, 2017c) to assess how large of a percentage contribution to the regional air emissions the operational activities would represent.

Air quality impacts are assessed to determine if implementation of any of the alternatives would directly or indirectly result in the exceedance of one or more of the NAAQS for any of the time frames analyzed, increase the frequency or severity of any such existing violations, or result in a negative change in ROI attainment status.

4.1.1 Proposed Action

Under the Proposed Action, launch facilities would be constructed as described in Section 2.1, *Proposed Action*, and operations would consist of up to 12 launches/landings per year. Landings may occur on land or on a barge located several hundred miles off shore.

4.1.1.1 Construction

This potential impact analysis addresses emissions from construction activities including construction equipment and operations, as well as emissions from worker vehicles commuting to and from the area during construction. USEPA's Motor Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, GHGs, and air toxics. The current version of the software is MOVES 2014a and was used to calculate mobile source emissions. More detailed description and discussion of air quality analysis methodology can be found in Appendix E, *Air Quality*. To evaluate the potential impacts of air emissions, the estimated emissions from project construction activities are compared with the total ROI emissions on a pollutant-by-pollutant basis for the region's 2014 NEI data. If the proposed activities result in emissions representing a large portion of ROI emissions for any of the NAAQS pollutants, the impacts on air quality could be significant. The analysis should also determine whether any exceedance of the NAAQS or State standards could be anticipated.

The spaceport would comply with applicable permit requirements under the PSD program per 40 CFR §51.166. No new major stationary sources are anticipated at the facility, so no new source review or PSD permit would be required. Although no major stationary sources are anticipated at the facility, the aggregate of many smaller sources may have the potential to emit more than the major source

threshold of 100 tons per year. Once the final construction plan is determined and facilities are constructed, an emissions inventory should be prepared in order to accurately determine if the facility will be required to obtain a Title V operating permit.

Since Camden County is currently in attainment for all NAAQS, a General Conformity assessment and determination is not necessary and is not included in the environmental consequences discussion. Calculated construction emissions are provided in Table 4.1-1.

Table 4.1-1. Proposed Action Construction Air Emissions Compared with Region of Influence Baseline Emissions

Category	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOCs	CO _{2e}
	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
Construction emissions (2018)	41.72	54.23	332.19	2.61	0.10	10.05	9,848
Construction emissions (2019)	3.42	4.77	43.98	0.22	0.01	1.11	881
Camden County¹	19,430	3,684	6,242	1,211	120	24,722	651,667
ROI baseline total¹	1,019,481	141,537	204,620	73,842	54,124	1,002,704	29,462,242
Percentage of baseline	0.00%	0.04%	0.16%	0.00%	0.00%	0.00%	0.03%

Notes: CO = carbon monoxide; NO_x = nitrogen oxides; PM₁₀ and PM_{2.5} = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; ROI = region of influence; SO₂ = sulfur dioxide; VOCs = volatile organic compounds; tpy = tons per year.

¹Source: (USEPA, 2017c)

The estimated emissions from construction of the Launch Control Center Complex, Vertical Launch Facility, Alternate Control Center and Visitor Center, and facility roads represent small percentages of the Camden County and regional emissions and would not cause an exceedance of any NAAQS. In conclusion, the construction impacts on air quality would not be significant.

4.1.1.2 Operation

This analysis addresses emissions from launches and associated launch activities (launches, landings, recovery barges and associated equipment, static fire engine tests, wet and dry rehearsals); routine activities at the site between launches; commuting employees and site visitors; delivery vehicles; and associated activities on an annual basis.

Calculated emissions from 12 launches and 12 first-stage landings are compared to the total ROI emissions on a pollutant-by-pollutant basis based on the region's NEI data (Table 4.1-2). Data used to calculate emissions from launch operations were obtained from the *Final Environmental Impact Statement for the SpaceX Texas Launch Site* (FAA, 2014), with the exception of Falcon 9 Heavy launches, which were not used for the Spaceport Camden EIS. Commute vehicle and delivery truck emissions were calculated using MOVES 2014a. Generator emissions were calculated using data from AP-42 Section 3.4, *Large Stationary Diesel and All Stationary Dual-Fuel Engines* (USEPA, 1996). Support vessel and barge operations were calculated using emission factors from USEPA's *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories* (USEPA, 2009) and *Exhaust Emission Factors for Nonroad Engine Modeling - Spark-Ignition* (USEPA, 2010). If the activities result in emissions representing a large portion of the ROI emissions for any of the NAAQS pollutants, the impacts on air quality could be significant. If exceedances of the NAAQS would be anticipated, the impacts would be determined to be significant.

Table 4.1-2. Projected Annual Operational Air Emissions (Tons per Year)

Operational Activity	Proposed Action Emissions (tpy)						
	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO _{2e}
Launch Vehicle Launches	2,742.88	0.00	0.00	0.00	0.00	0.00	1,590
Launch Vehicle Landings	1,371.44	0.00	0.00	0.00	0.00	0.00	795
Static Engine Tests	685.72	0.00	0.00	0.00	0.00	0.00	397
Generator Operations	79.48	941.42	17.17	15.51	100.23	33.42	38,219
Landing Barge Operations	3.99	17.43	0.51	0.51	5.87	0.51	842
Staff Commutes	12.69	1.12	0.03	0.02	0.01	1.12	1,133
Supply Deliveries	0.00	0.01	0.00	0.00	0.00	0.00	7.24
Total emissions	4,896.20	959.98	17.70	16.04	106.11	35.05	42,983
Camden County	19,430	3,684	6,242	1,211	120	24,722	651,667
ROI baseline total	1,019,481	141,537	204,620	73,842	54,124	1,002,704	29,462,242
Percentage of ROI Total	0.48%	0.68%	0.01%	0.02%	0.20%	0.00%	0.15%

Notes: CO = carbon monoxide; NO_x = nitrogen oxides; PM₁₀ and PM_{2.5} = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; ROI = region of influence; SO₂ = sulfur dioxide; VOCs = volatile organic compounds; tpy = tons per year.

The operational emissions for the proposed vertical launch and the control center areas represent small percentages of the Air Quality Control Region's regional emissions and would not cause an exceedance of any NAAQS. This area is in attainment; therefore, the General Conformity Rule does not apply. In conclusion, the operational impacts from the Proposed Action on air quality would not be significant. The impacts from GHG emissions associated with operations are discussed in Section 4.3, *Climate*.

4.1.1.3 Other Emissions Sources

Launch failures have the potential to generate emissions not normally generated during operations (from additional fuels, including satellite fuels). Additionally, the distribution of emissions (at the altitude of the emission) would be different than from a successful launch. The potential for adverse impacts associated with launch failures is discussed qualitatively since these impacts are not planned as part of the operations and would be unlikely. Furthermore, insufficient data exist to estimate impacts quantitatively, and substantial resources would be needed to do a launch failure chemical dispersion study specific to Camden County.

Although unlikely, a launch could fail. A launch failure could occur on the launch pad or after the launch vehicle has traveled several miles into the atmosphere. Other scenarios could occur, including the entire launch vehicle, with onboard propellants, being consumed in a "destruct action" during flight. In this case, the launch vehicle would be largely consumed in the destruct action, but residual propellant would escape and vaporize into an airborne cloud. Other propellants such as UDMH (also known as 1,1-dimethyl hydrazine), MMH, and NTO may also be released into the environment as a result of a launch failure. UDMH is highly reactive and degrades readily in environmental media and is not likely to produce significant exposure impacts to humans or the environment. Both MMH and NTO are toxic to humans and pose environmental hazards if released in sufficient quantity to the environment. MMH is highly reactive as well, and is listed by the International Agency for Research on Cancer as a possible human carcinogen.

Because of these potential hazards, all reasonable and feasible measures would be taken by Spaceport Camden operators and FAA to minimize accidents and to protect human health and the environment. To

minimize the risk of accidents, Spaceport Camden would fully comply with safety requirements set forth in 14 CFR Parts 400–450, for both ground safety and flight safety, and any other applicable regulations or guidance from FAA. In addition, Spaceport Camden would prepare and implement a Hazardous Materials Emergency Response Plan to ensure that adequate and appropriate guidance, policies, and protocols regarding hazardous material incidents and associated emergency response are available to and followed by all personnel.

4.1.2 Ocean-Landing Only Alternative

Under this alternative, all first-stage landings would occur on a barge located several hundred miles off shore. The construction of the Landing Zone Facility would not occur under this alternative.

Under this alternative, the emissions would generally be the same as described above for the Proposed Action. However, since the landings would occur at sea, well away from populated areas, the actual impacts to regional air quality would be less because offshore emissions would not be likely to disperse in such a manner as to appreciably contribute to pollutant concentrations on shore. Further, the construction emissions would be slightly lower as well since the construction of the Landing Zone at the spaceport would not be required.

Based on the analysis, this alternative would not result in any significant adverse air quality impacts because it would not cause any pollutant concentrations to exceed one or more of the NAAQS for any of the time periods analyzed.

4.1.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden, and no spaceport facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. The No Action Alternative is, essentially, the baseline condition, and air quality impacts under the No Action Alternative would consist of those generated by ongoing activities within the ROI as described in Section 3.1, *Air Quality*.

4.2 Biological Resources

4.2.1 Proposed Action

The following section provides an assessment of potential impacts from the implementation of the Proposed Action to the biological resources described in Section 3.2, *Biological Resources*. The analysis considers direct and indirect impacts of construction and operations to animals and plants/vegetation. Potential impacts on biological resources from construction and operations are analyzed both quantitatively (e.g., removal of habitat) and qualitatively within the following categories:

- Terrestrial vegetation and habitats
- Terrestrial animals
- Marine and estuarine vegetation and habitats
- Marine and estuarine animals

The analysis of biological resources considers potential impacts to vegetation (individual plants and vegetation/habitat communities) and animals, including special status species. The plant and animal resources potentially affected are identified based on habitat type and previously documented occurrence. The analysis includes an assessment of impacts resulting from direct physical impacts, habitat alteration, noise and other disturbance, and chemical materials. Where appropriate, projected conditions were compared with baseline conditions and a determination was made as to whether impacts would be adverse.

The methodologies used to analyze these impacts include examination of acres of habitat type affected (e.g., permanent removal for the construction of infrastructure) and the species associated with that habitat. Studies from similar actions were reviewed, with pertinent findings included in this section. Direct and indirect impacts are included in the analyses. Proposed measures to avoid, minimize, or mitigate impacts are included in this section as applicable and are summarized in Section 6.2, *Biological Resources*.

The analysis discusses the results of consultations required by the laws listed in Section 3.2.2, *Regulatory Setting* (i.e., ESA, MMPA, and the Magnuson-Stevens Fishery Conservation and Management Act), as well as compliance with the other laws and executive orders listed in Section 3.2.2.

4.2.1.1 Construction

Construction activities that may impact biological resources include vehicle and equipment operation, land clearing, earth moving, lighting, pile driving, stormwater runoff, and potential introduction of invasive species. These activities may result in injury, mortality, alterations to behavior and reproduction, water quality alterations causing physiological impacts, and increased competition from invasive species.

Terrestrial Vegetation and Habitats

Construction of the facilities and infrastructure for Spaceport Camden would result in the clearing of 122 acres and may increase the potential for erosion/sedimentation and invasive nonnative species infestations. The physical footprint of the facilities and infrastructure would result in the permanent removal of approximately 58 acres of pine plantation, 38 acres of maritime forest, 1.3 acres of interdunal wetlands, 24 acres of developed area, and 0.3 acre of savanna and flatwoods; the remainder of the site would remain in its current state (Table 4.2-1; Exhibit 3.2-1). The vegetation to be removed is a small percentage of the vegetation communities in the area and would not affect local or regional plant diversity. Up to 0.78 acre of the 3.61 acres of the wetland delineated in the vicinity of proposed construction areas may be directly impacted as a result of the Proposed Action and assuming all optional/alternate roadways and site are constructed as initially envisioned (Leidos, 2016).

The Proposed Action would result in direct impacts to wetlands at the Vertical Launch Facility and along certain roads (see Section 4.14, *Water Resources*). In some circumstances, stormwater runoff may lead to alterations of habitats and the hydrology of wetlands and waterways. In other circumstances, erosion associated with construction could result in sedimentation of wetlands, resulting in increased turbidity (tidal creeks are addressed under the Marine and Estuarine Vegetation and Habitats subsection). However, as the area is relatively flat, the site has a low erosion potential, and erosion control best management practices and stormwater controls would be implemented to avoid such impacts (see Section 4.14, *Water Resources*).

Table 4.2-1. Acres of Habitat Types to Be Cleared

Proposed Project	Developed Area	Pine Plantation	Southeastern Coastal Plain Interdunal Wetland	Southern Atlantic Coastal Plain Maritime Forest	Southern Atlantic Coastal Plain Wet Pine Savanna and Flatwoods	Total
Alternate Control Center & Visitor Center	0.8	2.3	0	0	0	3.1
Heavier Road	12.5	2.2	0	0.8	0.1	15.6
Landing Zone	0	21.4	0	0	0	21.4
Launch Control Center Complex	0	4.1	0	0	0	4.1
Main Gate	0.6	0	0	0	0	0.6
Regular Road	7.2	0.9	0	0.2	0.2	8.5
Regular Road (Perimeter)	0.6	5.9	0	0.7	0	7.2
Vertical Launch Facility	2.4	20.8	1.3	36.5	0	61
Total	24.1	57.6	1.3	38.2	0.3	121.5

Note: This table reflects the entire area to be removed of vegetation (disturbed) for construction, not just the facility footprints. The table also includes the additional clearing for the right-of-ways for the roads. The analysis includes the entire disturbed area from land clearing activities.

The introduction of invasive nonnative species from construction vehicles, equipment, and supplies would have the potential to alter native plant communities through increased competition. In keeping with EO 13112 and to reduce introduction of potential invasive species, equipment would be inspected and cleaned prior to first-time use at Spaceport Camden and only weed-free landscaping materials would be used. If areas of invasive species infestations were to be discovered, they would be treated with approved herbicides in accordance with guidance provided on the label.

No federally listed plant species have been documented at the Spaceport Camden site, although the federally endangered hairy rattle weed (*Baptismal arachnifera*) does occur north of the Satilla River. State-listed plant species potentially at the site, but not observed, include Morzenti's spleenwort, ciliate-leaf tickseed, Godfrey's wild privet, corkwood, wild coco, and climbing buckthorn. Prior to construction, surveys would be conducted for protected plant species. In the unlikely event that protected plant species are found within the 122 acres to be cleared, these areas would be marked and avoided, if possible. Georgia state law does not prohibit the taking of state-listed plants on private land (Rules and Regulations of the State of Georgia, Rule 391-4-10-.06).

Summary

Based on the overall acreage of the site, the construction of Spaceport Camden facilities and infrastructure would not result in significant impacts from the removal of 122 acres of terrestrial vegetation or habitats, including special status plant species.

Terrestrial Animals

General Impacts to All Terrestrial Animals

Direct Physical Impacts

The main cause of direct physical impacts associated with the Proposed Action is physical contact, which could involve the crushing/trampling of, or collision with, a species resulting from interactions with vehicles, equipment, power lines, towers, or personnel. Direct physical impacts are also possible from

1 exposure to chemical materials. During the 15 months of facilities construction, 40 to 50 workers would
2 transit to and from the site six days per week; during the seven months of infrastructure construction,
3 an additional 20 workers would commute to and from the site. There also would be delivery of
4 construction materials for roads, parking lots, concrete pads at the launch facility, landing pad, plus
5 12 buildings of various sizes, four lightning towers, a water tower, security fencing, parking lots, and
6 septic equipment and other associated equipment. Land clearing and construction equipment (i.e.,
7 cranes, concrete pump trucks, pile driving equipment, excavators) would be used during daylight hours
8 only. Crushing by vehicles and equipment may occur to smaller, less mobile species, but the majority of
9 animals would move away from the construction sites into surrounding areas. Similar habitats surround
10 the construction sites where the species could relocate.

11 Bird collisions would be possible with the four lightning towers (250 feet tall) and above-ground
12 powerlines (approximately 4 miles). Specific impacts from these towers and powerlines are discussed in
13 the Migratory Birds subsection.

14 The accidental spill of chemical materials have a low potential to affect animal species, the effects of
15 which could result in respiratory, reproductive and other physiological impacts. Hazardous materials
16 and hazardous wastes would be handled in accordance with protocols detailed in Section 4.7, *Hazardous*
17 *Materials, Solid Waste, and Pollution Prevention*, to prevent the exposure of fish and wildlife to
18 chemicals. Spills would be contained and cleaned up per the procedures identified in a Hazardous
19 Materials Emergency Response Plan.

20 **Noise and Human Presence**

21 Noise and human presence associated with construction may affect local wildlife by disturbing foraging,
22 breeding, migration, and wintering activities. An animal's response to construction noise would depend
23 on various factors, including noise level and frequency, distance and event duration, equipment type
24 and conditions, frequency of noisy events over time, slope, topography, weather conditions, previous
25 exposure to similar noises, hearing sensitivity, reproductive status, time of day, behavior during the
26 noise event, and an animal's location relative to the noise source.

27 The common measure for construction point source noise (i.e., pile driving) is maximum decibel level
28 (L_{max}), which is the highest value of a sound pressure over a certain time interval (Table 4.11-1). Noise
29 levels for construction activities range from 73 (for a generator) to 101 dBA L_{max} (for pile driver) at
30 50 feet from the activities (FHWA, 2006). As most of the Spaceport Camden site is vegetated or
31 unpaved, there would be a reduction in noise transfer such that the extent of noise impacts would be
32 less than these levels.

33 Construction of the facilities and infrastructure would result in temporary increases in daytime noise
34 over a 15-month period. Noise from these activities could disturb normal behaviors temporarily, or in
35 some cases, animals may permanently avoid the area. When exposed to noise from construction,
36 animals in the area may startle or move to adjacent habitat, causing extra caloric expenditures and
37 temporary stress, but these impacts would be short term. Noise during critical life cycle activities (i.e.,
38 nesting, rearing of young) is of the most concern. For any animals nesting in the area, noise from
39 construction could lead to abandonment of nesting activities and the stranding of young, which could
40 ultimately lead to animal mortality (e.g., death of nestlings).

41 Pile-driving activities are estimated to occur over the period of a month for each location (launch pad
42 and landing pad structures). Pile driving will likely elicit a flush/startle response behavior. This effect
43 could temporarily interfere with normal behaviors, such as breeding, feeding, or sheltering, and cause
44 increased stress and extra caloric expenditure. This could also leave offspring or nests vulnerable to
45 predators (i.e., feral cats, coyotes); however, predators would also likely be affected by increased noise

1 levels. Due to the short duration of high noise levels, the behavioral effects to terrestrial species would
2 be temporary and animals would resume normal behavior shortly after the disturbance.

3 **Habitat Loss/Degradation**

4 Habitat loss and degradation may involve changes in vegetation, water quality, and artificial lighting,
5 with resulting impacts to animal feeding, reproduction, resting, movement patterns, and physiological
6 functions. As discussed in the Terrestrial Vegetation and Habitats subsection, land clearing and
7 construction associated with Spaceport Camden facilities and infrastructure will result in the direct
8 permanent loss of 58 acres of pine plantation, 38 acres of maritime forest, 1.3 acres of interdunal
9 wetlands, 24 acres of developed area, and 0.3 acre of savanna and flatwoods (Table 4.2-1). The total
10 amount of habitat affected by the Proposed Action is a relatively small portion of available habitat at the
11 site; thus, species would likely move to similar habitat in surrounding areas. There may be localized
12 increases in predation and competition for foraging and nesting areas for certain species, but these
13 increases are not expected to affect the overall health of any populations.

14 Species would lose foraging, nesting, and roosting areas within these sites but have access to many
15 acres of suitable adjacent habitat. Most development would take place in areas that are not considered
16 suitable or optimal wildlife habitat (i.e., developed areas, pine plantations). Increased traffic on existing
17 roads, the development of new roads and utility corridors, and fencing installation would fragment
18 habitat for some wildlife species; however, the facilities and infrastructure footprints do not block any
19 known major terrestrial migration corridors.

20 Although the potential for erosion is low, any erosion could result in increased turbidity in aquatic
21 habitats, which can impair respiration, reproductive success, feeding, and physiological functions of
22 aquatic animals. Erosion control best management practices and stormwater controls would be
23 implemented to avoid such impacts (see Section 4.14, *Water Resources*).

24 As discussed previously, if invasive nonnative species were introduced to the site, native wildlife species
25 may suffer due to increased competition for resources and degradation of their habitats. However,
26 requirements for equipment cleaning, weed-free landscaping materials, and prompt treatment of any
27 invasive species that are discovered would minimize the potential for impacts from invasive species.

28 Although construction would occur only during daylight hours, outdoor lighting would be established for
29 site security and, eventually, additional exterior lighting would be installed as facilities were completed.
30 Exterior lighting could interfere with normal resting or hunting behaviors for wildlife and may disorient
31 bird species (see additional information on tower lighting in the Migratory Birds subsection). Lighting
32 for buildings and infrastructure would comply with the Lighting Management Plan, which will address
33 seasonality, what times lights may be on, and safety measures for animals. Lighting systems would be
34 designed and operated to reduce light pollution (refer to Section 6.13, *Visual Effects*, and the USFWS
35 consultation in Appendix A, *Public Involvement/Agency Coordination and Consultation*, for lighting
36 requirements). The Lighting Management Plan would provide details on spaceport lighting (e.g., type
37 [wavelengths, etc.] and location of lights via a plan drawing of exterior lighting), timing and positioning
38 considerations for exterior lighting, measures to minimize light glow (shielding mechanisms, directed
39 lighting, etc.), and processes and procedures for lighting installation and management.

40 ***Special Status Animal Species***

41 **Migratory Birds**

42 Migratory birds are likely to forage and roost on portions of the Spaceport Camden site, and some
43 species may use the area for nesting. Construction activities may disturb migratory bird species and

1 may destroy or degrade habitat used by these species. Direct physical impacts (injury or mortality) from
2 construction activities is unlikely because birds can easily avoid (fly away from) construction equipment.
3 As discussed in the Habitat Loss/Degradation subsection, there would be a permanent loss of habitat at
4 the four facility sites and in the areas cleared for infrastructure. Birds using the construction sites would
5 likely use similar adjacent habitats; however, they may be subject to increased predation or competition
6 pressures in these areas. To minimize the potential for having migratory bird nests within the areas to
7 be cleared, to the greatest extent possible, vegetation removal would be scheduled outside of peak
8 migratory bird breeding season. Nest surveys would be conducted within five days of any clearing or
9 construction activities; if an active nest is found, then a buffer zone would be established around the
10 nest where no activities would occur until the young fledge from the nest; thus, there would be no
11 direct impacts to active nests.

12 As discussed in the Noise and Human Presence subsection, noise from construction activities could
13 disturb normal behaviors temporarily or, in some cases, animals may permanently avoid the area.
14 When exposed to noise from construction, birds may startle or move to adjacent habitat, causing extra
15 caloric expenditures and temporary stress, but these impacts would be short term. Noise during critical
16 life cycle activities (i.e., nesting, rearing of young) is of the most concern. For any birds nesting in the
17 area, noise from construction could lead to abandonment of nesting activities and the stranding of
18 young. It would be preferable to conduct pile-driving activities outside of migratory bird breeding
19 season (late February to early August) and minimize the loudest construction operations during this
20 period. However, FAA cannot require the applicant to conduct pile-driving outside the breeding season.
21 It is the applicant's responsibility to avoid taking migratory birds.

22 Birds are vulnerable to injury or mortality due to collisions with powerlines and towers. Although there
23 are existing powerlines in the area, about three miles of overhead powerlines would be installed within
24 the Spaceport Camden site and to connect the onsite power lines to the offsite power grid; once
25 powerlines reach a facility boundary they would be installed underground. Four lightning towers
26 (250 feet tall) would be built at the Vertical Launch Facility. These towers would be in close proximity to
27 wetlands, which serve as feeding, nesting, and/or roosting grounds, which are the conditions when the
28 frequency of collisions is highest (APLIC and USFWS, 2005). To reduce the risk of electrocution and
29 collision mortality, Spaceport Camden would follow the guidelines for the Georgia Power Avian
30 Protection Plan developed in coordination with the Avian Power Line Interaction Committee (APLIC) and
31 USFWS to minimize impacts from power lines, unless structural or human safety would be compromised
32 (APLIC and USFWS, 2005). Part of this process would include an evaluation of data on established
33 flyways, adjacent wetlands, areas of high avian use, avian mortality, perch availability, prey populations,
34 and other factors that may increase bird interactions with utilities. New powerlines would be
35 constructed to avian-safe standards, including exclusion devices to discourage perching and nesting in
36 unsafe areas.

37 Tower lighting has the potential to disorient birds, causing them to circle the lights to exhaustion or to
38 fly into the lights. To minimize potential impacts from tower lighting, tower construction would follow
39 *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation,*
40 *Maintenance, and Decommissioning* unless structural or human safety would be compromised (USFWS,
41 2016). Practices would include using the minimum amount of pilot warning and obstruction avoidance
42 lighting required by FAA and using only white or red strobe lights at night at the minimum intensity,
43 number, and number of flashes per minute allowed by FAA.

44 Construction activities would not have any significant impacts on migratory birds.

ESA-Listed and Candidate Species

FAA has completed consultation with the USFWS by submitting a Biological Assessment to the USFWS (October 31, 2017) in accordance with Section 7 of the ESA (see Appendix A, *Public Involvement/Agency Coordination and Consultation*). The Biological Assessment addresses potential effects of the Proposed Action on federally listed threatened and endangered species, candidate species, and critical habitat under USFWS jurisdiction. Table 4.2-2 summarizes the potential for direct physical impacts, harassment impacts, and habitat impacts to federally listed species within the construction ROI; refer to the Biological Assessment in Appendix A for the complete analysis. FAA determined the Proposed Action “may affect, but would not likely adversely affect,” the striped newt, eastern indigo snake, gopher tortoise, wood stork, red-cockaded woodpecker, red knot, piping plover, West Indian manatee, and loggerhead, green, and leatherback sea turtles. All potential effects were determined to be insignificant or discountable. FAA determined the Proposed Action would have no effect on piping plover, red knot, and loggerhead sea turtle critical habitat. Refer to the Biological Assessment in Appendix A for the complete analysis. On February 12, 2018, the USFWS provided concurrence on FAA determinations, provided that conservation measures identified in the consultation are implemented.

Table 4.2-2. Federally List Species¹ Potentially Affected Within Construction ROI

Stressor	Striped newt	Eastern Indigo Snake	Gopher Tortoise	Red-cockaded Woodpecker	Wood Stork	Atlantic and Shortnose Sturgeon	Atlantic Sturgeon Critical Habitat
Buildings, infrastructure, lights	H, Hb	H, Hb	H, Hb	H, Hb	H, Hb	NI	NI
Construction equipment	DPI	DPI	DPI	H	H	NI	NI
Disturbance of soil contaminants	Hb	Hb	Hb	Hb	Hb	NI	NI
Ground vibrations	H	H	H	H	H	NI	NI
Invasive species	Hb	Hb	Hb	Hb	Hb	NI	NI
Land clearing	DPI, H	DPI, H	DPI, H	H	H	NI	NI
Pile driving	H	H	H	H	H	NI	NI
Spills	Hb	Hb	Hb	NI	NI	Hb	Hb
Stormwater runoff	Hb	Hb	Hb	Hb	Hb	Hb	Hb
Utility lines	DPI, H	DPI, H	DPI, H	DPI, H	DPI, H	NI	NI
Vehicles	DPI, H	DPI, H	DPI, H	DPI, H	DPI, H	NI	NI
Wetland fill	DPI, H	DPI, H	DPI, H	DPI, H	DPI, H	NI	NI

Notes: DPI = Direct Physical Impact; H = Harassment; Hb = Habitat Impacts; NI = No Impact.

¹ Species potentially affected by these stressors were determined through discussions with the Federal Aviation Administration, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and Leidos, Inc.

Bald Eagle

Eagles feed in the estuarine areas near the construction ROI and may establish nests in tall trees along the water’s edge. As discussed in the Habitat Loss/Degradation subsection, there would be a permanent loss of habitat at the four facility sites and in the areas cleared for infrastructure. Eagle nests occur within or near the construction ROI. Nest locations provided by GDNR are indicated in Exhibit 3.2-2 (GDNR, 2016a). A bald eagle nesting survey would be required prior to construction. If an active nest

(i.e., nest with eggs or chicks) occurs within the construction ROI, the nest would be protected until the chicks have fledged.

Construction activities have the potential to disturb feeding, roosting, and nesting activities. Noise and human presence may cause a startle response or cause adults to temporarily or permanently abandon a nest or feeding area. To avoid or minimize impacts during nesting season (October 1 to May 15), construction activities would follow the National Bald Eagle Management Guidelines (USFWS, 2007a):

- Maintain a 660-foot buffer between clearing and construction areas and the nest.
- Avoid off-road vehicle usage within 330 feet of the nest.
- Avoid pile driving within 0.5 mile of active nests.

As discussed in the Migratory Birds subsection, there would be the potential for collisions with power lines and lightning towers; however, these would be designed per the *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (USFWS, 2016) and the guidelines for Avian Protection Plans (APLIC and USFWS, 2005) to the greatest extent possible.

In summary, construction activities are not expected to result in a take of a bald eagle.

Summary

While the construction of Spaceport Camden facilities and infrastructure may result in adverse effects to individual terrestrial animal species, adverse effects to special status species and critical habitat are not expected. Therefore, construction would not result in significant impacts on biological resources.

Marine and Estuarine Vegetation and Habitats

Although there would be a vegetated buffer of at least 25 feet along all creeks and marshes (per Georgia laws 12-7-6[b]15[A] and 12-7-6[b][16] and 12-7-6[b][17][A]), there is the potential for impacts to marine and estuarine vegetation, habitats, and EFH from stormwater runoff (Exhibit 3.2-1). Increased turbidity, pollutants, salinity, or temperatures could affect the health of estuarine/marine vegetation and the quality of habitats. However, as described in the Terrestrial Animals subsection above, erosion control best management practices and stormwater controls would be implemented to prevent these impacts from occurring (see Section 4.14, *Water Resources*). Additionally, the implementation of spill prevention and containment procedures would prevent chemical materials from harming marine resources.

EFH potentially occurring within the action area is listed in Table 3.2-3. All these areas consist of waters and substrate necessary for spawning, breeding, or growth to maturity for federally managed fisheries. No in-water construction activities are proposed to occur; therefore, impacts to substrate or marine sediments are not anticipated. Section 4.14.1.1, *Water Resources, Proposed Action, Construction*, analyzes the potential impacts to water resources from sedimentation and pollutants associated with the Proposed Action. Based on that analysis, impacts to the water column are not considered significant. The largest potential stressor on EFH would result from increased turbidity associated with increased runoff during construction activities, which would be reduced by the implementation of construction best management practices and installation of stormwater retention ponds (refer to Section 6.14, *Water Resources*). The implementation of spill prevention and containment procedures would prevent chemical materials from harming marine resources.

The potential effects of increased turbidity on federally managed species include avoidance of the impacted area, minor physiological effects, such as interference with respiratory functions, and indirect

effects related to light reduction. Reduced light penetration could impact the photosynthetic ability of phytoplankton and submerged aquatic vegetation, such as seagrass. Reduced photosynthesis could lead to a decreased amount of dissolved oxygen released into the water column during the day. However, turbidity would be temporary and localized to a small area relative to the amount of similar habitat available in the action area. Implementation of best management practices would reduce the potential for impacts. Due to the localized and temporary nature of turbidity-producing activities and the implementation of best management practices effects to the water column are not expected to be significant or long term and would only result in minor, temporary impacts to EFH or federally managed species.

Construction would not result in significant impacts to marine/estuarine vegetation and habitats. Furthermore the Proposed Action would not adversely affect EFH.

Marine and Estuarine Animals

Although there would be a vegetated buffer of at least 25 feet along all creeks, there is the potential for impacts to marine and estuarine animals from stormwater runoff. Increased turbidity, pollutants, salinity, or temperatures in estuarine and marine habitats could impair respiration, reproductive success, and feeding. However, as described in the Terrestrial Animals subsection above, erosion control best management practices and stormwater controls would be implemented to prevent these impacts from occurring (see Section 4.14, *Water Resources*). Additionally, the implementation of spill prevention and containment procedures would prevent chemical materials from harming marine resources.

FAA submitted an ESA consultation letter to NMFS in accordance with Section 7 of the ESA (see Appendix A, *Public Involvement/Agency Coordination and Consultation*). The letter addresses potential effects of the Proposed Action on federally listed threatened and endangered marine species and critical habitat under NMFS jurisdiction. Table 4.2-2 summarizes the potential for direct physical impacts, harassment impacts, and habitat impacts to federally listed species within the construction ROI (refer to the Biological Assessment in Appendix A for the complete analysis). FAA determined the Proposed Action “may affect, but would not likely adversely affect,” Atlantic sturgeon, shortnose sturgeon, North Atlantic right whale, and green, hawksbill, Kemp’s ridley, loggerhead, and leatherback sea turtles. FAA determined the Proposed Action would have no effect on Atlantic sturgeon, loggerhead sea turtle, and North Atlantic right whale critical habitat. Refer to Appendix A for the complete analysis. NMFS is currently reviewing the consultation letter. The Final EIS will document the conclusion of the ESA consultation with NMFS.

Summary

The construction of Spaceport Camden facilities and infrastructure would not result in significant impacts to marine/estuarine vegetation and habitat and animal species, including special status animal species, and would have no effect on critical habitat.

4.2.1.2 Operation

Spaceport operations include activities described in Section 2.1.2, *Representative Launch Vehicle and Operational Activities*, which would consist of up to 12 launches, wet dress rehearsals, and static firings, and up to 12 associated launch vehicle first-stage landings per year. The potential impacts from operational activities include increased vehicular traffic, increased human presence from daily use of facilities, increased impervious surface (stormwater runoff), use of the dock during operations, and associated noise, lights, chemical materials, and debris from launch/landing activities as well as daily

operational activities. These activities may result in injury, mortality, alterations to reproductive success, startle responses, and water quality alterations. ESA Section 7 consultation with the USFWS is complete and NMFS consultation is ongoing in accordance with the ESA. On February 12, 2018, the USFWS provided concurrence that the Proposed Action is not likely to adversely affect federally listed species, provided that conservation measures identified in the consultation are implemented. Final requirements associated with the NMFS consultation will be incorporated into the Final EIS.

Terrestrial Vegetation and Habitats

Daily operations of Spaceport Camden are not expected to cause significant impacts to vegetation. As stated in in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, it is expected that most of the hazardous materials would be consumed, and that no substantial volumes of hazardous waste would require disposal. Launch vehicle maintenance, propellant and fuel storage and dispensing, and facility and grounds maintenance are among those activities that may generate very small quantities of hazardous wastes. In addition, appropriate permits and requirements will be in place to reduce accidental spills, fires, explosions, or other potential incident risks that could adversely impact vegetation at, or downgradient from, the vertical launch and control center areas.

The area around the launch and landing pads will primarily be cleared of vegetation during the construction phase; however, pre-launch, launch, and landing activities may still result in indirect impacts from launch vapor and vegetation scorch. Minimal impacts to vegetation are anticipated from particulate deposition because launch vehicles would use liquid fuels and the majority of the vapor is water (see Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*). Small fires could result from pre-launch, launch, and landing activities. These small fires may scorch surrounding vegetation, but vegetation would likely return as the surrounding habitats are fire tolerant.

Operational impacts from new impervious surfaces have the potential to increase stormwater discharge, introducing contaminants from runoff, which could impact terrestrial vegetation during storm events. However, as discussed in Section 4.14, *Water Resources*, appropriate permits and requirements, such as retention ponds, will be in place to minimize impacts from new impervious surfaces in order to decrease stormwater discharge to surrounding vegetation within the Spaceport Camden site.

The introduction of invasive nonnative species from operational vehicles, equipment, and supplies would have the potential to alter native plant communities through increased competition. In keeping with EO 13112 and to reduce introduction of potential invasive species, equipment would be inspected and cleaned prior to first-time use at Spaceport Camden. If areas of invasive species infestations were to be discovered, they would be treated with approved herbicides in accordance with guidance provided on the label. Operational vehicles and equipment would avoid areas known to contain invasive species. In addition, all out-of-area vehicles or equipment to be used onsite would be inspected for invasive nonnative species prior to use at Spaceport Camden.

If present, impacts to State-listed plants (listed in Table 3.2-1) from Spaceport Camden operations would be similar to those described above for terrestrial vegetation. Appropriate permits and requirements would be in place to reduce accidental spills, fires, explosions, or other potential incident risks that could adversely impact State-listed plants within or near the site.

Summary

Overall, impacts to terrestrial vegetation and habitats from Spaceport Camden operations would not be significant, including special status terrestrial plant species.

1 Terrestrial Animals

2 Daily operations would increase human presence and traffic within the Spaceport Camden site. Visual
3 presence of people, in concert with associated noise (as discussed in Section 4.11, *Noise and Noise-*
4 *Compatible Land Use*), may startle species or deter use of surrounding habitats. Over time, some
5 animals may leave the area due to the presence of humans, which may decrease biodiversity.
6 Permanent staffing at Spaceport Camden will consist of approximately 77 full-time employees, with up
7 to 200 personnel present starting about two weeks before the launch. These surges in personnel may
8 occur up to 12 times annually. This is fewer than the average historic uses of the property dating back to
9 the 1950s (approximately 400 personnel), during the production of rocket engines, munitions, and
10 pesticides (Nelson, 2017). As described in the Section 2.1.2.5, *Pre-Launch Activities*, a closure area would
11 be required during pre-launch, launch, and landing operations (includes land and water areas). Closures
12 for safety could last up to 12 hours on a launch day, with 4 to 6 hours being the typical closure time for a
13 nominal launch. Checkpoints would be established to control access as depicted in Exhibit 2.1-11. During
14 a closure, monitoring would be done by vehicles along existing roads and video surveillance.²⁷ To reduce
15 the potential for impacts to terrestrial animals from being injured, killed, startled, or temporarily
16 displaced by daily operations, personnel would be notified in verbal or written form with maps and
17 photos to identify sensitive species (i.e., gopher tortoise and indigo snake) to avoid during daily
18 operations and during closure procedures (refer to the NMFS consultation located in Appendix A, *Public*
19 *Involvement/Agency Coordination and Consultation*).

20 Artificial lighting at night from daily operations, pre-launch, launch, and landing activities may alter the
21 feeding, resting, or reproductive behavior of terrestrial animals. To reduce the potential for effects to
22 animals from artificial lighting, lighting for buildings and infrastructure would comply with the Lighting
23 Management Plan, which will address seasonality, what times lights may be on, and safety measures for
24 animals. The Lighting Management Plan would provide details on spaceport lighting (e.g., type
25 [wavelengths, etc.] and location of lights via a plan drawing of exterior lighting), timing and positioning
26 considerations for exterior lighting, measures to minimize light glow (shielding mechanisms, directed
27 lighting, etc.), and processes and procedures for lighting installation and management (refer to
28 Section 6.13, *Visual Effects*, and the USFWS consultation located in Appendix A, *Public*
29 *Involvement/Agency Coordination and Consultation*, for suggested lighting management guidelines).

30 Noise, sound pressure induced vibration, and the visual effect (stimuli) from pre-launch, launch, and
31 landing activities have the highest potential to impact animals. Operations at the site would not produce
32 any noticeable seismic effects (ground vibrations) (TetraTech, 2017). Animals within an 8-mile radius of
33 the launch site would be exposed to a short duration (less than seven seconds for a static fire and up to
34 five minutes for a launch) of noise levels ranging from 70 to 117 dBA (refer to Section 4.11, *Noise and*
35 *Noise-Compatible Land Use*) during pre-launch, launch, and landing activities. Launches would not
36 normally generate sonic booms at or above 0.25 psf on land (see Exhibit 4.11-9 in Section 4.11). First
37 stage landings at the Spaceport Camden landing pad would generate sonic booms that would fall, at
38 least partially, on land (see Exhibit 4.11-10 in Section 4.11). Land areas affected at between 1 and 2 psf
39 could include portions of Jekyll and Cumberland Islands as well as inland areas. The sonic boom noise
40 levels generated during launches and landings would not materially increase the area exposed to noise
41 levels of 65 dBA DNL or greater when combined with propulsion noise. Sound pressure induced
42 vibration would also occur within a 3-mile radius (refer to Section 4.11). During the day, visual impacts
43 would be minimal, while the one yearly launch event conducted at night could be seen up to 5 miles

²⁷ Ground sweeps would only occur in emergency situations. Other monitoring methods would only be used if video surveillance is insufficient (as noted in Section 2.1.2.5, *Pre-Launch Activities*).

1 from the launch site for up to two minutes (refer to Section 4.13, *Visual Effects*). Most commonly, the
2 reaction from animals to noise or sound pressure induced vibration, particularly when the source is
3 visible to the animal, is some degree of startle response. A startle response can cause an animal to
4 temporarily change its normal behavior by causing it to stop feeding, breeding, or leave nest/young
5 exposed. The most susceptible species to impacts from noise, sound pressure induced vibration, and
6 visual effect are birds, which may be startled. Feral horses on Cumberland Island may also be sensitive
7 to effects associated with launches and may startle or stampede; however, feral horses on Cumberland
8 Island seem to tolerate nearby airplane landings and takeoffs without noticeable effect (Duffe, 2011).
9 Other terrestrial species may not be as susceptible to noise but may be sensitive to sound pressure
10 induced vibration, which may cause temporary changes in behavior. Bowles (1995) suggests that
11 outcome measures, such as reproductive success, are better indicators of distress in animals than short-
12 term responses (i.e., startle reaction).

13 Animal species differ greatly in their responses to noise, sound pressure induced vibration, and visual
14 stimuli. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its
15 hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food,
16 and communicate with and attract other members of their species. Noise, sound pressure induced
17 vibration, and the visual effect from pre-launch, launch, and landing activities may mask or interfere
18 with these functions. Secondary effects may include no auditory effects similar to those exhibited by
19 humans: stress, hypertension, and other nervous disorders. Tertiary effects may include interference
20 with mating and resultant population declines. As noted earlier, feral horses seem tolerant of airplane
21 operations on Cumberland Island, and there has been no indication that these operations have
22 impacted the overall population (NPS, 2017d). Most of the effects of noise on terrestrial animals are
23 mild enough such that the effects might never be detectable as changes in population size or population
24 growth against the background of normal variation (Bowles, 1995). Many other environmental variables
25 (e.g., predators, weather, changing prey base, ground based human disturbance) may influence
26 reproductive success and confound the ability to tease out the ultimate factor in limiting productivity of
27 a certain nest, area, or region (Smith, Ellis, & Johnson, 1988).

28 ***Special Status Terrestrial Animals***

29 **Migratory Birds**

30 To understand potential impacts to birds from noise, and given that a lot of noise information is
31 expressed in terms of human-hearing impact thresholds, a brief explanation of some differences
32 between bird and human hearing is warranted. Exhibit 4.2-1 is a diagram of a hearing audiogram of
33 humans and birds. This audiogram represents the sound level in unweighted dB and the frequency
34 range of humans and birds, offering some insight into a few differences. The average bird, woodpecker,
35 or owl does not hear low-frequency sounds (e.g., rumbles) as well as humans or frequencies on the high
36 end of the audiogram. Some have a greater range in terms of being able to hear softer sounds—owls
37 can hear sounds that humans cannot—and appear to tolerate, or rather are sensitive to, higher decibel
38 levels at mid- and high frequencies. The structure of the human ear is often compared to that of an
39 animal ear to understand whether similarities in hearing ability exist. Scientists have measured the
40 hearing range and frequencies of birds and people and found some similarities in function and ability
41 (Okanoya & Dooling, 1987). Major differences include the ability of some birds to regenerate damaged
42 hair cells within the inner ear, something humans cannot do (Dooling & Dent, 2001).

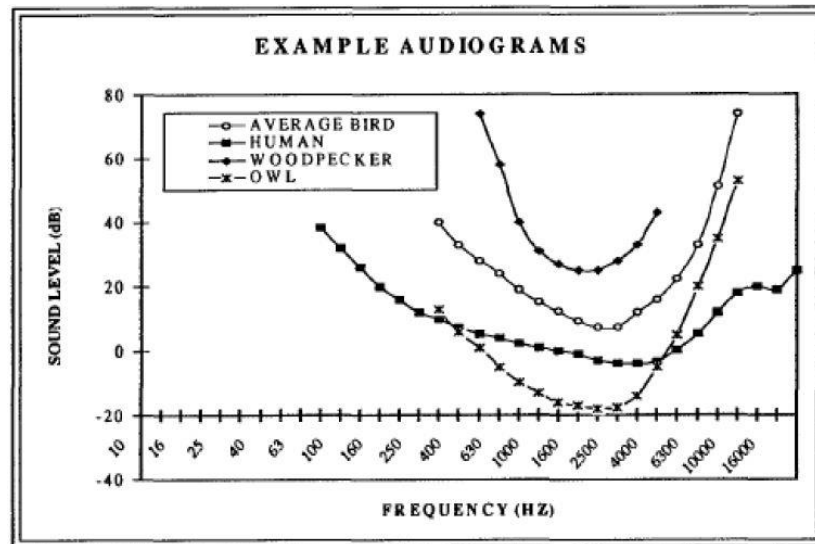


Exhibit 4.2-1. Comparison of Human and Bird Hearing Sensitivities

Source: (Delaney et al., 2002)

Impacts to migratory birds from Spaceport Camden operations would be similar to those described above for terrestrial animals, including potential direct physical impacts from collisions with powerlines and towers and impacts to feeding, roosting, and nesting due to noise and visual disturbance. Noise, sound pressure induced vibration, and visual effects from up to 12 launches, up to 12 landings, and up to 12 static fire engine tests, would last less than five minutes per event over the 8-mile range, which may cause birds to flush from the area during pre-launch, launch, and landing activities. This effect could temporarily interfere with normal behaviors such as breeding, feeding, or sheltering and cause increased stress, resulting in extra caloric expenditure. This could also leave offspring or nests vulnerable to predators (i.e., feral cats, coyotes); however, predators would also likely be disturbed by increased noise levels. Due to the short duration of high noise levels, the behavioral effects would be temporary, bird species would be expected to resume normal behavior after the disturbance was over. Operations would not have any significant impacts on migratory birds.

ESA-Listed and Candidate Species

FAA has completed consultation with the USFWS by submitting a Biological Assessment to the USFWS in accordance with Section 7 of the ESA (see Appendix A, *Public Involvement/Agency Coordination and Consultation*). The Biological Assessment addresses potential effects of the Proposed Action on federally listed threatened and endangered species, candidate species, and critical habitat under USFWS jurisdiction. Table 4.2-3 summarizes the potential for direct physical impacts, harassment impacts, and habitat impacts to federally listed species within the operational ROI; refer to the Biological Assessment in Appendix A for the complete analysis. FAA determined the Proposed Action “may affect, but would not likely adversely affect,” the striped newt, eastern indigo snake, gopher tortoise, wood stork, red-cockaded woodpecker, red knot, piping plover, West Indian manatee, and loggerhead, green, and leatherback sea turtles. All potential effects were determined to be insignificant or discountable. FAA determined the Proposed Action would have no effect on piping plover, red knot, and loggerhead sea turtle critical habitat. On February 12, 2018, the USFWS provided concurrence that the Proposed Action is not likely to adversely affect federally listed species, provided that conservation measures identified in the consultation are implemented.

Table 4.2-3. Federally Listed Species¹ Potentially Affected Within Operational ROI

Stressor	Striped newt	Eastern Indigo Snake	Gopher Tortoise	Red-cockaded Woodpecker	Wood Stork	Piping Plover	Red Knot	Sea Turtles	Loggerhead Critical Habitat	Atlantic and Shortnose Sturgeon	Atlantic Sturgeon Critical Habitat	North Atlantic Right Whale	North Atlantic Right Whale Critical Habitat
Boats	NI	NI	NI	NI	NI	NI	NI	DPI	NI	DPI	NI	DPI	NI
Buildings Infrastructure, lights	H, Hb	H, Hb	H, Hb	H, Hb	H, Hb	H, Hb	H, Hb	H, Hb	NI	NI	NI	NI	NI
Daily operations	H	H	H	H	H	NI	NI	NI	NI	NI	NI	NI	NI
Drone	NI	NI	NI	H	H	H	H	NI	NI	NI	NI	NI	NI
Invasive species	Hb	Hb	Hb	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Landings	H	H	H	H	H	H	H	H	NI	NI	NI	NI	NI
Launch vapor	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Launches/rehearsals	H	H	H	H	H	H	H	H	NI	NI	NI	NI	NI
Rocket debris	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Sound pressure induced vibrations	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Spaceport Camden personnel	H	H	H	H	H	NI	NI	NI	NI	NI	NI	NI	NI
Spectators	H	H	H	H	H	H	H	H	NI	H	NI	H	NI
Spills	Hb	Hb	Hb	Hb	NI	NI	NI	NI	NI	NI	NI	NI	NI
Stormwater runoff	Hb	Hb	Hb	Hb	Hb	NI	NI	NI	NI	NI	NI	NI	NI
Towers	NI	NI	NI	DPI	DPI	NI	NI	NI	NI	NI	NI	NI	NI
Utility Lines	NI	NI	NI	DPI	DPI	NI	NI	NI	NI	NI	NI	NI	NI
Vehicles	NI	DPI	DPI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Wildfires	Hb	Hb	Hb	Hb	Hb	NI	NI	NI	NI	NI	NI	NI	NI

Notes: DPI = Direct Physical Impact; H = Harassment; Hb = Habitat Impacts; NI = No Impact.

¹ Species potentially affected by these stressors were determined through discussions with the Federal Aviation Administration, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and Leidos, Inc.

1 **Bald Eagle**

2 Bald eagles have been documented within 1 mile of the Spaceport Camden site (Yellin, 2014; Forster,
3 2016). Bald eagles can coexist at spaceport launch complexes, as demonstrated at Kennedy Space
4 Center/Cape Canaveral Air Force Station (KSC/CCAFS), which supports twelve nesting pairs of bald
5 eagles. However, KSC/CCAFS has been operating for decades with a robust natural resources
6 management program, whereas rocket launches in Georgia have never occurred and this launch site will
7 be new to the landscape. Impacts to the bald eagle from Spaceport Camden operations would likely be
8 similar to those described above for migratory birds. Spaceport Camden would follow applicable
9 regulatory requirements in accordance with the Bald and Golden Eagle Protection Act (USFWS, 2007b).

State and Federal permits for eagle take (disturbance) are required in order to avoid liability under Bald and Golden Eagle Protection Act. Camden County is responsible for determining if a Bald and Golden Eagle Protection Act permit is necessary.

Summary

The operation of Spaceport Camden would not result in significant impacts to terrestrial animal species, including special status animal species, and would not affect critical habitat.

Marine and Estuarine Vegetation and Habitats

The primary impacts to marine vegetation and habitats resulting from Spaceport Camden operations would be associated with increased equipment/vessel traffic and first-stage landings in the Atlantic Ocean or barge landing in the Atlantic Ocean. The barge landing would then utilize the existing dock on Floyd Creek shown in Exhibit 2.1-2. No in-water dock improvements or modifications are planned at this time. However, should future improvements or modifications to the dock be required, then a Coastal Marshlands Protection Committee permit, which is facilitated through the GDNR Coastal Resources Division and approved by the Committee, may be required.

Disturbance or impacts on marine and estuarine vegetation by anchors, chains, or other items moving through the water column would be minimal. Vegetation would likely experience only temporary disturbance during first-stage landing operations. In addition, with the exception of zooplankton, relatively few invertebrates occur at the surface or in the water column, and the number of individuals potentially affected would be low.

Essential Fish Habitat

EFH in the affected area consists of the water column and unconsolidated sand substrate. First-stage landings would not result in changes to physical water parameters (temperature, salinity, oxygen concentration, etc.). The amount of metals or other substances that could leach or dissolve into the water or substrate from anchors, chains, and other hardware would be minimal and would not result in detectable changes to water or sediment quality. Water currents flowing around or across anchors or ground leg chains on the bottom could cause a small amount of scouring and sediment suspension in the water column. However, the effects would be very localized. Only a small amount of sediment surface area would be lost due to anchor and chain placement. Impacts would be temporary and minor and would not result in long-term impacts to EFH. Therefore, the Proposed Action would not adversely affect EFH.

Marine and Estuarine Animals

Marine and estuarine animals may be impacted by vessel use during operations, specifically for ocean landings. A very small portion of the Atlantic Ocean would be closed during launch activities, but this area is in the nearshore area off Cumberland Island. Vessels used to close this area would be located at various checkpoints throughout the closure area. Accidental collisions between marine animals and vessels associated with first-stage landings are not expected because vessels will either be stationary or operating at low speeds. The ability of vessels to detect and avoid marine mammals is enhanced by the fact that all of the marine mammal species that potentially occur within the Spaceport Camden operation area tend to surface at relatively short, regular intervals. It is further expected that the vessel operators will comply with all applicable State and Federal laws and regulations when transiting between the Spaceport Camden site and the first-stage landing site or barge located approximately 200 to 300 miles off shore in the Atlantic Ocean. This includes operating vessels at speeds that are

reasonable and prudent based on boating traffic, weather conditions, visibility, and other potential hazards such as encounters with marine mammals. In the event a marine mammal is encountered during transit, pilots are expected to adjust course and speed as necessary to maintain a safe distance consistent with prudent seamanship. The NMFS consultation in Appendix A, *Public Involvement/Agency Coordination and Consultation*, identifies additional mitigation measures which are expected to further reduce the potential for adverse impacts.

Placement of the anchors, ground legs, and riser chain would require these items to be dropped or lowered through the water column. These actions could startle or disturb individual fish or groups of fish, and the items could potentially strike individuals as they descend through the water. Anchors, ground leg chains, and other items that contact the seafloor could disturb or strike benthic fish species such as rays and various species of flatfish. Given the small number of anchors and low frequency of operations, direct strike to individuals is not considered likely. Most fish would be able to detect movement through the water and avoid contact with any items. Hardbottom habitat and other structures would be avoided during operations, reducing the number of species and individuals affected (for example, reef fish such as snappers and groupers). The number of individuals potentially affected would not result in detectable impacts to populations of any fish species.

Special Status Marine and Estuarine Species

Marine Mammals

In-air noise from pre-launch, launch, and landing activities are not expected to result in impacts to marine mammals underwater. Acoustic energy from in-air noise does not effectively cross the air/water interface; therefore, most of the noise is reflected off the water surface (Richardson, 1995). In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury. Previous research conducted by the U.S. Air Force supports this conclusion with respect to sonic booms, indicating that there is no risk of harassment for protected marine species in water (U.S. Air Force Research Laboratory, 2000). Therefore, in-air noise associated with Spaceport Camden operations is not expected to result in adverse impacts to marine mammals.

A launch event may increase boat traffic during clearance of ocean areas and from spectators watching launch events, which would increase the risk for marine mammal boat strikes. Launches would only occur a maximum of 12 times a year. Spaceport personnel would also use boats during an ocean landing if a barge is used as a landing platform and to recover any payloads or launch vehicles. This is anticipated to occur one time annually (refer to Section 2.1.2.7, *First-Stage Landing*). The number of potential spectators on boats is unknown and would likely vary per launch event. Security boats would clear an area out to 60 miles from shore. If a marine mammal is observed while performing closure or recovery activities, security boats will maintain a 50-foot distance from the observed animal.

Chemical degradation of marine mammal habitat areas from spills is not likely to occur, as discussed in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*. Access restrictions from monitoring, including the rescue of distressed marine mammals, is also considered unlikely given that launch events that involve closure of water areas around Camden County are only proposed to occur 12 times a year. The operator would coordinate with NMFS prior to each launch event to ensure all conflicts associated with access restrictions are resolved prior to launch day. Spaceport operations would not result in significant impacts to marine mammals.

ESA-Listed Species

FAA submitted an ESA consultation letter to NMFS in accordance with Section 7 of the ESA (see Appendix A, *Public Involvement/Agency Coordination and Consultation*). The letter addresses potential

effects of the Proposed Action on federally listed threatened and endangered marine species and critical habitat under NMFS jurisdiction. Table 4.2-3 summarizes the potential for direct physical impacts, harassment impacts, and habitat impacts to federally listed species within the operational ROI; refer to the Biological Assessment in Appendix A for the complete analysis. FAA determined the Proposed Action “may affect, but would not likely adversely affect,” Atlantic sturgeon, shortnose sturgeon, North Atlantic right whale, and green, hawksbill, Kemp’s ridley, loggerhead, and leatherback sea turtles. FAA determined the Proposed Action would have no effect on Atlantic sturgeon, loggerhead sea turtle, and North Atlantic right whale critical habitat. NMFS is currently reviewing the consultation letter. The Final EIS will document the conclusion of the ESA consultation with NMFS.

Summary

The operation of Spaceport Camden facilities and infrastructure would not result in significant impacts to marine/estuarine animal species, including special status animal species, and would not affect critical habitat.

Launch Failure and Emergency Procedures

In the event of a launch failure, an explosion could injure or kill species or damage habitat adjacent to the launch pad or within areas impacted by debris. However, due to the limited number of launches and the unlikely scenario of a launch failure, the likelihood of an impact on biological resources is low. Debris scatter that could occur over the Atlantic Ocean during a launch abort would also have a low probability of impacting aquatic species.

Fires could potentially start from an explosion on the pad or in flight, which could result in a temporary loss of habitat lasting a few weeks during the growing season or up to a few months during the dormant season. The launch vehicle propellant tanks would likely rupture, and the propellants would burn explosively. Thus, it is possible for propellants to be spilled directly or released as a burning byproduct into local surface water bodies, upland areas, and infiltrating soils to make contact with groundwater. The extent of potential impacts would depend on the type of propellant, the conditions of the accident, and the nature of the terrestrial and water resources affected (see Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*). Terrestrial and marine/estuarine animals could suffer injury or mortality from associated chemicals, heat, and noise. Habitats may be temporarily degraded or permanently destroyed, causing animals to move to other areas to forage and nest. Spaceport Camden would prepare and implement a plan to ensure that adequate and appropriate guidance, policies, and protocols regarding fire incidents, hazardous material incidents, and associated emergency responses are available to and followed by all personnel, including coordination with the NPS Cumberland Island National Seashore and its Fire Management Plan. In the event of a launch failure, emergency response and cleanup procedures contained in the plan would reduce the magnitude and duration of any impacts.

In the event of an emergency situation, in which ground sweeps or unmanned aerial systems are required (described in Section 2.1.2.5, *Pre-launch Activities*), prior to such an event, security personnel would be briefed on protected species and avoidance areas to minimize damage to sensitive habitats. In addition, personnel would be provided with a 24-hour emergency contact to minimize impacts from conducting ground sweeps.

In the event of a launch failure or emergency response procedures, FAA would reinitiate ESA Section 7 consultation with the USFWS and/or the NMFS to assess the impacts of the incident as well as potential impacts from cleanup and restoration.

4.2.2 Ocean-Landing Only Alternative

4.2.2.1 Construction

Under the Ocean-Landing Only Alternative, potential construction impacts would remain the same for the Vertical Launch Facility, Launch Control Center Complex, Alternate Control Center and Visitor Center, and the related infrastructure improvements as those described in Section 4.2.2.1, *Construction*, for the Proposed Action. As the Landing Zone Facility would not be constructed, there would be no construction-related impacts in this area from a landing pad, septic system, security fencing, guard shack, lighting system, or other associated components. For this alternative, there would also be a reduction in the length of heavier road by 11,250 linear feet, the length of power transmission lines by about a mile, and the length of water lines by approximately a mile (refer to Table 4.2-1). Construction impacts to terrestrial animals (including ESA-listed species) under the Ocean-Landing Only Alternative would not be significant.

4.2.2.2 Operation

The potential impacts from operational activities for the Ocean-Landing Only Alternative are similar to those under the Proposed Action but without impacts from a Landing Zone Facility. Potential impacts would increase within marine habitats under this alternative as there would be additional landings in the ocean.

Terrestrial Vegetation and Habitats

Under the Ocean-Landing Only Alternative, impacts to terrestrial vegetation and habitats (including State-listed plants) would be similar to those discussed under the Proposed Action except there would be no impacts from landings. Appropriate permits and requirements would be in place to reduce accidental spills, fires, explosions, or other potential incident risks that could adversely impact vegetation at, or downgradient from, the vertical launch and control center areas. Appropriate permits and requirements will be in place to minimize impacts from new impervious surfaces creating increased stormwater discharge to surrounding vegetation within the Spaceport Camden site. In order to reduce the spread of invasive plants, disturbances to vegetation would be minimized and localized. Overall, operations impacts to terrestrial vegetation and habitats under the Ocean-Landing Only Alternative would not be significant.

Terrestrial Animals

Under the Ocean-Landing Only Alternative, impacts to terrestrial animals (including special status species) would be similar to those discussed under the Proposed Action except there would be no impacts from landings. Sonic booms associated with launches would not affect land areas. Because first stage landings would not occur at Spaceport Camden, noise levels would not exceed 65 dB DNL in the area surrounding the Proposed Action landing zone site. Appropriate permits and requirements would be in place to reduce accidental spills, fires, explosions, or other potential incident risks. In order to reduce the potential to terrestrial animals from being injured, killed, startled, or temporarily displaced by daily operations, personnel would be notified in verbal or written form with maps to identify potential sensitive species to avoid during daily operations and during closure procedures (refer to USFWS consultation in Appendix A, *Public Involvement/Agency Coordination and Consultation*). Typical (non-launch weekday) operations would dictate external lighting would be turned on until about 9 p.m., then go into an automatic dim mode. Security lighting would be on trip sensors after 9 p.m. and would only be activated and on when triggered by a security alert. For launch operations, external lighting may be active from dusk until dawn due to the potential for three-shift operations at all four facilities.

Exterior lighting for buildings and infrastructure would comply with measures listed in the USFWS consultation located in Appendix A. Given that noise, sound pressure induced vibrations, and visual effects from pre-launch and launch activities would last less than five minutes over the 8-mile range and only occur a maximum of 12 times per year, and with the implementation of proposed measures discussed previously and outlined in the USFWS consultation in Appendix A, there would be no significant impacts to terrestrial animals. Overall, operations impacts to terrestrial animals (including ESA-listed species) under the Ocean-Landing Only Alternative would not be significant.

Marine and Estuarine Vegetation and Habitats

Under the Ocean-Landing Only Alternative, impacts to marine vegetation and habitats (including EFH) would slightly increase to those discussed under the Proposed Action. The number of ocean landings under this alternative would increase from 1 to 12 annually. The higher level of operations in the Atlantic Ocean would not increase impacts to marine and estuarine vegetation and habitats to a significant level. Disturbance or impacts on marine and estuarine vegetation by anchors, chains, or other items moving through the water column would still be minimal. Vegetation would likely experience only temporary disturbance during first-stage landing operations. The amount of metals or other substances that could leach or dissolve into the water or substrate from anchors, chains, and other hardware would be minimal and would not result in detectable changes to water or sediment quality. Overall, operations impacts to marine vegetation and habitats under the Ocean-Landing Only Alternative would not be significant.

Marine and Estuarine Animals

Under the Ocean-Landing Only Alternative, increasing the number of ocean landings from 1 to 12 annually would not substantially increase potential impacts to marine and estuarine animals (including EFH) when compared to the Proposed Action. Accidental collisions between marine animals and vessels associated with first-stage landings are not expected because vessels would either be stationary or operating at low speeds. Vessel operators would comply with all applicable State and Federal laws and regulations when transiting between the Spaceport Camden site and the first-stage landing site or barge in the Atlantic Ocean. Hardbottom habitat and other structures would be avoided during operations, reducing the number of species and individuals affected (for example, reef fish such as snappers and groupers). Chemical degradation of marine and estuarine habitat areas from spills is not likely to occur, as discussed in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*. With the implementation of the mitigation measures described previously and outlined in the NMFS consultation located in Appendix A, *Public Involvement/Agency Coordination and Consultation*, operations impacts to marine and estuarine animals (including ESA-listed species) under the Ocean-Landing Only Alternative would not be significant.

Summary

The operation of Spaceport Camden under the Ocean-Landing Only Alternative would not result in significant impacts to terrestrial vegetation and habitats, terrestrial animal species, marine and estuarine vegetation and habitats, and marine and estuarine animals, including special status animal species, and would not affect critical habitat.

4.2.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. The No Action Alternative

would not change the existing conditions for biological resources and, therefore, would not result in impacts on biological resources.

4.3 Climate

Potential impacts on climate (climate change) could result from the proposed construction and operation of the new facilities. Construction activities are expected to occur over a 15-month period. Activities associated with operations are evaluated based on the site conducting up to 12 launches/landings per year, wet dress rehearsals, and static engine tests.

4.3.1 Proposed Action

4.3.1.1 Construction

This analysis addresses GHG emissions from construction activities and worker vehicles commuting to and from the area. Emission factors were obtained from USEPA's emissions calculation software MOVES 2014a. Further discussion and detailed description of climate change analysis methodology can be found in Appendix E, *Air Quality*.

To evaluate GHG emissions and their impact, the emissions associated with the project's construction activities were compared with the total ROI emissions of GHGs for Camden County and the Jacksonville-Brunswick Interstate Air Quality Control Region from the 2014 NEI data and USEPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014* NEI data. Results are provided in Section 4.1, *Air Quality* (Table 4.1-1).

The Proposed Action would increase GHG emissions by 9,848 tons CO₂e over the annual baseline for the region. This increase would comprise less than 0.03 percent of GHG emissions in the Air Quality Control Region and less than 1.51 percent in Camden County. Total annual GHG emissions would be minimal in terms of the national GHG emissions, which total 6,870 million metric tons (7,474 million tons) annually (USEPA, 2016). GHG emissions may be further reduced by implementing measures such as changing to more fuel-efficient equipment, reducing operational delays, and using renewable fuels. A change of this minute magnitude is not likely to have any impact on global climate change, sea level rise, or any potential impacts of climate change. However, sea level rise and other climatological changes such as an increase in extreme weather events, may or may not impact the spaceport in the coming years.

4.3.1.2 Operation

This analysis addresses GHG emissions from launches and associated launch activities (launch, landings, and static engine fire tests), commuting employees, delivery vehicles, support vessels and barge operations, and associated activities on an annual basis. The methodology for GHG calculations is the same as the methodology for air quality emissions calculations and uses the same emission factor sources. Further discussion and detailed description of climate change analysis methodology is located in Appendix E, *Air Quality*.

Calculated emissions from the project's end-state operations were compared with the total ROI emissions on a pollutant-by-pollutant for Camden County and the Air Quality Control Region's NEI data and USEPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014* NEI data. Results are provided in Section 4.1, *Air Quality* (Table 4.1-2).

The Proposed Action would increase GHG emissions by 80,507 tons CO₂e over the annual baseline for the region. This increase would comprise approximately 0.27 percent of the GHG emissions in the Air

1 Quality Control Region and approximately 12.35 percent in Camden County. Total annual GHG emissions
2 would be minimal in terms of the national GHG emissions, which total 6,870 million metric tons (7,474
3 million tons) annually (USEPA, 2016). GHG emissions may be further reduced by implementing
4 measures such as changes to more fuel-efficient equipment, delay reductions, and use of renewable
5 fuels.

6 A small change of this magnitude is not likely to have any impact on global climate change, sea level rise,
7 or any potential impacts of climate change. However, sea level rise and other climatological changes
8 such as increase in extreme weather events, may impact the spaceport in the coming years.

9 **4.3.2 Ocean-Landing Only Alternative**

10 Under this alternative, all first-stage landings would occur on a barge located several hundred miles off
11 shore. The construction of the Landing Zone Facility would not occur under this alternative.

12 Under this alternative, GHG emissions would generally be the same as discussed above for the Proposed
13 Action. However, construction emissions would be slightly lower since the construction of the landing
14 zone at the spaceport would not be required.

15 Based on the analysis presented above, this alternative would not result in any significant adverse
16 climate impacts, because it would contribute a small and insignificant amount of GHGs to the
17 environment.

18 **4.3.3 No Action Alternative**

19 Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of
20 Spaceport Camden, and no spaceport facilities would be constructed. The property use would not
21 change and the proposed construction and operations would not take place. The baseline climate of the
22 area under the No Action Alternative would continue to change over time, affected by natural processes
23 and ongoing activities within the ROI as described in Section 3.3, *Climate*.

24 **4.4 Coastal Resources**

25 **4.4.1 Proposed Action**

26 Coastal resources may be impacted during construction activities or operations by an increase in
27 impermeable surface, new structures, noise from launches and landings, daily use of the facilities, and
28 associated lighting. These activities may result in increased runoff and impacts on wildlife. Potential
29 impacts from Spaceport Camden construction activities and operations relative to coastal resources are
30 described in the following sections of the EIS: Section 4.2, *Biological Resources*; Section 4.8, *Historical,*
31 *Architectural, Archaeological, and Cultural Resources*; Section 4.9, *Land Use*; Section 4.11, *Noise and*
32 *Noise-Compatible Land Use*; Section 4.12, *Socioeconomics, Environmental Justice, and Children's*
33 *Environmental Health and Safety Risks*; and Section 4.14, *Water Resources*.

34 In accordance with the CZMA and Georgia's Coastal Management Program, Camden County has
35 submitted a Federal consistency certification to GDNR's Coastal Resources Division. The County declares
36 its proposal to construct and operate a launch site in Camden County, Georgia, complies with the
37 policies of Georgia's approved Coastal Management Program (i.e., State laws) and will be conducted in a
38 manner consistent with such program. FAA has submitted this EIS to the Coastal Resources Division to
39 assist the State with its Federal consistency review. FAA will include the Coastal Resources Division's

response in the Final EIS. The county's consistency certification is provided in Appendix A, *Public Involvement/ Agency Coordination and Consultation*.

FAA has not identified any significant adverse impacts associated with the Proposed Action or Ocean-Landing Only Alternative. FAA and Camden County, through consultation with GDNr, has determined both the Proposed Action and Ocean-Landing Only Alternative are consistent with the Georgia Coastal Management Program (see Appendix A, *Public Involvement/Agency Coordination and Consultation*).

4.4.1.1 Marine Protected Areas

Satilla River Marsh Island Natural Area

Construction

As discussed in Section 4.14.1.1, *Water Resources, Proposed Action, Construction*, no construction related impacts to the Satilla River Marsh Island Natural Area are anticipated that would adversely impact this river system. The river is located more than 1 mile from proposed construction activities and the potential for the offsite migration of sediments would be low.

Operation

As discussed in Section 4.14.1.2, *Water Resources, Proposed Action, Operation*, no significant adverse impacts to surface waters are anticipated from normal operations of the spaceport; this would include no adverse impacts to the Satilla River Marsh Island Natural Area.

Cumberland Island National Seashore

Construction

None of the proposed construction areas would impact Cumberland Island. Therefore, construction activities would have no significant impacts to coastal resources at Cumberland Island.

Operation

Potential impacts from Spaceport Camden operations relative to Cumberland Island resources are described in the following sections of the EIS: Section 4.2, *Biological Resources*; Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*; Section 4.9, *Land Use*; Section 4.11, *Noise and Noise-Compatible Land Use*; Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*; and Section 4.14, *Water Resources*. The following is a summary of operational noise impacts found in Section 4.11 that are applicable to the coastal resources discussion.

The Settlement is located within the Cumberland Island National Seashore. To better evaluate park visitor response in terms of human annoyance, an adjusted DNL is used to compute the percent highly annoyed. The adjusted DNL for a quiet environment adjusts the basic DNL by adding 10 dBA to account for the greater expectation for and value placed on "peace and quiet" in rural settings. For the Settlement, the adjusted DNL is approximately 53 dBA, which equates to 3 percent highly annoyed. For launches at Spaceport Camden, levels may exceed 66 dBA for a period of up to 132 seconds per launch at the Settlement (BRRC, 2017). Additionally, noise levels may exceed daytime ambient levels of 40 dBA for an estimated period of 266 seconds per launch at the Settlement. Sonic boom peak overpressure levels from Medium Class Launch Vehicle (MCLV) first-stage landings are modeled to be between 1.4 and 1.5 psf at the Settlement (BRRC, 2017). As the overpressure levels are less than 2 psf, sonic

booms associated with the operations are not anticipated to affect hearing conservation or cause structural damage. Noise and overpressure levels experienced on Cumberland Island originating from activities at the spaceport are similar to those already experienced due to existing conditions on Cumberland Island, including vehicle and vessel traffic and airplane operations. Overall, impacts to coastal resources at Cumberland Island from Spaceport Camden operations would not be significant.

Summary

The construction and operation of Spaceport Camden would not result in significant impacts to coastal resources, including marine protected areas such as the Satilla River Marsh Island Natural Area and Cumberland Island National Seashore.

4.4.2 Ocean-Landing Only Alternative

Under the Ocean-Landing Only Alternative, potential impacts to MPAs would be similar to those discussed for the Proposed Action. Differences between the two alternatives are discussed below.

4.4.2.1 Marine Protected Areas

Satilla River Marsh Island Natural Area

Construction

As discussed in Section 4.14.2, *Water Resources, Ocean-Landing Only Alternative*, construction-related impacts to floodplain and groundwater would be the same as those described previously under the Proposed Action. There would be no impacts to the Satilla River Marsh Island Natural Area.

Operation

As discussed in Section 4.14.2, *Water Resources, Ocean-Landing Only Alternative*, operational impacts to wetlands, floodplains, and surface waters would be the same in type as those described in the Proposed Action but would be reduced in scale. There would be no impacts to the Satilla River Marsh Island Natural Area.

Cumberland Island National Seashore

Construction

None of the proposed construction areas would impact Cumberland Island National Seashore. Therefore, construction activities would have no significant impacts to coastal resources.

Operation

Potential impacts under the Ocean-Landing Only Alternative relative to Cumberland Island resources are described in the following sections of the EIS: Section 4.2, *Biological Resources*; Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*; Section 4.9, *Land Use*; Section 4.11, *Noise and Noise-Compatible Land Use*; Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*; and Section 4.14, *Water Resources*.

Noise impacts to Cumberland Island National Seashore from first-stage landings would be removed under the Ocean-Landing Only Alternative. Sonic booms associated with launches would not affect land areas. Because first stage landings would not occur at Spaceport Camden, noise levels would not exceed 65 dB DNL in the area surrounding the Proposed Action landing zone site, and sonic booms associated

with landings would not occur on land. However, noise from launches would remain the same (as discussed in Section 4.4.1.1, *Marine Protected Areas: Cumberland Island National Seashore*). For launches at Spaceport Camden, levels may exceed 66 dBA for a period of up to 132 seconds per launch at the Settlement (BRRRC, 2017). Additionally, noise levels may exceed daytime ambient levels of 40 dBA for an estimated period of 266 seconds per launch at the Settlement. Therefore, impacts to coastal resources at Cumberland Island National Seashore from Spaceport Camden operations would not be significant.

4.4.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. There would be no impacts on the specific resource area because the property would remain in its current state.

4.5 Department of Transportation Act, Section 4(f)

This section provides impact analyses for resources under Section 4(f) of the U.S. Department of Transportation Act. Following the Section 4(f) regulations, recommendations included in the FHWA Section 4(f) Policy Paper (USDOT, 2012), and guidance from FAA Order 1050.1F Desk Reference (FAA, 2015), this section assesses the potential for the Proposed Action and alternatives to result in a *use* of properties eligible for protection under Section 4(f) and identified in Section 3.5.3, *Existing Conditions*. The construction and operations of the proposed launch site were analyzed and the potential for all types of *use*—including *permanent incorporation*, *temporary occupancy*, and *constructive use*—were considered.

All properties qualifying for protection under Section 4(f) (see Section 3.5.1, *Definition and Description*) described in the ROI were identified and screened following the process described in Section 3.5.3, *Existing Conditions*. This resulted in eight parks and recreational areas that were analyzed in detail to determine if the Proposed Action and alternatives would result in a *use* under Section 4(f). As part of this analysis, FAA engaged in coordination with officials with jurisdiction over the Section 4(f) properties, both to ascertain the significance of the properties, and in determining potential for *use* under Section 4(f).

Because all eight parks and recreation areas are well outside the footprint of the proposed launch site's permanent boundaries and physical construction footprint, only the potential for *constructive use* of was considered. In order for this type of *use* to occur, the proposed action or alternatives must result in substantial impairment to the property's activities, features, or attributes that qualify the property for protection under Section 4(f). As a general matter, this means that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost (USDOT, 2012). As noted in FHWA's Section 4(f) Tutorial²⁸, "*Constructive use* involves an indirect impact to the Section 4(f) property of such magnitude as to effectively act as a permanent incorporation."

As noted in Section 3.5.3, *Existing Conditions*, the ROI for historic sites eligible for protection under Section 4(f) corresponds to the APE for historical, architectural, archaeological, and cultural resources as defined in Section 3.8, *Historical, Architectural, Archaeological, and Cultural Resources*. In order for a historic site to be protected under Section 4(f), it must be determined to be significant through the Section 106 process—typically, with a corresponding determination that the property is on or eligible for

²⁸ Available online at: <https://www.environment.fhwa.dot.gov/section4f/default.aspx>

the NRHP. For archaeological sites to qualify for protection under Section 4(f), they must be on or eligible for the NRHP and the site must warrant preservation in place.

Based on FAA's review of the historic sites, archaeological sites, parks, and recreation areas to identify the significant activities, features, and attributes of the properties, and incorporating information obtained through coordination with officials with jurisdiction over the Section 4(f) properties, FAA has made the preliminary determinations of use described below.

4.5.1 Proposed Action

4.5.1.1 Construction

Construction of facilities for the Proposed Action would not involve the permanent incorporation of lands from Section 4(f) properties. The land that would be acquired for construction of the launch site launch, landing, and control facilities along with the required infrastructure is privately owned. No lands from public parks, recreation areas, refuges, or historic sites would be purchased or placed under a permanent easement.

The proposed construction of the launch site facilities and infrastructure was analyzed to determine whether construction activities would constitute a *constructive use* of Section 4(f) properties (i.e., whether construction would result in adverse indirect impacts that would substantially impair Section 4(f) properties). A Section 4(f) property is substantially impaired when the activities, features, or attributes of the property that contribute to its significance or enjoyment are substantially diminished. The following sections provide this assessment for public parks and recreation areas, and historic and archaeological sites.

Parks and Recreation Areas

Upland portions of Cumberland Island National Seashore at a distance of about 3.5 miles from the closest construction (Vertical Launch Facility) would experience noise levels of approximately 43 dBA DNL (see Section 4.11.1.1, *Noise and Noise-Compatible Land Use, Proposed Action, Construction*). At this location, construction noise could be audible during certain phases of construction (e.g., pile driving). Pile driving activities would occur over a period of a month for each construction location. Construction noise would be temporary, lasting only the duration of the construction project, and would be limited to normal working hours. Some visitors may experience construction noise during their visit and, in the case of day-use visitors, potentially lasting the duration of their visit. Such audible noise may be inconsistent with visitor expectations for natural quiet and the natural setting found on much of the island. However, because construction noise attributable to the Proposed Action would be temporary and limited, the noise would not substantially limit the use or diminish the quality of any of the Section 4(f) properties, such that their value would be impaired. Therefore, FAA has made a preliminary determination that construction activities would not constitute a *constructive use* of Section 4(f) properties.

Historic and Archaeological Sites

The analysis of impacts on historic sites protected under Section 4(f) was determined in accordance with Section 106 regulations (36 CFR Part 800). As described in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*, four archaeological historic properties are within, or partially within the construction footprint of the Vertical Launch Facility. The four archaeological sites are considered "potentially eligible" for listing on the NRHP. In order to qualify for Section 4(f) protection, the sites must be eligible for listing and warrant preservation in place. If construction-related activities

cannot avoid these sites, and if Phase II testing determines that the sites are eligible for listing on the NRHP and that they warrant preservation in place, construction of the proposed spaceport could result in the *permanent incorporation* of the sites. Consultation between FAA and the SHPO could also determine that the archaeological resources are important chiefly for data recovery and are not important for preservation in place, in which case, no *use* would result.

Three NRHP-eligible architectural components of the Floyd's Fairfield and Bellevue Plantations/Union Carbide Property are located within the proposed Spaceport Camden boundary near the proposed construction area for the Vertical Launch Facility. There would be no direct impact to the three historic properties and vibration from construction (e.g., pile driving) would be far enough away that there would also be no indirect effects. Outside of the proposed Spaceport Camden boundary, within the 5-mile radius APE for audible and visual effects, the Cumberland Island National Seashore historic properties and cultural landscape are also unlikely to experience audible or visual impacts related to construction activities rising to the level of substantial impairment. FAA determined that construction activities within the proposed Spaceport Camden boundary would not constitute a *constructive use* of these Section 4(f) historic sites.

4.5.1.2 Operation

Proposed Spaceport Camden operations were evaluated to determine if they could result in a *constructive use* of the Section 4(f) properties including eight parks and recreation areas identified in Section 3.5.3, *Existing Conditions*, and a number of cultural and historic resources identified in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*.

The operation of the Proposed Action would not result in the *permanent incorporation* or *temporary occupancy* of Section 4(f) properties. The potential for the Proposed Action to result in a *constructive use* on Section 4(f) properties due to visual impacts or noise impacts during launch and landing activities was considered and is described below. The potential for *constructive use* to occur as a result of closures or restricted access to parks and recreational areas is not evaluated in this analysis. This is because sufficient information about individual launches that may take place at the proposed launch site is not yet available. The need for, and extent and duration of closures can be ascertained only when a number of important launch variables are known. These include, among other factors, the time of launch, the trajectory of the launch, and the specific type and payload of the launch vehicle. At the time when individual launch licenses are applied for, FAA will evaluate the potential for restrictions in access and closures for parks and recreational areas that qualify for protection under Section 4(f) to result in a *constructive use* of the properties. Further coordination with officials with jurisdiction over the properties will occur at that time in order to arrive at a *constructive use* determination.

Parks and Recreation Areas

FAA has engaged in coordination with officials with jurisdiction over the eight parks and recreational properties that qualify for Section 4(f) in the ROI and for which, the Proposed Action may result in a *constructive use*. As described in Section 3.5.3, *Existing Conditions*, natural and quiet surroundings are key attributes of several of the parks and recreation areas, and are important components of the primary activities that take place and attract users to these properties. In many cases, a quiet, serene, and natural soundscape were identified by officials with jurisdiction as significant attributes or features of the properties.

FAA considered the potential for the Proposed Action to substantially impair the quiet and serenity of the Section 4(f) properties to the extent that it would result in a *constructive use*. FAA also considered the potential for the Proposed Action to impair the aesthetic features of the properties to the extent

1 that it would constitute a *constructive use*. Although noise from launch and landing activities would be
2 perceptible at all eight Section 4(f) parks and recreation areas, these events would be infrequent and
3 short in duration. While other noise-generating activities would occur during the operation of the
4 Proposed Action (e.g., static engine tests) noise from launches and landings would have higher intensity
5 and would propagate farther than other sources.

6 As described in Section 2.1.2, *Representative Launch and Vehicle Operational Activities*, operations
7 would consist of up to 12 launches and landings per year and the associated 12 engine tests and wet
8 dress rehearsals. With these events occurring once per month (on average) and with noise levels being
9 above the thresholds used to measure interference with outdoor speech for short durations of time
10 only, the operation of the Proposed Action would not substantially impair the Section 4(f) properties.
11 Furthermore, even within secluded and undeveloped locations in each Section 4(f) property, it is likely
12 that other human-caused noise are perceived on a regular basis including noises such as motorized
13 watercraft, automobiles, and fixed-wing and rotary aircraft.

14 Visual disturbances during launch and landing may also be perceptible at the properties, depending on
15 weather and atmospheric conditions, the time of the launch, and other factors, these events would also
16 be infrequent and short in duration. As described in Section 4.13.1.2, *Visual Effects, Proposed Action,*
17 *Operation*, the visibility of launch vehicles during operations are temporary and sporadic and would not
18 change existing landscapes; therefore, they would not cause permanent visual impacts. Although the
19 occurrence of a launch is inconsistent with wilderness values for naturalness and lack of any imprint of
20 humans, launches would not cause any lasting imprint, nor any impairment. Weather conditions (low
21 cloud cover, fog, high humidity) could partially or totally obscure the visibility of a rocket trajectory soon
22 after takeoff. FAA considered light emissions as a potential visual impact from the Proposed Action as
23 well. FAA acknowledges that the depletion of darkness in the night sky is at odds with wilderness values
24 and the NPS responsibility to keep the imprint of man to a minimum. Because of the distance of the
25 launch site to Section 4(f) properties, including the Cumberland Island National Seashore, and the low
26 frequency of night launch activities, effects on dark skies would likely not rise to a level of substantial
27 impairment.

28 For the reasons described above, and in the case of all eight properties, FAA has made the preliminary
29 determination that the Proposed Action would not result in a *constructive use*.

30 **Historic Sites**

31 Information on noise and vibration impacts from the operation of the Proposed Action useful in
32 determining the potential for *constructive use* on archaeological and architectural resources is discussed
33 in Section 4.8.1.2, *Historical, Architectural, Archaeological, and Cultural Resources, Proposed Action,*
34 *Operation*. As noted in that section of the EIS, noise impacts on historic properties would be transitory,
35 lasting only as long as each noise event. Although such noise would result in an effect on historic
36 properties, it is unlikely to be an adverse effect, and is, therefore, unlikely to constitute a *constructive*
37 *use*. Vibrations from operational noise could potentially result in structure damage to historic
38 properties, and if allowed to accumulate or go unrepaired, this could constitute a *constructive use*.
39 However, a constructive use to historic sites can only be determined through consultation with the
40 officials with jurisdiction, in this case, the SHPO and tribes. FAA continues to consult with these parties
41 to determine the eligibility of historic sites, the potential for adverse effects to the sites, and an
42 agreement necessary to resolve any adverse effects that may be identified.

4.5.2 Ocean-Landing Only Alternative

4.5.2.1 Construction

There would be no Section 4(f) use associated with this alternative beyond what was described for the Proposed Action.

4.5.2.2 Operation

Operation of the ocean-landing only alternative would result in identical noise and vibration-related impacts on the Section 4(f) properties during rocket launches, but no noise or vibration-related impacts during landings as they would occur approximately 200 to 300 miles off shore in the Atlantic Ocean. Potential Section 4(f) use under this alternative would therefore be similar during rocket launch activities, but reduced during rocket landings when compared to those described for Spaceport Camden operations under the Proposed Action. The ocean-landing only alternative would have lower overall impacts on Section 4(f) properties and FAA has made the preliminary determination that it would not result in a use of a Section 4(f) property.

4.5.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no launch site facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. Consequently, there would be no use of any identified Section 4(f) properties.

4.6 Farmlands

This section analyzes potential impacts to important farmlands (including pastureland, cropland, and forest considered to be prime, unique, or of State or local importance), including those from construction and operational activities. The analysis involved the following steps:

- Identify existing farmland and determine if there is a change in land use from farmland to another land use, resulting in decreased farmland uses (see Section 3.6.3, *Existing Conditions*). A significance determination is presented based on the FAA Order 1050.1F significance threshold, which states a significant impact would occur if “the total combined score on Form AD-1006, ‘Farmland Conversion Impact Rating,’ ranges between 200 and 260 points.” As discussed in Section 3.6.3, *Existing Conditions*, there would be no land use change; therefore, no impact analysis is required for this step in the methodology.
- Consider whether the action would have the potential to convert important farmlands to nonagricultural uses.
- Evaluate indirect and direct impacts from restricting access and/or activities to/on land with farmlands.
- As described in Chapter 2, *Proposed Action and Alternatives*, evaluate impacts from the proposed launch trajectories, hazard area, and access-controlled areas (outside the fenced areas) using a programmatic approach. More specific impact analysis will be evaluated on a case-by-case basis in a separate environmental analysis study specific to that launch operation.

4.6.1 Proposed Action

4.6.1.1 Construction

Construction of the facilities (Launch Control Center Complex, Alternate Control Center and Visitor Center, Landing Zone, Vertical Launch Facility) at the three proposed sites (see Table 2.1-3 for acreage) and the infrastructure improvements (roads, above and below-ground power lines, water lines, and septic systems) as described in Section 2.1.1, *Construction – Activities and Facility Descriptions*, would occur in areas already developed and/or within the proposed property boundary for the Spaceport Camden site. None of these locations are designated as farmland; therefore, no impacts would occur.

Existing trees at the proposed sites where construction would occur would need to be cleared. These trees could be used for timber, and the sale or use of the timber could offset construction or other costs.

There would be no indirect impacts on access to existing farmlands due to the location of construction sites and no road closure requirements.

4.6.1.2 Operation

Site-Specific ROI

No farmland was identified within site-specific ROI (site boundary); therefore the year-round and launch operations would have no impact on farmland. However, the land within the site-specific ROI is generally forested, which could provide the opportunity to sell timber to a local timber-harvesting company.

Operational ROI

No farmland was identified within the operational ROI (the land outside the site boundary but within the proposed launch trajectory and hazard areas); therefore, there would be no impacts on farmland.

Road closures associated with the areas for the launches, wet dress rehearsals, and static fire engine tests could last up to 12 hours. The closed roads are not known to be used by farmland-related transportation or site access, however, there could be a low indirect impact based on the length of the closure causing traffic congestion. There is also the possibility that harvesting activities may consider coordinating their schedule with launch activities to prevent any impacts.

The parcel owned by Big Pasture LLC (southwest of the spaceport site and north of Union Carbide Road) would be briefly inaccessible due to road closures (Points X₁, X₂, and X₃). This site has the potential for timber harvesting but is zoned as planned development; therefore, there would be no impacts to farmlands.

4.6.2 Ocean-Landing Only Alternative

4.6.2.1 Construction

With the exception of no construction of the Landing Zone, construction impacts would be the same as those described previously under the Proposed Action. Without construction of the Landing Zone the construction footprint would be reduced by approximately 12.9 acres of forested area as compared to the Proposed Action. This area would not be disturbed, and existing trees at this site present the

opportunity for future timber harvesting. However, the site is not considered farmland and, therefore, there would be no impact to farmlands under this alternative.

4.6.2.2 Operation

Operations would mostly be the same as the Proposed Action, except that first-stage landings would only occur on a barge located several hundred miles off shore. The activity and closure areas would not differ from those described for the Proposed Action, and there would be no direct impact on farmland under this alternative. However, there would still be the low possibility of indirect impacts to transportation access to existing farmlands to the west and south due to launch closures.

4.6.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. The property use would not change, and the proposed construction and operations would not take place. Farmlands in the area would continue to be affected by ongoing and future activities within the region, but no change would occur to farmlands as a result of spaceport development and operation.

4.7 Hazardous Materials, Solid Waste, and Pollution Prevention

This section describes the activities that may require the transportation, storage, and use of hazardous materials or generate solid waste during site preparation, construction, and operations activities and addresses potential impacts associated with hazardous materials, solid waste, and pollution prevention as compared to the environmental baseline.

This section identifies waste streams that would be generated by the Proposed Action and alternatives; environmental site investigations and site remediation that may be required for the construction of the proposed project; hazardous and solid wastes that may be generated by construction and operation of the proposed project; management, transportation, storage, and use of hazardous materials for site preparation, site remediation, construction, and operation of the Proposed Action (including transportation); and pollution prevention strategies and procedures for site preparation, site remediation, construction, and operation of the Proposed Action.

Additionally, this section identifies whether waste disposal related to the Proposed Action or alternatives would result in impacts to facility disposal capacity, whether the Proposed Action or alternatives would interfere with any ongoing remediation of existing contaminated sites at the proposed project site or in the immediate vicinity of the project site. It also describes any special precautions needed to transport hazardous materials and hazardous waste as part of the Proposed Action or alternatives and how construction and operation of the Proposed Action will conform to the existing restrictions of the site, including land use and groundwater use restrictions, covenants, required ongoing monitoring and maintenance requirements, maintenance of signage, etc.

The methodology used to evaluate the impact of these factors identified proposed activities and, using process knowledge or other available data, determined the type and quantity of waste (hazardous and non-hazardous) that would likely be generated the Proposed Action. Resulting waste types/quantities were then compared to proposed management measures to determine if applicable waste regulations would be met, or if regional landfill capacities (in the case of solid wastes) would be exceeded.

Analysis also evaluated the types and quantities of hazardous materials that would be employed and whether proposed engineering controls (e.g., secondary containment) or operational controls

(emergency response plans) would be adequate to address potential releases and whether local emergency response resources would be available to respond to a potential release of hazardous materials.

To evaluate impacts to existing contamination sites, the existing location of these sites was compared with the location of proposed activities. Site-specific conditions, including the existence of land use controls, were then analyzed against proposed activities to assess whether these activities could result in health impacts to workers or releases of hazardous constituents to the environment.

Based on the above factors, FAA has not identified any significant adverse impacts associated with hazardous materials, solid waste, or pollution prevention. No National Priorities List properties are involved in the project, and landfill capacities would not be exceeded. As indicated in discussions below, there is the potential for effects to historical contamination sites. Once the land is acquired by Camden County, these potentially contaminated sites would likely be managed under the Georgia Brownfields Program. In this case, the new owner (Camden County) would be responsible for soil and groundwater investigations and management of soil and source material that are above Georgia risk reduction standards. This would involve preparing a CAP, which would work like a contract for soil and source management at these sites in accordance with State of Georgia requirements.

4.7.1 Proposed Action

Construction activities associated with roads and facilities are expected to occur over a 15-month period. Activities associated with operations are evaluated based on the site conducting up to 12 launches and 12 landings per year. Secondary indirect impacts are also identified and included in the analysis. Additional information on activities associated with the Proposed Action is provided in Section 2.1, *Proposed Action*.

4.7.1.1 Construction

Hazardous Materials

Hazardous materials that are common to construction include diesel and gasoline to fuel the construction equipment; hydraulic fluids, oils and lubricants; and welding gases, paints, solvents, adhesives, and batteries. Typical of most construction projects, the storage and use of these materials may result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling of lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses. To prevent the release of hazardous materials to the environment, appropriate measures would be implemented to ensure hazardous materials are handled, stored, and used in compliance with Federal, State, and local regulations.

Hazardous materials would be brought onsite using DOT-approved trucks or containers and would be temporarily stored until needed. Transportation would be only over approved roads by licensed carriers employing appropriate DOT placarding. In case of a hazardous materials incident during the course of transportation (including loading, unloading, and temporary storage), the carrier would be required to immediately provide notification to the appropriate agency, such as the local police or fire department.

Because more than 1,320 gallons of petroleum would be stored onsite, a federally mandated Spill Prevention, Control, and Countermeasure (SPCC) Plan would be developed and implemented. The SPCC Plan would describe all oil handling operations, spill prevention practices, discharge or drainage controls, and training requirements, as well as the personnel, equipment, and resources at the facility that would be used to prevent oil spills. Additional chemical-specific spill response plans would be

developed for other hazardous materials stored onsite (e.g., fuel, hydraulic fluid, and lubrication oils). Typical measures that would be implemented to minimize the potential for a hazardous material release would include the following:

- Implementing SPCC Plan prevention measures while loading and unloading fuel, such as preventing movement of transport vehicles during product handling operations and inspecting vehicle outlets for leakage before filling and truck departure
- Providing secondary containment for all bulk hazardous materials storage locations
- Storing bulk hazardous materials in approved containers that meet National Fire Protection Association industrial fire protection codes and required containment systems
- Storing hazardous materials in protected and controlled areas designed to comply with the SPCC Plan or chemical-specific plans
- Implementing appropriate storage container inspection and personnel training procedures

The use and management of hazardous materials for the construction phase of the Proposed Action are summarized in Table 4.7-1.

Table 4.7-1. Hazardous Materials Management for Construction

Material	Storage Quantity	Use	Management
Fuel, hydraulic fluid and lubrication oils	Containers up to 5 gallons (gal) each	Construction equipment	Stored on impervious surface with spill cleanup materials available. Used oils would be collected for recycling.
Welding gases	Containers up to 150 pounds each	Construction of launch structures and fabrication and maintenance of equipment	Consumed in welding operations. Cylinders would be removed from launch site by vendors.
Diesel fuel, gasoline, propane	Up to seven tanks of up to 5,000 gal each	Fuel for construction equipment	Stored in aboveground tanks with secondary containment and periodic inspections.
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, etc.	Containers up to 5 gal each	Construction of launch site facilities and equipment, cleaning	Limited quantities stored onsite at any one time. Stored in a small, locked steel building in the shop areas at least 2,500 feet from any fuel storage.

Hazardous and Solid Wastes

Hazardous and non-hazardous solid wastes would be generated in small quantities during construction, and would include empty containers, spent solvents, waste paint and solvents, used oil, spill cleanup materials, and lead-acid batteries from construction equipment. These wastes would be stored in appropriate containers in accordance with applicable Federal and State of Georgia regulations. Wastes that cannot be recycled would be disposed of by the contractor at licensed facilities in a manner approved by USEPA; consequently, no significant impacts would be expected.

Construction activities would also generate construction-related debris. A total of approximately 200,000 square feet of buildings space would be constructed as part of the Proposed Action, with the largest construction associated with the Vehicle Integration Building (120,000 square feet). Using conventional construction methods, approximately 4.34 pounds of C&D debris would be generated for

every square foot of building space (USEPA, 2003). This would equate to a total of approximately 435 tons of C&D debris generated (the product of 200,000 [square feet] multiplied by 4.34 [psf], divided by 2,000).

Buildings on the site would primarily be of a pre-engineered design. These are metal buildings that are pre-fabricated offsite then assembled onsite over a concrete slab-type of foundation; consequently, the actual quantity of C&D debris generated would be minimal, and would consist of scrap materials associated with interior spaces (e.g., offices), and would include wood, drywall, plastic, masonry, etc. C&D debris would also be generated during construction of paved surfaces (e.g., roads, buildings slabs, sidewalks). Building materials, such as asphalt and concrete, would not be expected to generate significant waste since they are produced in the needed quantities and can be recycled in the event that the material or its placement does not meet specifications. In the case of paved surfaces, C&D debris would likely consist mostly of wooden forms that could be recycled.

Soil excavated during construction activities would be stockpiled for construction and landscaping uses, while woody debris from land-clearing activities could also be chipped or mulched onsite and used for landscaping. Other non-hazardous waste generated would be the result of construction site operations (e.g., lunch waste, office waste, packaging materials). The quantity of this type of waste would be minor, when compared to the C&D debris generated.

C&D debris from construction activities would likely be disposed of at the Camden County C&D and Industrial Waste Landfill. As discussed in Section 3.7.3, *Existing Conditions*, sufficient landfill capacity exists to accommodate the additional solid waste generated as a result of construction activities; consequently, no significant impacts are expected to solid wastes.

Management actions of hazardous and solid waste for the construction phase of the Proposed Action are summarized in Table 4.7-2.

Table 4.7-2. Hazardous and Solid Waste Management for Construction

Waste	Source	Management
Construction-related debris (drywall, scrap lumber, scrap wood, metal, cardboard, paper, etc.)	Construction activities	Removed for offsite recycling or disposal during construction phase.
Spent solvents, paper, waste oil, batteries, spill cleanup materials, antifreeze, and empty containers	Construction, grounds maintenance, housekeeping, maintenance, and spill response (as needed) activities	Removed for appropriate offsite recycling or disposal.
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, isopropyl alcohol	Construction and maintenance of launch site facilities and equipment, cleaning	Small amounts of spent solvents would be transported offsite for recycling or disposal. Waste generated from these materials would be managed by the contractor and disposed of at the local landfills or hazardous waste quantities may be disposed as allowed under Georgia regulations.

Pollution Prevention

Construction projects would apply pollution prevention measures to the greatest extent possible. In addition to the release prevention measures described above, these measures would include purchase of environmentally friendly products, such as paints with a low content of VOCs. Projects would also incorporate recycling to limit the quantity of solid waste generated. This may include recycling wooden pallets and using soils and woody debris from land-clearing activities for landscaping onsite.

Historical Areas of Contamination

MEC Sites

Several historical areas of contamination are located within the ROI, as described in Section 3.7.3, *Existing Conditions*. These contamination (MEC) sites are primarily associated with historical uses of munitions. Construction in areas such as MRA-1 and MRA-2 could potentially expose workers to MECs.

Risks from exposure to MEC differ greatly from risks associated with exposure to chemicals. Direct (handling) or indirect contact with MEC has the potential to result in injury or death. Unlike chemical exposure where there may be an exposure limit where no adverse effects will occur, there is no accepted method for establishing the incremental probability for injury or death from an encounter with MEC. If the potential for an encounter with MEC exists, the potential that the encounter will result in death or injury also exists.

To eliminate the potential for impacts, prior to any work on MEC sites (e.g., MRA-1 and MRA-2), comprehensive surveys would be conducted by a qualified unexploded ordnance disposal contractor. These surveys usually include establishing transects throughout the entire work area, and then performing surface and subsurface scans (visual and electronic) along these transects. To ensure maximum coverage, subsurface scans would employ both magnetometers and electromagnetic metal detectors (magnetometers detect only ferrous metals while electromagnetic metal detectors detect both ferrous and non-ferrous metals).

Prior to construction, workers would also be educated on the potential for MECs in these areas, including how to recognize MECs and what procedures to apply in case MECs are encountered. These procedures would include leaving MECs where found, stopping all work around the MECs, and contacting the appropriate response personnel. Any detected MECs (either during the surveys or during construction activities) would be investigated and disposed of by an approved unexploded ordnance disposal contractor. If any explosive MEC is encountered, it would be detonated in-place with prior coordination with local agencies, such as the police and fire departments, and the Georgia Environmental Protection Division. With implementation of these construction and coordination practices, no adverse impacts would be expected as a result of construction activities in these areas.

Road Improvements

The Proposed Action also includes improvements to roads that currently traverse historical MEC sites, such as MRA-1 and MRA-2. Road improvement activities, such as filling and grading or removing and replacing existing surfaces, would primarily be limited to the existing road beds, limiting the potential for exposure to MECs. Soil-disturbing activities that extend outside the existing road bed, such as road widening, would also be subject to the same risk minimization construction and coordination practices described above; consequently, no adverse impacts would be expected.

Post-Construction Practices

In order to be exposed to MECs, personnel would have to leave the prescribed work areas and leave the prescribed access routes to each part of the site. Post construction, signage would be posted along all non-cleared MEC areas to inform employees and visitors of potential MEC hazards. Additionally, when non-employees visit the site, they would be escorted and instructed not to leave the prescribed travel routes. So long as these travel routes are adhered to, the probability on an employee or a visitor being exposed to MECs would be extremely low.

As discussed in Section 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, a 2012 CAP determined that updating the current ICP, would achieve the project objective of mitigating MEC hazards at MRA-1 and MRA-2 by preventing potential contact with MEC through site restrictions (signage and perimeter fencing) and passive restrictions (through training and educational programs). As part of the Proposed Action, the CAP would require updating to include any additional legal restrictions that may be required to prevent future contact with MEC resulting from any land use disturbances or changes.

Non-MEC Sites

Areas/roads associated with proposed activities also traverse non-MEC contamination areas, such as the Empty Drums Area (proposed site of launch facility), SWMU 6 and the Loop Road Equipment and Material Surface Storage site (proposed site of landing zone). These areas have been investigated and have been found to require no further action (see Section 3.7.3, *Existing Conditions*). However, if any evidence of potential contamination is encountered during construction (stained/discolored soil, odors, sheen on groundwater, etc.), all work would cease and the Spaceport Camden management and/or the Georgia Environmental Protection Division would be immediately notified. Regardless, all work on or near these areas would be coordinated with these same agencies. With implementation of these procedures (to include risk minimization practices previously discussed), no significant impacts would be expected as a result of construction activities in these areas.

Additional Investigations

As discussed in Section 3.7.3, *Existing Conditions*, there are also 10 additional sites that may be potentially contaminated. They are located on the northwest quadrant of the Bayer CropScience property, with most of the sites adjoining, or located near, Union Carbide Road (which would be improved as part of the Proposed Action).

Once the land is acquired by Camden County, these potentially contaminated sites would likely be managed under the Georgia Brownfields Program. As previously discussed, the purpose of the program is to encourage voluntary cleanup and reuse through redevelopment projects. The program makes it possible to acquire contaminated property without assuming all of the liability, as the new owner is protected from third party claims (lawsuits) resulting from prior contamination. In this case, the new owner (Camden County) would be responsible for soil and groundwater investigations and management of soil and source material that are above Georgia risk reduction standards. This would involve preparing a CAP, which would work like a contract for soil and source management at these sites in accordance with State of Georgia requirements.

Additionally, the land acquisition process would require completion of a Phase I Environmental Site Assessment. The Environmental Site Assessment would document environmental conditions at the Spaceport Camden site. The Environmental Site Assessment would also include a radius search report with information on properties located up to 1 mile from the site boundary, as documented in various

government environmental databases (leaking underground storage tanks, hazardous waste generators, etc.).

With implementation of the above procedures, no significant impacts would be expected from historical areas of contamination.

4.7.1.2 Operation

Hazardous Materials

Hazardous materials would be used during launches, maintenance and flight support activities (Table 4.7-3). Flight support operations at the vertical launch area would use products containing hazardous materials, including paints, solvents, oils, lubricants, acids, batteries, fuels, surface coating, and cleaning compounds. Some rocket propellants and materials used in maintaining launch vehicles are considered hazardous. The types of rocket propellants fuels to be potentially launched from Spaceport Camden include the following:

- Hydrocarbon fuel (i.e., RP-1 Propellant) with an oxidizer such as liquid oxygen
- Cryogenic propellants (i.e., liquid oxygen) maintained at very low temperatures
- Satellite and special fuels (i.e., hydrazine, MMH, UDMH, and NTO)

Table 4.7-3. Hazardous Materials Management for Operations

Material	Storage Quantity	Use	Management
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, isopropyl alcohol	Containers up to 5 gallons (gal) each	Maintenance of launch site facilities and equipment, cleaning	Limited quantities stored onsite at any one time. Stored in a small, locked steel building in the shop areas at least 2,500 feet from any fuel storage.
Liquid oxygen	Up to six tanks of 50,000-100,000 gal each	Used as oxidizer	Stored in appropriate storage tanks on impervious ground surfaces with berms capable of containing full volume of material stored. Areas would be fenced and checked for security. Consumed during launch or recovered after landing.
RP-1 Propellant	Up to four tanks with 50,000 gal each	Used as propellant	Stored in appropriate storage tanks on impervious ground surfaces with berms capable of containing full volume of material stored. Areas would be fenced and checked for security. Consumed during launch or recovered after landing.
Hydrazine, MMH, UDMH, and NTO	Containers 30 to 55 gal each	Satellite and special fuels	Stored on impervious ground surfaces with berms capable of containing full volume of material stored. Areas would be fenced and checked for security. Consumed during launch.
Helium gas	Total storage of 10,000 to 15,000 gal	Used in Launch Vehicle assembly and testing	Consumed onsite. An additional 1,000 cubic feet of helium gas would be stored tanks at the Launch Control Center Complex.

Table 4.7-3. Hazardous Materials Management for Operations

Material	Storage Quantity	Use	Management
Nitrogen gas	Total storage of 25,000 to 50,000 gal	Used in Launch Vehicle assembly and testing	Consumed onsite. An additional 3,000 cubic feet of nitrogen gas would be stored tanks at the Launch Control Center Complex.
Small explosive initiators and rocket motor igniters	-	Ignite fuels and propellants	Stored in a locked bunker at least 2,500 feet from fuel storage. Consumed during launch.

Notes: MMH = monomethylhydrazine; UDMH = unsymmetrical dimethyl hydrazine; NTO = nitrogen tetroxide.

These products would be supplied by conventional suppliers and would be delivered to the site by licensed vendors in approved tanker truck or other containers. Offsite storage would be maintained by the suppliers and is outside the scope of this EIS. Fuel and oxidizer loading/unloading operations would take place in designated areas located on impervious surfaces, with spill prevention and emergency response procedures in place. Fueling operations would take place under the provisions of the SPCC Plan. The risk of hazardous material releases due to leaking storage tanks, tanker trucks, delivery lines, or other infrastructure would be limited by proper handling practices, in compliance with 14 CFR §420.67 for liquid fuels.

These products would be used and stored at appropriate locations throughout the facility. As discussed previously, specific materials management plans would be developed that included strategies and procedures for storing, handling, and transporting hazardous materials (in addition to responding to onsite spills). This would include compliance with protocols for maintaining up-to-date Material Safety Data Sheets, as well as SPCC Plans. Containment areas surrounding the fuel storage tanks and any fueling facilities must be designed to ensure adequate containment or catchment of fuel so that tidal resources would not be impacted by a fuel spill (O.C.G.A. 12-8-60, *Hazardous Waste Management Act*).

Spaceport Camden would coordinate with, and obtain approval from, the State Fire Marshall regarding the onsite storage of any flammable materials (e.g., diesel, gasoline, propane). Additionally, Spaceport Camden would comply with EPCRA hazardous materials reporting requirements. Under EPCRA Sections 311 and 312 (Community Right-to-Know Requirements) facilities handling or storing any hazardous chemicals in excess of applicable reporting thresholds must submit Material Safety Data Sheets and annual inventory (Tier II) forms to State and local officials and local fire departments. In Georgia, the reporting threshold is 10,000 pounds for most common chemicals, with lower thresholds for chemicals identified as extremely hazardous substances (e.g., hydrazine).

Asbestos/LBP

As discussed in Section 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, information was not available regarding existing buildings or foundations, when previous buildings were removed, or if remaining structures contain asbestos or LBP. Regardless, prior to demolition or modification of any structures, asbestos surveys would be conducted, and if present, asbestos would be abated. Disposal of asbestos wastes would be conducted as directed by the National Emission Standards for Hazardous Air Pollutants. The State of Georgia would be notified prior to removal actions and only Georgia-licensed contractors would be allowed to perform the work. Contractor personnel would have to be trained and certified. Transport and disposal documentation records, including signed manifests, would also be required.

As with asbestos, prior to demolition or modification of any structures, a LBP survey would be conducted. Proper disposal of any resulting lead-containing wastes would also be conducted in accordance with Federal regulations, including the Toxic Substances Control Act and the Occupational Safety and Health Act. Further, these wastes would be accompanied by a waste manifest and disposed of at an approved facility. Implementation of these waste management requirements would mitigate any adverse impacts resulting from asbestos or LBP, and neither of these materials would be employed in new construction.

Hazardous and Solid Wastes

Hazardous wastes would also be generated during operations, although during successful launches all hazardous materials would be consumed, so no waste would be left requiring disposal. Spacecraft and vehicle maintenance, propellant and fuel storage and dispensing, and facility and grounds maintenance are among those activities that may generate very small quantities of hazardous wastes. The sources of hazardous waste include waste fuel, waste oils, spent solvents, paint waste, and used batteries. The Spaceport Camden operations and management entity would develop a hazardous waste management plan. The plan would lay out the steps for appropriate management of hazardous waste, such as establishment of satellite accumulation points and properly labeled DOT-approved containers. Wastes would be disposed of using designated hazardous waste accumulation facilities or private hazardous waste contractors, as needed.

Based on operations at similar facilities, it is estimated that the hazardous waste quantities would be small enough to qualify Spaceport Camden as a conditionally exempt small quantity generator (CESQG) of hazardous waste (FAA, 2008). CESQGs are defined as those facilities that produce less than 100 kilograms (220 pounds) of hazardous waste per calendar month, or less than 1 kilogram (2.2 pounds) of acutely hazardous waste per calendar month. The CESQG requirements additionally limit the facility's waste accumulation quantities to less than 1,000 kilograms (2,200 pounds) of hazardous waste, 1 kilogram (2.2 pounds) of acute hazardous waste, or 100 kilograms (220 pounds) of any residue from the cleanup of a spill of acute hazardous waste at any time. Spaceport Camden would obtain a generator identification number related to hazardous waste operations from the Georgia Environmental Protection Division.

Georgia follows Federal hazardous waste management regulations, which allow the disposal of hazardous waste generated by CESQGs in municipal waste landfills permitted by State (such as the Camden County C&D and Industrial Waste Landfill). The regulations governing hazardous waste management are found Georgia Administrative Code 391-3-11, Hazardous Waste Management. Generation rates for a CESQG (i.e., less than 220 pounds per month) would have a negligible impact on disposal capacity on this landfill or on other landfills in the region.

Operations would also generate non-hazardous solid waste such as office waste, break room waste, packaging from supplies, and solid waste from maintenance activities that use non-hazardous materials. There would be approximately 75 full-time employees at the facility, with up to 300 staff present during launch operations. Based on an estimated generation rate of 9.2 pounds per worker per day (California Integrated Waste Management Board, 2007), the annual generation would be approximately 250 tons (assuming an average annual staff of 150 personnel). For comparison, the Camden County MSW Landfill accommodates up to 400 tons per day of solid wastes; consequently, no adverse impacts would be expected.

- 1 Management actions of hazardous and solid waste for the operations phase of the Proposed Action are
2 summarized in Table 4.7-4.

Table 4.7-4. Hazardous and Solid Waste Management for Operations

Waste	Source	Management
Spent solvents, paper, waste oil, batteries, spill cleanup materials, antifreeze, and empty containers	Grounds maintenance, housekeeping, maintenance, and spill response (as needed) activities	Removed for appropriate offsite recycling or disposal.
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, isopropyl alcohol	Maintenance of launch site facilities and equipment, cleaning	Small amounts of spent solvents would be transported offsite for recycling or disposal. Waste generated from these materials would be managed by the contractor and disposed of at the local landfills or hazardous waste quantities may be disposed as allowed under Georgia regulations.

3 **Launch Failure**

4 The largest potential for hazardous materials/wastes releases would occur in the event of a launch
5 failure. Possible outcomes include fires, explosions, or releases of propellants or other hazardous
6 materials. In case of a launch failure or other vehicle accident, clean up and recovery of components
7 would be performed to minimize impacts on lands. Trained fire suppression and clean up teams would
8 be sent to the area to put out possible fires and clean up possibly hazardous materials and waste. The
9 specific recovery activities following accidents would be specified in the Launch Site Operator License;
10 Spaceport Camden standard operating procedures; and Environment, Safety, and Health documents.

11 Hazardous materials and waste would be managed in accordance with Federal, State, and local
12 requirements, and any necessary permits would be obtained prior to onsite treatment. Additional
13 considerations for specific launch vehicles would be specified in the launch licenses. In all cases, the
14 owner or agency of the affected land would be notified of the accident and response activities would
15 begin as soon as possible.

16 **Pollution Prevention**

17 As with construction, operational activities would also apply pollution prevention measures to the
18 greatest extent possible. These measures may include purchase of environmentally friendly products;
19 recycling cardboard containers and wooden pallets; incorporating energy efficient building design for
20 cooling, heating, and lighting; and using alternate power sources such as photovoltaic cells. Additionally,
21 as part of security patrols during launches and landings, Spaceport Camden personnel may coordinate
22 sweeps after each event to recover materials that have been discharged from rockets. Any
23 launch/landing vehicle debris landing in tidally-influenced marsh or State waters out to 3 miles must be
24 recovered when feasible and may require authorization from the Georgia Coastal Resources Division
25 (O.C.G.A. 12-5-230, *Shore Protection Act*, and/or O.C.G.A. 12-5-280, *Coastal Marshlands Protection Act*,
26 and/or O.C.G.A. 50-16-61, *Administrative Procedures Act/Revocable License Program*).

4.7.2 Ocean-Landing Only Alternative

Under this alternative, hazardous materials utilized, hazardous and non-hazardous solid waste types generated, and associated management requirements for materials storage, waste generation and storage, and contaminated site management would be the same as those described under the Proposed Action. The only substantive difference between this alternative and the Proposed Action is that there would be less C&D waste generated because the landing facility would not be constructed.

4.7.3 No Action Alternative

Under this alternative, Spaceport Camden would not be constructed or operated; consequently, no impacts from hazardous materials and wastes or contamination sites over those under current conditions would occur.

4.8 Historical, Architectural, Archaeological, and Cultural Resources

This section provides the results of the analysis of the actions and recommendations for the appropriate finding of effect for each historic property, then summarizes the finding of effect for the entire project. Possible outcomes for the findings of effect include: no historic properties affected; no adverse effect on historic properties; and adverse effect on historic properties. As part of the Section 106 process mandated by the NHPA, FAA consults with the SHPO and seeks concurrence on the finding of effect. This section reports the status or results of the consultation at the time of the publication of this EIS, and identifies the need for mitigation measures to resolve adverse effects.

Analysis of potential impacts on historic properties considers direct impacts that may occur by physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the types and locations of proposed activity and determining the exact location of cultural resources that could be affected. Indirect impacts occur later in time or farther from project activities. Indirect impacts are assessed by identifying cultural resources located near the project that may be altered by effects related to noise, vibrations, or visual intrusions related to project construction, maintenance activities, and operation of the spaceport, as well as increased use of the area attributable to the proposed project.

Impacts on historical, architectural, archaeological, and cultural resources could arise from direct effects resulting from ground-altering activities associated with construction and possibly operational activities. Indirect impacts could also affect this resource type through changing the audible or visual environment during the period of construction and operation of Spaceport Camden.

This introductory section briefly describes the activities that are evaluated for potential impacts on historic properties. Table 4.8-1 summarizes the potential effect on resources within the boundary of Spaceport Camden and within the 5-mile audible and visual APE, including the type of effect and whether it would occur from construction or operation.

Table 4.8-1. Effect on Historic Properties of Proposed Spaceport Camden

Resource Number	Resource Description	NRHP Eligibility*	Location in APE	Potential Effect*	Potential Source of Effect
Cultural Resources in the APE for Direct Effects: Construction Areas					
9CM30	Shell scatter and pottery, pre-contact	Potentially Eligible, Criterion D	Vertical Launch Facility	Adverse effect	Construction: Ground disturbance
9CM64	Shell midden and pottery, Mississippian	Potentially Eligible, Criterion D	Vertical Launch Facility	Adverse effect	Construction: Ground disturbance
9CM570	Shell midden and pottery, Woodland	Potentially Eligible, Criterion D	Vertical Launch Facility	Adverse effect	Construction: Ground disturbance
9CM571	Shell midden and pottery, Woodland	Potentially Eligible, Criterion D	Vertical Launch Facility	Adverse effect	Construction: Ground disturbance
Historic Properties in the APE for Direct and Audible and Visual Effects: Proposed Spaceport Camden Boundary					
9CM24	Shell scatter, Late Archaic - Mississippian	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary	No effect	n/a
9CM25	Shell midden, Woodland, Mississippian	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary	No effect	n/a
9CM26	Shell mounds, Woodland	Potentially eligible, Criterion D	Outside of construction area, within proposed Spaceport Camden boundary	No effect	n/a
CM-CO 31	Floyd's Fairfield and Bellevue Plantations/ Union Carbide Property, c. 1804-c. 1877	Eligible, Criteria B and C, Criteria Consideration C and D	Outside of construction area, within proposed Spaceport Camden boundary	No effect	Operations: Vibration
CM-CO 31, Resource A	Anchor House ruins, early 19 th century	Eligible, Criterion A	Outside of construction area, within proposed Spaceport Camden boundary	No effect	Operations: Vibration
CM-CO 31, Resource B	Charles Rinaldo Floyd Burial Site, 1845	Eligible, Criterion B, Criteria Consideration C	Outside of construction area, within proposed Spaceport Camden boundary	No effect	Operations: Vibration

Table 4.8-1. Effect on Historic Properties of Proposed Spaceport Camden

Resource Number	Resource Description	NRHP Eligibility*	Location in APE	Potential Effect*	Potential Source of Effect
CM-CO 31, Resource C	Floyd Family Cemetery, early to mid-19 th century	Eligible, Criterion A, Criteria Consideration D	Outside of construction area, within proposed Spaceport Camden boundary	No effect	Operations: Vibration
Cultural Resource in APE for Audible and Visual Effects: 5-mile Radius					
#78000265	High Point-Half Moon Bluff Historic District (HP-HMB), c. 1700-1950	Listed as HP-HMB HD, Criterion A	CUIS: High Point-Half Moon Bluff Historic District (HD)	No adverse effect	Operation: Vibration, noise, visual
#78000265, Resource A	First African Baptist Church, 1937	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff	No adverse effect	Operation: Vibration, noise, visual
#78000265, Resource B	Rischarde Red Barn, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff	No adverse effect	Operation: Vibration, noise, visual
#78000265, Resource C	Alberty House, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff	No adverse effect	Operation: Vibration, noise, visual
#78000265, Resource D	Trimmings House, c. 1935-1945	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff	No adverse effect	Operation: Vibration, noise, visual
#78000265, Resource I	Cemeteries, c. 1880	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff	No adverse effect	Operation: Noise, visual
#78000265, Resource J	High Point Road, c. 1880	Contributing to HP-HMB HD, Criterion A	CUIS: Half Moon Bluff to High Point	No adverse effect	Operation: Noise, visual
#84000941	Main Road, c. 1800-1870	Listed individually (no HD), Criterion A	North end of CUIS	No adverse effect	Operation: Visual
[no number]	Cumberland Island Cultural Historic Landscape	Eligible as Historic Landscape (no HD), Criteria A and B	CUIS	No adverse effect	Operation: Noise, visual

NOTE TO REVIEWERS: *Within the APE for Direct Effects: Construction Areas - SHPO has concurred with potential eligibility of archaeological resources, and avoidance to resolve adverse effect. Within the APE for Audible and Visual Effects - SHPO has not yet concurred with findings of effect – once concurrence received this table will be updated in the Final EIS.

Notes: CUIS = Cumberland Island National Seashore; c. = circa; HD = historic district; HP-HMB = High Point-Half Moon Bluff; n/a = not applicable; NRHP = National Register of Historic Places.

- 1 Construction-related actions would include ground-disturbing activities such as excavation, fill, utility
- 2 installation, or use of an area for staging; these activities could impact archaeological sites that are
- 3 within the area of direct disturbance and could have an adverse effect on archaeological historic

properties (i.e., archaeological sites that are eligible for listing on the NRHP). Architectural historic properties, including above-ground structures or ruins potentially could be adversely affected by vibration associated with ground disturbance activities, such as pile driving. Vibrations could cause cracks in tabby concrete walls or unsettle the foundations of grave markers and monument footings. However, distance from the construction activity would diminish vibration effects, which is taken into account in the analysis of potential impacts to the historic properties in the APE.

Transitory noise associated with construction activity is unlikely to affect archaeological resources as setting is rarely a component of an archaeological site's eligibility for listing on the NRHP. Architectural resources could be affected if the noise level were great enough to cause damage, as noted above, but noise related to construction of the spaceport is unlikely to have a lasting effect on the setting of historic properties, because of its short-term nature. Within the APE for audible and visual effect, it is unlikely that construction would cause any effect because of the distance of historic properties from the activities associated with the Proposed Action.

Post-construction activities, including operation of the spaceport, would likely have no effect on archaeological historic properties. However, operation of the spaceport could have a visual and audible effect on other historic properties when setting is a key characteristic of NRHP eligibility. Noise or vibrations from spaceport operation or visual intrusion from spaceport structures, static engine firings, launches and landings could potentially affect historic landscapes, as well as architectural historic properties, or traditional cultural properties.

Audible effects could arise from static engine tests, launches, and spaceport landings, including the sonic boom that would be associated with each spaceport landing. Although there is no established criterion for how loud noise must be to adversely affect a historic property, the 65 dB level identified for "Noise and Noise-Compatible Land Use" is a generally accepted standard (FAA Order 1050.1F; FAA 1050.1F Desk Reference Sections 11.1.2, 11.1.3, and 11.2: Projects Not Requiring a Noise Analysis, FAA Aircraft Noise Screening Tools and Methodologies, and Affected Environment, respectively). Noise above this level in a previously quiet environment, or even a noise level below this in a noise sensitive area where the increase is above the FAA standard of 1.5-dB increase, is generally accepted as creating a potential adverse effect to historic properties. Impacts to historic properties from noise in the APE for audible and visual effects would be from changes to setting through the increase in noise levels, as vibrations are unlikely to be of a duration or at a level great enough to result in physical changes (refer to Section 4.11, *Noise and Noise-Compatible Land Use*).

Visual effects may arise when the view from a historic property or the view to the historic property is changed in a way that affects its NRHP eligibility characteristics. Constructed elements such as buildings, lightning protection system towers and water towers, ambient elements such as lights visible at night, or the rocket launches and spaceport landings themselves may have a visual effect on a historic property if setting is a key element of its NRHP eligibility.

4.8.1 Proposed Action

4.8.1.1 Construction

An archaeological survey of the portions of the APE for direct effects where ground disturbance would occur (see Section 3.8.3, *Historical, Architectural, Archaeological, and Cultural Resources, Existing Conditions*) was conducted to identify archaeological historic properties that could be directly affected by ground-disturbing activities (Cultural Resources Analysts, Inc., 2017a). An architectural survey of the APE for audible and visual effects identified cultural resources that could be affected by changes to the

audible, vibratory, and visual environment (Cultural Resources Analysts, Inc., 2017b). The results of these surveys are described in Chapter 3, *Affected Environment*, of this EIS (refer to Table 3.8-1) and used as the baseline for analysis.

Archaeological Resources

Cultural resources inventory of the areas of the proposed Spaceport Camden facilities located a total of four archaeological historic properties within the APE for direct impacts. The four archaeological sites, all within, or partially within the construction footprint of the Vertical Launch Facility, are considered “potentially eligible” for listing on the NRHP (SHPO letter dated April 3, 2017); if project activities cannot avoid these sites, and if Phase II testing determines that the sites are eligible for listing on the NRHP, they could be adversely affected by construction of the spaceport through direct disturbance related to construction activities. Construction could affect the integrity of an archaeological site, which is an essential feature of its ability to yield information important in prehistory or history (NRHP Criterion D). Two isolated finds within the footprint of the Vertical Launch Facility and one within the Launch Control Center Complex are not eligible for listing, and construction would have no effect on them. Three other archaeological sites, within the proposed Spaceport Camden boundary but outside of the project construction areas of direct impact, have not been evaluated for NRHP eligibility, but would not be disturbed by construction. Until evaluated, these three sites are treated as if they are eligible. However, none of these three would be affected by actions related to construction of the facilities. Not all parcels within the proposed Spaceport Camden boundary but outside of the project construction areas have been surveyed, because some project elements are on Bayer CropScience property. Phased identification of archaeological resources may locate additional sites; if identified as historic properties (36 CFR §800.4(b)(2)), continuation of Section 106 consultation would be required.

Despite the intensive nature of the archaeological survey in the portions of the APE for direct effects where ground disturbance would occur, it remains possible that additional archaeological sites could be located during construction-related ground disturbance. In the event of such a discovery, the spaceport operator should immediately notify the SHPO and evaluate the resource for NRHP eligibility. If the resource is a historic property (i.e., eligible for listing on the NRHP), initiation of the Section 106 consultation process would determine the next steps needed to comply with the NHPA.

Architectural Resources

Physical disturbance. No architectural historic properties would be permanently affected by construction of the spaceport facilities. Of the three NRHP-eligible architectural components of the Floyd’s Fairfield and Bellevue Plantations/Union Carbide Property located within the proposed Spaceport Camden boundary, none are within the construction areas. The three historic properties are: ruins of the Anchor House, the Charles Rinaldo Floyd Burial Site, and the Floyd Family Cemetery. Because these historic properties are outside of the construction footprint, there would be no direct impact from construction. Noise generated by construction would be short-term and would not reach levels sufficient to affect the NRHP eligibility of these resources, as their eligibility is based on their significant associations and setting is not a key characteristic of the properties’ integrity.

Noise and vibration from construction, possibly including pile driving, are not anticipated to impact any architectural resources in the APE. The common measure for construction point source noise (i.e., pile driving) is the maximum decibel level (i.e., the L_{max}), which is the highest value of a sound pressure over a certain time interval (see Table 4.11-1 in Section 4.11, *Noise and Noise-Compatible Land Use*). Noise levels for construction activities range from 73 (for a generator) to 101 dBA L_{max} (for pile driver) at 50 feet from the activities (FHWA, 2006). As most of the proposed Spaceport Camden site is vegetated or unpaved, there would be a reduction in noise transfer such that the extent of noise impacts would be

less than these levels. Within the proposed Spaceport Camden boundary, the Anchor House, the Charles Rinaldo Floyd Burial Site, and the Floyd Family Cemetery would be far enough away from the noise source so that there would be no effect. The remaining six architectural resources are not eligible for listing on the NRHP.

Visual intrusion. Outside of the proposed Spaceport Camden boundary, within the 5-mile radius APE for audible and visual effects, the historic properties on Cumberland Island are unlikely to experience audible or visual impacts from construction. Based on the viewshed analysis performed (see Sections 3.13 and 4.13, *Visual Effects*), visual effects to historic properties could stem from visibility of launch facility features such as buildings and towers and/or view of the space vehicles during launch or spaceport landing. Within the proposed Spaceport Camden boundary, the three historic properties and seven potentially eligible archaeological sites are unlikely to be affected by visual intrusions. As recently as 2009, their setting contained a more-than-300-foot-tall manufacturing building with conveyors and related buildings and structures (which have since been removed); the setting has also undergone significant changes since the resources' period of significance, without affecting NRHP eligibility.

On Cumberland Island, visual intrusions from the proposed lightning towers and water towers could have an effect on historic properties because setting is a key element of their NRHP listing. Vegetation or other structures would block the view of the proposed lightning and water towers from most of the contributing features of the High Point-Half Moon Bluff Historic District and the Main Road. However, the proposed lightning and water towers, and the 65-foot-tall Vehicle Integration Building at the Vertical Launch Facility site will reach heights that will be visible from the easternmost portion of the High Point-Half Moon Bluff Historic District, which is included in the Cumberland Island Cultural Historic Landscape. Representative observation points for the visual analysis are illustrated in Exhibit 3.13-3; observation point 4 is adjacent to the easternmost point of the Historic District.

Structures and lights would be visible from the portion of the Cumberland Island Cultural Historic Landscape that lies within the indirect APE, introducing elements to the setting of the historic landscape that affect a key characteristic of its eligibility (Cultural Resources Analysts, Inc., 2017b). However, as with the Cumberland Island Historic District, it will not be an adverse effect.

These same effects apply to the Dover Bluff Club Historic District, the Tabby Ruins on Dover Bluff, and the Cabin Bluff Cumberland River Retreat Historic District. Although lightning and water towers may be visible at times, resulting in an effect to the setting of these historic properties, the effect will not be adverse, as views from these resources have included contemporary industrial objects during their periods of significance.

Cultural Landscape

The Cumberland Island Cultural Historic Landscape, located within the 5-mile radius APE for audible and visual effects, is unlikely to experience impacts from construction.

Traditional Cultural Resources

No traditional cultural resources have been identified within the facilities' construction footprints or within the proposed boundary of Spaceport Camden.

4.8.1.2 Operation

Effects to historic properties related to noise and vibration within the APE for direct effects and the APE for audible and visual effects (the 5-mile radius from the spaceport) were examined with measurements of $L_{A,max}$ (dBA), L_{max} , and sonic booms.

Archaeological Resources

There would be no impacts to archaeological resources anticipated from the proposed operation of Spaceport Camden. The archaeological survey of the APE for direct effects identified four archaeological sites that are potentially eligible for listing on the NRHP for the purposes of Section 106, all located within, or partially within, the construction area for the Vertical Launch Facility. As discussed in Section 4.8.1.1, *Construction*, if project actions cannot avoid one or more of these sites, then Phase II testing would formally determine NRHP eligibility (see Appendix A, *Public Involvement/Agency Coordination and Consultation*, for the letter from the SHPO dated April 3, 2017). There are three other archaeological sites outside the facilities' footprints that have not been assessed for NRHP eligibility but are also treated as though they are eligible for listing on the NRHP. Once construction is completed, it is unlikely that any of these resources would be affected by operation of Spaceport Camden, for example, by vibration and noise generated by, static engine tests, movement of the launch vehicle to the launch pad or other activities (Cultural Resources Analysts, Inc., 2017a). The change in the acoustical setting due to the proposed Spaceport Camden operations would not be an adverse effect to the seven prehistoric archaeological sites because they are considered potentially eligible for their potential data content under Criterion D, and setting is not one of the characteristics of these sites that would qualify the property for inclusion in the NRHP.

Architectural Resources

Acoustic Setting $L_{A,max}$ (dBA). Three NRHP-eligible architectural features associated with the 19th century Floyd's Fairfield and Bellevue Plantations are within the proposed Spaceport Camden boundary but outside the construction areas. These features are the Anchor House ruins, the Charles Rinaldo Floyd Burial Site, and the Floyd Family Cemetery. These historic properties are within a radius of the launch site that would experience noise levels exceeding 65 dBA, and in most cases between 90 and 115 dBA during static fire, launch, and spaceport landing-related activities under all models and trajectories. These noise events would exceed the standards identified by FAA Order 1050.1F of a 1.5-dB increase in the noise environment of a generally quiet setting, in this case of the historic properties. This increase in noise would constitute a change to the setting of the historic properties. However, the change would be transitory, lasting only as long as each noise event, varying from about seven seconds for a static test, to a little over two minutes for a launch. Although such noise-induced changes to the quiet setting would be an effect to historic properties, it is unlikely to be an adverse effect, because the changes would be transitory and infrequent.

An architectural survey of the APE for audible and visual effects within a 5-mile radius of the proposed Spaceport Camden also identified historic properties. As described in Chapter 3, *Affected Environment*, in addition to the three NRHP-eligible architectural resources within the proposed Spaceport Camden boundary, architectural historic properties on Cumberland Island were identified as listed on or eligible for listing on the NRHP. The architectural resources that could be affected by changes to the audible and visual environment (Cultural Resources Analysts, Inc., 2017b) include the NRHP-listed Main Road and High Point-Half Moon Bluff Historic District (listed on the NRHP), including six contributing elements: the First African Baptist Church, Rischarde Red Barn, Alberty House, Trimmings House, three cemeteries dating to circa 1880, and the High Point Road. Historic properties were also identified on Dover Bluff and Cabin Bluff. On Dover Bluff, the Dover Bluff Club Historic District includes 23 contributing elements consisting of residences (4.8-1). Tabby Ruins comprise a contributing element of the Black Hammock Plantation. The plantation is outside of the APE and is of unknown NRHP eligibility, but is treated as eligible, as are the Tabby Ruins. On Cabin Bluff, the Cabin Bluff Cumberland River Retreat Historic District includes 16 contributing elements, mostly cabins but also including a main lodge and various facilities (Table 4.8-1).

1 These historic properties would be subject to periodic noise levels of between 80 and 90 dBA under all
2 launch trajectory headings (see Exhibit 4.11-2 in Section 4.11, *Noise and Noise-Compatible Land Use*).
3 Noise modeling for vehicle first-stage landings indicate noise levels below 80 dBA in this portion of the
4 historic district (see Exhibit 4.11-3 in Section 4.11, *Noise and Noise-Compatible Land Use*), and
5 somewhat less for static fire tests (see Exhibit 4.11-4 in Section 4.11, *Noise and Noise-Compatible Land*
6 *Use*). These noise levels are unlikely to cause physical effects to these historic properties, although in all
7 cases, these noise events would exceed the standards identified by FAA Order 1050.1F of a of 1.5 dB
8 increase in the noise environment of a generally quiet setting, in this case of the historic districts. The
9 Settlement at the NRHP-listed Half Moon Bluff, including the First African Baptist Church, is considered a
10 noise-sensitive area (refer to Section 4.11, *Noise and Noise-Compatible Land Use*, and as defined in
11 Paragraph 11-5.b(8) of FAA Order 1050.1F). This increase in noise would constitute a change to the
12 setting of the historic properties. However, the effect would be transitory, lasting only as long as each
13 noise event. This varies from about seven seconds for a static test, to a little over two minutes for a
14 launch (refer to Table 4.11-3 in Section 4.11, *Noise and Noise-Compatible Land Use*). Although such
15 noise would be an effect to historic properties, it is unlikely to be an adverse effect, as the portion of
16 Cumberland Island that includes these historic properties lies within the hazard area that would be
17 closed to visitors, except those specifically authorized (e.g., residents, vacation house owners and
18 permit-holding campers; see Section 2.1.1, *Construction – Activities and Facility Descriptions*), during
19 launch and landing operations (refer to Exhibit 2.1-10 and Exhibit 2.1-11). On Dover Bluff and Cabin
20 Bluff, setting includes enough modern elements and intrusions so that short-lived noise events would
21 not constitute an adverse effect.

22 **Noise Vibration ($L_{\max}$ [dB]).** Technical analysis indicates that an increase in noise and vibration is
23 expected in the area of the NRHP-eligible architectural features of the Floyd's Fairfield and Bellevue
24 Plantations from periodic static fire, launch, and landing-related activities under all models and
25 trajectories (see Exhibit 4.11-2 in Section 4.11, *Noise and Noise-Compatible Land Use*). The technical
26 analysis suggests that cracking or displacement to the tabby walls of the Anchor House ruins, or
27 displacement or cracking of grave markers or the base of the Floyd Burial monument could occur as a
28 result of the operation of Spaceport Camden.

29 $L_{\max}$ analysis to determine the potential for structural damage related to vibrations from noise indicates
30 that the three historic properties within the proposed Spaceport Camden boundary would be exposed
31 to noise levels of 120 dB, a level which is predicted to generate structural damage claims at a rate of
32 1 per 100 households (structures) (see Exhibit 4.11-5, Exhibit 4.11-6, and Exhibit 4.11-7 in Section 4.11,
33 *Noise and Noise-Compatible Land Use*) (James, Salton, & Downing, 2017). Archaeological structures like
34 the Anchor House ruins, the Charles Rinaldo Floyd Burial Site, and the Floyd Family Cemetery could be
35 damaged by vibration from these periodic elevated noise levels, but the probability is low (1 per
36 100 structures per event).

37 The Anchor House ruins are in a state of deterioration, with one elevation of the tabby ruins being braced
38 with wood beam supports (Cultural Resources Analysts, Inc., 2017b). The Charles Rinaldo Floyd Burial Site
39 is mostly intact with barely legible inscription and some collapse of the 1920s concrete block fence that
40 surrounds it. The box tomb features of the Floyd Family Cemetery are in similar condition with illegible
41 inscriptions and cracked and broken slabs. All three properties are heavily overgrown with vegetation.
42 Thus, while archaeological structures like the Anchor House ruins, the Charles Rinaldo Floyd Burial Site,
43 and the Floyd Family Cemetery could be damaged by vibration and overpressure from these periodic
44 noise events, it is unlikely that such damage would affect the condition of the properties to such a degree
45 that they would be no longer eligible for listing on the NRHP.

On Cumberland Island, Dover Bluff and Cabin Bluff, the historic properties within the APE for audible and visual effects would be subject to L_{max} of at least 111 dB for all launch trajectory headings, resulting in a potential effect to setting, and possibly to structural elements such as windows in buildings in poor repair, cracked plaster or displaced bric-a-brac (refer to Exhibit 4.11-5 in Section 4.11, *Noise and Noise-Compatible Land Use*). On Cumberland Island, these could include elements of the NRHP-listed High Point-Half Moon Bluff Historic District such as the First African Baptist Church, Rischarde Red Barn, Alberty House and Trimmings House. However, the likelihood of an adverse effect is low, with a probability of 1 damage claim submitted per every 1,000 households. Effect from noise on the Cemeteries, High Point Road, or Main Road, on Cumberland Island, is unlikely. L_{max} from all landing trajectories would fall below the levels shown to potentially cause damage, and the same holds for static fire engine tests (see Exhibit 4.11-6 and Exhibit 4.11-7 in Section 4.11).

The same conditions apply to the historic properties on Dover Bluff and Cabin Bluff. The Tabby Ruins on Dover Bluff could be vulnerable to adverse effects from vibrations generated by spacecraft launches, but in all cases, the likelihood of damage remains low, with a probability of one damage claim per 1,000 households (structures) (James, Salton, & Downing, 2017).

Sonic booms. Sonic booms would be associated with both launch and spaceport landing events. For all launch trajectories, the sonic boom would occur far enough east of the coastline that there would be no effect on historic properties. For landings at the Spaceport, the sonic boom overpressure contour would be between 1 and 2 psf over Cumberland Island, and as high as 2.8 psf over the proposed Spaceport Camden (see Exhibit 4.11-9 and Exhibit 4.11-10, Section 4.11, *Noise and Noise-Compatible Land Use*) (James, Salton, & Downing, 2017). At an overpressure of 2 psf, structures in poor repair could experience minor damage to structural elements including windows, plaster, or bric-a-brac (James, Salton, & Downing, 2017). For this reason, sonic booms, although projected to be relatively rare events (no more than 12 Spaceport landings per year) could have an effect on historic properties both within the proposed Spaceport Camden and on Cumberland Island. Although the incidence would be expected to be low, effects could include cracking or displacement of tabby walls, monument base, or grave markers of the NRHP-eligible architectural features of the Floyd's Fairfield and Bellevue Plantations within the proposed Spaceport Camden site. As described above, it is unlikely that such damage, if it were to occur, would affect the condition of the properties to such a degree that they would be no longer eligible for listing on the NRHP.

On Cumberland Island, potential damage from the projected rare sonic boom events could include glass breakage, damage to outside walls, or other, hard-to-predict damage to other structural elements (refer to Table 3.11-1, Section 3.11, *Noise and Noise-Compatible Land Use*) of the First African Baptist Church, Rischarde Red Barn, Alberty House and Trimmings House on Cumberland Island. Sonic booms are unlikely to affect the cemeteries, High Point Road, or Main Road on Cumberland Island. If structural damage to historic properties were allowed to accumulate or go unrepaired, then that would be an adverse effect.

On Dover Bluff and Cabin Bluff, sonic boom overpressure would be approximately 0.5 psf, a level that would be unlikely to result in any damage to historic properties (James, Salton, & Downing, 2017), so there would be no effect from sonic booms.

Visual intrusion. Based on the viewshed analysis performed (see Sections 3.13 and 4.13, *Visual Effects*), visual effects to historic properties could stem from visibility of the space vehicles during launch or landing operations. Within the proposed Spaceport Camden boundary, the three historic properties of the Floyd's Fairfield and Bellevue Plantations are unlikely to be affected by visual intrusions, as their setting contained a more-than-300 foot tall manufacturing building with conveyors and related buildings

1 and structures (which have since been removed); the setting has also undergone significant changes
2 since the resources' period of significance, without affecting NRHP eligibility.

3 On Cumberland Island, the space vehicle would be visible from the historic properties on Cumberland
4 Island during launches, which would temporarily intrude into their visual setting. However, the intrusion
5 into the visual setting would be very small because the space vehicle would be at a distance of
6 approximately 4 miles at launch, and then at an estimated altitude of 30,000 feet as it passes overhead.
7 Although these small changes to the viewscape would temporarily affect the setting of the historic
8 properties, they would not constitute an adverse effect, because the views from Cumberland Island to
9 the mainland over the past decades has varied considerably, including both rural and industrial objects,
10 as well as modern air traffic overhead and boat traffic on the Intracoastal Waterway, but not to the
11 degree that the historic properties no longer qualify for listing on the NRHP.

12 These same effects apply to the Dover Bluff Club Historic District, the Tabby Ruins on Dover Bluff, and
13 the Cabin Bluff Cumberland River Retreat Historic District. Although the space vehicle may be visible
14 from a distance during launches, resulting in a temporary effect to the visual setting of these historic
15 properties, the effect will not be adverse, as views from these resources have included contemporary
16 industrial objects, including modern air traffic overhead and boat traffic on the Intracoastal Waterway,
17 during their periods of significance.

18 **Cultural Landscape**

19 Structures and lights would be visible from the portion of the historic landscape that lies within the APE
20 for audible and visual effects. Launches and spaceport landings will also introduce elements to the
21 setting of the historic landscape that affect a key characteristic of its eligibility (Cultural Resources
22 Analysts, Inc., 2017b) (see Section 4.11, *Noise and Noise-Compatible Land Use*, and Section 4.13, *Visual*
23 *Effects*). However, this would not be an adverse effect; the viewscape has included industrial features in
24 the recent past and continues to have modern intrusions such as modern elements on the horizon, as
25 well as boat and air traffic. These did not affect the eligibility of some landscape elements that are
26 already listed on the NRHP, including the High Point-Half Moon Bluff Historic District, and do not
27 adversely affect the Cumberland Island Cultural Historic Landscape.

28 **Traditional Cultural Resources**

29 No traditional cultural resources have been identified within the 5-mile radius APE for audible and visual
30 effect for Spaceport Camden.

31 **4.8.1.3 Summary of Finding of Effect for the Proposed Action**

32 According to FAA Order 1050.1F, FAA has not “established a significance threshold for the full range of
33 historical, architectural, archaeological, and cultural resources.” However, FAA considers a finding of
34 adverse effect, identified through the Section 106 process, to be a factor in determining if the impact is
35 significant. This section discusses whether the findings of effect discussed in Section 4.8.1.1,
36 *Construction*, and Section 4.8.1.2, *Operation*, warrant a decision that the impacts on cultural resources
37 are significant.

38 An adverse effect to archaeological historic properties, identified through the Section 106 process, could
39 arise from direct ground disturbance resulting from construction of the Vertical Launch Facility, where
40 four archaeological sites that are currently considered potentially eligible for listing on the NRHP have
41 been identified. If project actions could not avoid one or more of these sites, and if subsequent Phase II
42 testing determined that the site(s) were eligible for listing on the NRHP, then there would be an adverse

effect, which would be a significant impact to cultural resources from construction of Spaceport Camden that would require mitigation measures.

Although effects to architectural historic properties, also identified through the Section 106 process, would arise from the changes to the audible and visual environment during operation of the spaceport through introduction of elements inconsistent primarily with the historic properties' setting, in most cases these are not of an intensity or duration to constitute an adverse effect. Within the proposed Spaceport Camden boundary but outside the construction zone, three NRHP-eligible components of the Floyd's Fairfield and Bellevue Plantations/Union Carbide Property could experience effects (such as damage to plaster, monument base, or grave markers) from vibration related to noise from static engine firings, and launch and landing operations. However, it is unlikely that such noise-induced damage would affect the condition of the properties to such a degree that they would be no longer eligible for listing on the NRHP.

On Cumberland Island, there would be effects from noise and visual intrusions on a portion of the NRHP-listed High Point-Half Moon Bluff Historic District (including six contributing elements); to the NRHP-listed Main Road; and to the NRHP-eligible Cumberland Island Cultural Historic Landscape (a Historic Vernacular Landscape). However, structural damage due to noise vibration from static tests, launches, and landings at the proposed Spaceport Camden are unlikely. Visual effects from light from lightning poles and the water tower; visual impacts from the launch and spaceport landings; and visual effects on the view towards the launch facility as seen from the historic landscape would be an effect on historic properties, but would not be an adverse effect, because the viewscape included industrial features at the time it was listed on the NRHP, so that this aspect of setting is not a key element of the NRHP eligibility. The same holds true for the Dover Bluff Club Historic District, the Tabby Ruins on Dover Bluff, and the Cabin Bluff Cumberland River Retreat Historic District.

As of the Draft EIS, SHPO has concurred with findings of eligibility for the cultural resources within the proposed Spaceport Camden APES. One Native American tribe has responded to FAA's initiation of consultation under Section 106 and government-to-government consultation in compliance with EO 13007, EO 13175, and NEPA. The Choctaw Nation of Oklahoma has responded, deferring to other tribes (see Appendix A, *Public Involvement/Agency Coordination and Consultation*).

Adverse effects to historic properties identified through the Section 106 process require resolution, usually through development of a Section 106 agreement between the proponent and the SHPO. The agreement describes the steps necessary to resolve the adverse effect. A finding of adverse effect is also considered a significant impact under NEPA. Section 106 consultation, including resolution of adverse effects must be concluded prior to completion of the NEPA process. FAA continues to consult with SHPO regarding its determination of *no adverse effect*, as well as Indian tribes. Copies of all consultation correspondence are provided in Appendix A, *Public Involvement/Agency Coordination and Consultation*, and consultation will be completed prior to the signing of any Record of Decision.

4.8.2 Ocean-Landing Only Alternative

Under this alternative, first-stage landings would only occur on a barge located several hundred miles from the shoreline. With the exception of no construction of a landing zone all other project components and operational activities would be the same as the Proposed Action, as would the respective impacts. Under this alternative there would be no sonic booms over land associated with first-stage landings (see Exhibit 4.11-10 in Section 4.11, *Noise and Noise-Compatible Land Use*) and as a result there would be no significant impacts to cultural resources from vibration/overpressures associated with barge landings under this alternative.

4.8.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. There would be no effect to historic properties, and thus no impact on cultural resources within the APE for direct effects and no impact on cultural resources within the APE for audible and visual effects.

4.9 Land Use

This section includes an analysis of whether the construction and operation of the proposed spaceport creates impacts that are incompatible with existing and/or future planned uses in the study area. Typically, impacts to land use involve changes in the designated land use designation and the manner in which the land may be utilized by people. Adverse impacts may result in recreational use conflicts or preclude recreational use of certain areas either temporarily or permanently. Adverse impacts on landowners can include incompatibilities with current landowner uses or have negative effects on property values. In certain circumstances, incompatibilities in land use may arise that require further planning or consultations between landowners until an agreeable designation is issued.

The analysis discusses any inconsistency with approved State and/or local land use plan(s) or law(s). It was also coordinated and cross-referenced with the analyses performed in other sections such as noise-compatible land use (Section 4.11, *Noise and Noise-Compatible Land Use*) and any induced socioeconomic impacts on land use (Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*).

Cumberland Island Wilderness

The analysis of impacts to Cumberland Island Wilderness determines whether the proposed Spaceport Camden construction and operation activities would potentially degrade wilderness qualities described in Section 3.9.3, *Land Use, Existing Conditions*. The NPS Wilderness Character Integration User Guide identifies indicators for each wilderness quality that can be used to monitor trends in a given wilderness area. The User Guide also describes factors that would degrade each quality (Table 4.9-1).

Table 4.9-1. Wilderness Qualities, Associated Indicators, and Degradation Factors

Quality	Indicator	Degradation Factors
Untrammeled	Actions authorized by the Federal land manager that manipulate the biophysical environment	Modern human activities or actions that control or manipulate the components or processes of ecological systems inside wilderness
	Actions not authorized by the Federal land manager that manipulate the biophysical environment	
Natural	Plant and animal species and communities	Intended or unintended effects of modern civilization on the ecological systems inside a wilderness
	Physical resources	
	Biophysical processes	
Solitude or primitive & unconfined recreation	Remoteness from sights and sounds of people inside the wilderness	Settings that reduce opportunities for solitude or primitive and unconfined recreation, such as encounters with other visitors, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior
	Remoteness from occupied and modified areas outside the wilderness	
	Facilities that decrease self-reliant recreation	
	Management restrictions on visitor behavior	

Table 4.9-1. Wilderness Qualities, Associated Indicators, and Degradation Factors

Quality	Indicator	Degradation Factors
Undeveloped	Non-recreational structures, installations, and developments	Presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases people's ability to occupy or modify the environment.
	Inholdings	
	Use of motor vehicles, motorized equipment, or mechanical transport	
Other features of value	Condition of cultural resources integral to wilderness character	Deterioration in the condition of a cultural site or loss of an endangered species within the area
	Other locally identified indicators	

Source: (NPS, 2014)

The indicators and degradation factors listed above offer an approach to assess potential impacts to wilderness qualities. They also imply that an analysis of impacts to wilderness areas would involve both quantitative and qualitative assessments of wilderness qualities. The untrammeled, natural, undeveloped, and other features of value qualities consist of physical attributes found within the wilderness area that can be analyzed quantitatively with field surveys, measurements, and other data-gathering techniques. The Wilderness Act does not provide a definition of what would qualify as “outstanding opportunities” and agency policies do not provide clear guidance on what conditions are necessary to provide outstanding opportunities to wilderness visitors (Carlson et al., 2010). Therefore, in addition to the degradation factors listed above, potential impacts to outstanding opportunities for solitude or primitive and unconfined recreation must include a qualitative analysis. Additional challenges in evaluating the solitude or primitive and unconfined recreation quality, and to a lesser extent the natural quality, can occur when impacts arise from activities outside the boundaries of wilderness.

The NPS Wilderness Character Integration User Guide suggests assigning weighting measures to each wilderness quality to reflect ecological importance, managerial importance, vulnerability, or other factors (NPS, 2014). While the guide provided examples of weighting measures applied to wilderness qualities from other wilderness areas, similar guidance is not available for the Cumberland Island Wilderness. Given the lack of quantitative measures to assess wilderness qualities specific to Cumberland Island Wilderness, the analysis assumes all qualities are equally weighted.

4.9.1 Proposed Action

For Cumberland Island Wilderness, proposed Spaceport Camden activities may generate four types of impacts, or stressors, to wilderness qualities: noise, light emissions, visual intrusions (i.e., towers, rocket), and access restrictions. This section focuses on the potential impacts of these stressors as related to wilderness character; for details on analysis methodologies for biological resources, noise impacts, socioeconomics, and visual effects, see Sections 4.2, *Biological Resources*, 4.11, *Noise and Noise-Compatible Land Use*, 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*, and 4.13, *Visual Effects*, respectively. Each stressor has the potential to detract from solitude or primitive and unconfined recreation opportunities for wilderness visitors. In addition, light emissions may degrade the natural quality through potential impacts to the light environment of wildlife species that occur within Cumberland Island Wilderness. Impacts to untrammeled, undeveloped, and other features of value (i.e., cultural/historic resources) qualities of Cumberland Island Wilderness would only occur for activities or actions that would result in a physical change or alteration of these features. No components of proposed Spaceport Camden activities are expected to manipulate the biophysical environment of the wilderness. No structures would be constructed and no vehicle use

associated with Spaceport Camden activities is proposed to occur within the land boundaries of the Cumberland Island Wilderness Area. Furthermore, as detailed in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*, proposed Spaceport Camden activities would not result in physical changes to historic properties. Therefore, impacts to untrammeled, undeveloped, and other features of value qualities would not occur from the Proposed Action and are not discussed further in the analysis.

4.9.1.1 Construction

Construction of the facilities associated with Spaceport Camden would not have any adverse land use impacts on the proposed 11,800-acre industrial site presently owned by Union Carbide Corporation and Bayer CropScience. Although the majority of the 1,200-acre upland portion of the site is presently undeveloped, the area has been previously disturbed (primarily from silvicultural activities, industrial manufacturing, and munitions testing). No facilities are presently planned for the adjacent former Bayer CropScience industrial site except for an Alternate Control Center and Visitor Center proposed to be located on a previously developed area near the main front gate.

As described in Section 3.9, *Land Use*, the Camden County Planning and Development Department amended the UDC to allow spaceport-related manufacturing as a permitted use and spaceport-related aviation as a special use in the I-G zoning that applies to the proposed Spaceport Camden property. Future land use for the upland portion of the property would remain as Industrial and marsh portion would continue to be designated as Conservation. The zoning and future land use designations for the surrounding parcels would remain unchanged and would be compatible with the industrial use of the Spaceport Camden property.

Cumberland Island Wilderness

Noise. As described in Section 4.2.1.1, *Biological Resources, Proposed Action, Construction*, wildlife species within and around Cumberland Island Wilderness may be exposed to increased levels of noise from construction activities. However, impacts would primarily consist of behavioral effects that are temporary and would not result in permanent changes to ecological systems or biophysical processes within Cumberland Island Wilderness. Therefore, no impacts from construction-related noise to the natural quality of wilderness would occur.

Noise from construction and pile driving activities may occur at levels that would detract from the perception of solitude for visitors of the Cumberland Island Wilderness Area. Section 4.11.1.1, *Noise and Noise-Compatible Land Use, Proposed Action, Construction*, describes noise levels associated with construction equipment and pile driving activities. Upland areas of Cumberland Island National Seashore, including portions of Cumberland Island Wilderness, are located about 3.5 miles east of the closest proposed construction site and may experience noise levels of approximately 43 dBA DNL. While this slightly exceeds NPS estimates of noise levels in the area, which have been estimated at between 36 and 38 dBA (NPS, 2016c), it does fall within the range of acoustic readings recorded at six separate sites within the Cumberland Island National Seashore for the Travel Management Plan (NPS, 2009). However, even a slight increase in noise would be easily noticeable in an otherwise quiet setting, as provided and expected within a wilderness area. This change in the soundscape would impact wilderness visitors' perceptions of solitude. Construction activities are proposed to occur during normal daytime working hours for 15 months, with pile driving estimated to occur over a 1-month period each at the launch pad and landing pad locations. The resulting increases in noise levels from construction would be temporary, in that it would only last for 15 months, but are expected to be continuous within that time period with higher intensities during pile driving. Overnight visitors of wilderness would still

1 have opportunities to enjoy solitude during the night and on weekends, but day-use visitors would likely
2 experience the majority of impacts. However, given the daily vehicle use of Main Road, occasional
3 aircraft overflights, vessel traffic in surrounding waterways, and beach driving in areas adjacent to
4 Cumberland Island Wilderness, visitors already experience some degree of detracting from solitude. The
5 addition of construction noise from Spaceport Camden sites miles away from wilderness would not
6 substantially diminish perceptions of solitude over baseline conditions. Construction-related noise
7 would result in short-term, minor to moderate adverse effects to solitude or primitive and unconfined
8 recreation quality; however, impacts would not permanently degrade this quality and would therefore
9 not be significant.

10 **Visual Intrusions.** This discussion focuses on potential impacts to the daytime viewshed, as nighttime
11 viewshed impacts are addressed in the Artificial Lighting section below. Visual intrusions to Cumberland
12 Island Wilderness from construction would include visibility of tall cranes, along with buildings and
13 towers at the Vertical Launch Facility, from certain portions of the Wilderness, which may detract from
14 the solitude quality for some visitors. The visual impacts assessment in Section 4.13, *Visual Effects*,
15 considered the extent to which the proposed spaceport would contrast with, detract from, or change
16 the visual character or viewshed of the existing environment. Existing vegetation would mostly obstruct
17 offsite views to the construction activities at three of the four construction project areas (see Section
18 4.13, *Visual Effects*). The tallest structures are planned for the Vertical Launch Facility, including four
19 250-foot lightning towers, one 250-foot water tower, and the 65-foot-tall Vehicle Integration Building.
20 The forest surrounding this site would provide partial screening, but use of tall cranes for installation of
21 the higher elements of the site would be visible above the tree canopies.

22 Visual impacts affecting solitude would vary based on the distance of wilderness visitors from the
23 changes, frequency of viewing (such as sunset viewings), and visual access to the proposed spaceport
24 site from the wilderness (unobstructed line of sight). Vegetation, terrain, or other structures block the
25 view of the lightning and water towers from most of the wilderness. Lightning and water towers, and
26 structures on the Launch Pad Complex would be moderately noticeable from certain areas along the
27 western coastline of Cumberland Island Wilderness because they contrast with natural features and the
28 sky, but they would occupy a very small area in a viewer's cone of vision and viewing plane, low on the
29 horizon (see Section 4.13, *Visual Effects*). Although they would not be dominant features in the
30 viewshed, given the wilderness expectation for views free of human features, the presence of even
31 these few structures may negatively impact a visitor's perception of solitude during their wilderness
32 experience. However, visitors can enjoy adjacent natural views by slight shifts in their viewing angle.

33 For inland and eastern portions of the wilderness, analysis found that the overall impact to viewshed
34 quality was low because visibility is obscured by vegetative screening and local terrain. The overall
35 impact to the daytime viewshed from the western shoreline of the wilderness (using Brickhill Bluff and
36 Cumberland Wharf as representative locations) is moderate to high, due to the sensitivity of the
37 viewshed (see Table 4.13-1 in Section 4.13, *Visual Effects*). Although up to 300 visitors are permitted
38 daily to Cumberland Island National Seashore, only a small portion of those visitors access the
39 wilderness portion of the island, and the number of those visitors that visit the western shoreline of the
40 wilderness from which the spaceport towers/facilities would be visible is an even smaller number.

41 Overall, the daytime visual intrusion of towers and buildings constructed for the proposed Spaceport
42 Camden may detract from a small number of visitors' perceptions of solitude, with resulting long-term,
43 minor adverse impacts to this quality. However, overall impacts to this quality would not be significant.

44 **Artificial Light.** As the proposed spaceport site currently has very low nighttime radiance, the increase
45 in the luminescence from the site would be noticeable. Lighting associated with construction may
46 impact the natural quality and detract from solitude within portions of the wilderness; however,

1 construction occurring at night is expected to be infrequent and may likely only occur during winter
2 months when the days are shorter. Sky glow has been associated with ecological changes and possible
3 human health effects, since natural circadian rhythms are driven by light patterns and are foundational
4 for the functions of biota in any given context. Diminishing dark skies is a concern not just in developed
5 areas, but also in pristine areas where the absence of light is valued for the experience of darkness and
6 higher visibility of the sky and stars.

7 Construction-related lighting at the proposed Spaceport Camden site would alter the natural lightscape,
8 which may elicit behavioral changes in nocturnal animals exposed to the artificial lighting. Behavioral
9 changes of animals within the wilderness are described in Section 4.2.1.1, *Biological Resources*,
10 *Proposed Action, Construction*. Since animal species are listed as an indicator, these behavioral changes
11 could degrade the natural quality. However, as described in Section 4.2.1.1, *Biological Resources*,
12 *Proposed Action, Construction*, the potential for impacts to species on the island were low. To minimize
13 impacts from construction lighting, a Light Management Plan would be developed in coordination with
14 the USFWS and GDNr. Implementation of the plan would minimize, direct light impacts to wildlife that
15 occur within and around the wilderness, especially sea turtle nesting beaches (see Section 4.2.1.1,
16 *Biological Resources, Proposed Action, Construction*, and Appendix A, *Public Involvement/Agency*
17 *Coordination and Consultation*). Construction-related lighting would result in minor to moderate adverse
18 effects to natural quality; however, impacts would not permanently degrade this quality and would
19 therefore not be significant.

20 A change in the lightscape may also affect wilderness visitors' perceptions of solitude. The introduction
21 of light sources from construction during evening hours may alter the darkness of night skies, degrading
22 the "remoteness from the sights of human activity from areas outside the wilderness" indicator for
23 solitude and primitive or unconfined recreation (Landres et al., 2015; NPS, 2014). However, any
24 construction activities at night are expected to be infrequent and limited to possibly a few hours during
25 the winter months when days are shorter. Park use during these months is the lowest and, therefore,
26 impacts would be expected to be short-term and temporary, concluding each evening and eliminated
27 after construction is completed.

28 **4.9.1.2 Operation**

29 Proposed Spaceport Camden operations would not be expected to have any adverse land use impacts
30 for the communities of Woodbine, Kingsland, and St. Marys, Crooked River State Park, Naval Submarine
31 Base Kings Bay, Jekyll Island, or Fort Clinch State Park on Amelia Island. However, Spaceport Camden
32 would create temporary adverse land use (i.e., recreational) impacts on the nearby privately owned and
33 operated Cabin Bluff Cumberland River Retreat, portions of Cumberland Island National Seashore,
34 Intracoastal Waterway users, areas of the Atlantic Ocean within a closure area, and potentially for the
35 residents of Little Cumberland Island. Operational and business activities in St. Marys and on
36 Cumberland Island National Seashore could also be disrupted during launch closures (see Sections 3.12
37 and 4.12, *Socioeconomics*).

38 Impacts would result from the designated security and safety zones that would need to be enforced
39 prior to and during launch operations (see Section 2.1.2.5, *Pre-Launch Activities*). These security and
40 safety zones would result in the establishment of hazard and closure areas to prevent the public and
41 other nonauthorized personnel from accessing the area during hazardous operations (i.e.,
42 launches/landings, wet dress rehearsals, and static fire engine tests).

43 Exhibit 2.1-10 and Exhibit 2.1-11 show possible hazard and closure areas for a launch/landing from
44 Spaceport Camden based on a range of representative trajectories. Additional trajectories, all in a

generally easterly direction, could be used for launches and landings, and each launch/landing would have an individually defined hazard and closure area. However, the hazard and closure areas shown for the two representative trajectories bound the affected areas to the north and south of the Spaceport Camden site.

The 300 daily allowed visitors (see Section 1.1, *Background*) to Cumberland Island National Seashore would be impacted by Spaceport Camden launch and landing operations on the up to 12 days per year when these activities could occur. The primary area impacted would be the northern end of the island while the majority of the area to the south would remain open. The St. Marys ferry typically drops and picks up at Sea Camp and Dungeness Dock, which are on the southern part of the island. None of the docks used (Sea Camp, Dungeness, and Plum Orchard) would be impacted by closure areas for any launches, as the docks are all south of the launch overflight area. Areas affected would include Brickhill Bluff campground, Cumberland Wharf Ruins, High Point, the Settlement, First African Baptist Church, and up to 10 trails. Closures for launch operations would also impact the Land and Legacies Tour, which includes historic locations around Cumberland Island National Seashore, including Plum Orchard Mansion, the Settlement (including the First African Baptist Church), Cumberland Island Wharf, and other sites along the main road. Depending on the launch schedules, it is also possible that one or more of the six public hunts that are held each year in the north end of the island could be adversely impacted. In accordance with State hunting regulations, these hunts have to be scheduled two years in advance.

The up-to-24 allowed campers per day at Brickhill Bluff, plus other residents and potential persons at habitable structures on the north end of Cumberland Island (Squaw Town and Plum Orchard) and Little Cumberland Island would be considered “authorized persons” and could remain if they wished. The County has discussed the option to offer anyone who is an “authorized person” who wants to depart for the launch window, a complimentary ride and/or appropriate temporary accommodations including “VIP” viewing passes for the launch. The Intracoastal Waterway would be temporarily closed north of Crooked River State Park. Launch trajectories between 115 and 83 degrees would impact residents of Little Cumberland Island. FAA anticipates that because most of the park would remain open and without restrictions during launch events and because many launches would occur in the early morning or later in the afternoon, launch activities and closures would not impact park visits to the northern most reaches of the island.

Camden County and/or the launch operator would notify the public anywhere between one month to three days prior to a launch/landing operation requiring a closure (Sections 2.1.2.3, *Representative Launch*, and 2.1.2.5, *Pre-Launch Activities*). The Georgia Coastal Resources Division recommends avoiding or minimizing launch operations that require closure areas on weekends, holidays, and during organized fishing tournaments in the vicinity, as well as posting closure dates/times at all public access points within 10 miles of proposed closure areas, including public boat ramps, 30 days in advance (O.C.G.A. 12-5-320, *Coastal Management Act*). Closures could last up to 12 hours on a launch/landing day, with 4 to 6 hours being the typical closure time for a launch/landing. A closure for a wet dress rehearsal or static fire engine test would be shorter (typically three hours or less) and would only include those areas within a 2-mile radius of the launch pad and, therefore, would not impact Cumberland Island or Little Cumberland Island. It is anticipated that there could be up to 12 launches/landings, up to 12 static fire engine tests, and up to 12 wet dress rehearsals per year.

Potential noise and noise-compatible land use impacts are discussed in Section 4.11, *Noise and Noise-Compatible Land Use*. Because the sound environment in noise-sensitive locations near the proposed spaceport would be unchanged during the vast majority of the year, current land uses (e.g., recreation, residences, commercial, etc.) would remain compatible. Socioeconomic impacts indirectly associated

1 with land use such as economic impacts (e.g., from temporary restricted access or short closures of
2 portions of the Cumberland Island National Seashore) and Little Cumberland Island property values are
3 presented in Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health*
4 *and Safety Risks*.

5 **Cumberland Island Wilderness**

6 **Noise.** As described in Section 4.2.1.2, *Biological Resources, Proposed Action, Operation*, wildlife species
7 within and around Cumberland Island Wilderness may be exposed to increased levels of noise from daily
8 operations, launches/landings, and support activities including static fire engine tests, dry rehearsals,
9 and wet rehearsals. However, impacts would primarily consist of behavioral effects that are temporary
10 and would not result in permanent changes to ecological systems or biophysical processes within
11 Cumberland Island Wilderness. Therefore, no impacts from operations-related noise to the natural
12 quality of wilderness would occur.

13 Noise from daily operations, launches/landings, and support activities may occur at levels that would
14 detract from the perception of solitude for visitors within the wilderness. Section 4.11.1.2, *Noise and*
15 *Noise-Compatible Land Use, Proposed Action, Operation*, describes noise levels associated with
16 proposed Spaceport Camden operations. Noise generated from daily operations and landings would not
17 exceed 80 dBA $L_{A,max}$ within the wilderness (Exhibit 4.11-1 and Exhibit 4.11-3). As shown in
18 Exhibit 4.11-2, the entire Cumberland Island Wilderness would be exposed to noise levels ranging
19 between 80 and 90 dBA $L_{A,max}$ during launches. In addition, a small area of the wilderness would be
20 exposed to noise levels between 80 and 85 dBA $L_{A,max}$ during a static fire engine test (Exhibit 4.11-4).
21 Each launch and support activity event would be short in duration, approximately up to five minutes for
22 a launch and seven seconds for a static fire test. These noise levels would exceed baseline conditions
23 and temporarily alter the soundscape of Cumberland Island Wilderness, detracting from the solitude
24 quality of wilderness. However, only 12 launches/landings and 12 support activities would be conducted
25 annually; therefore, adverse noise impacts to solitude would be short-term.

26 As described in Section 3.9.3, *Land Use, Existing Conditions*, Cumberland Island Wilderness is exposed to
27 noise from sources outside the area including vehicular traffic on Main Road, vessel use of surrounding
28 water ways, military aircraft overflights, and beach driving. Therefore, visitors currently experience a
29 diminished level of solitude within Cumberland Island Wilderness. As described below, portions of the
30 wilderness will be closed to public access for day-users. Advanced notification will be provided to the
31 public prior to each launch that will inform the public of the area closure. Wilderness visitors that access
32 Cumberland Island Wilderness outside the closure area will be made aware of the launch and will either
33 expect the noise disturbance to occur or choose not to visit the wilderness during that time. While this
34 will prevent unexpected disturbances in solitude of visitors, it will still have an impact on the primitive
35 and unconfined recreation quality, as described below in the Access Restrictions section. Given the short
36 duration of operations-related noise, combined with the existing soundscape of Cumberland Island
37 Wilderness, impacts to the solitude or primitive and unconfined recreation quality would be adverse,
38 but short-term and minor. These impacts would not permanently degrade this wilderness quality;
39 therefore, impacts would not be significant.

40 **Visual Intrusions.** This discussion focuses on potential impacts to the daytime viewshed, as nighttime
41 viewshed impacts are addressed in the Artificial Lighting section below. Visual intrusions to the
42 wilderness from operations would include visibility of the buildings and towers at the Vertical Launch
43 Facility and views of the space vehicles during launches and spaceport landings from certain portions of
44 the wilderness, which may detract from the solitude quality for some visitors. Refer to the Construction
45 section above for visual impacts to Cumberland Island Wilderness from the daily daytime operations of

1 the towers and buildings. Views of the rockets on the ground would likely be obscured due to the
2 required intervening vegetation buffers at the site.

3 The rocket launch flight path would be highly visible overhead for a short duration, about once per
4 month. The visual impact would be temporary and no permanent change to viewscape would occur;
5 however, the launch may affect the perception of solitude for any of the visitors within the wilderness
6 with a line of sight to the launch path. A maximum of 72 people could potentially be impacted because
7 only authorized campers could remain within the wilderness on launch day. As these events would be
8 highly publicized and all authorized campers would be notified, there should not be any concern for
9 startle effects due to the visual component of the launches. Recovery operations would be similar to a
10 small aircraft landing. These operations would be infrequent and cause no permanent change to views
11 in the area.

12 Overall, visual intrusions associated with proposed Spaceport Camden daily operations would result in
13 long-term, minor adverse impacts to the solitude and primitive or unconfined recreation quality. In
14 addition, visual intrusions associated with launches/landings would result in short-term, moderate
15 adverse impacts to the solitude and primitive or unconfined recreation quality. However, given the
16 minor level of long-term impacts and short-term level of moderate impacts, permanent degradation to
17 this quality is not anticipated and impacts would not be considered to be significant.

18 **Artificial Light.** Lighting associated with daily operations, pre-launch operations, launches, and landings
19 may impact the natural quality and detract from visitors' perception of solitude within portions of
20 Cumberland Island Wilderness. Night lighting during daily operations would likely involve exterior
21 building lighting and parking area lighting. Additional light emissions associated with pre-launch events
22 would be visible from portions of the wilderness, as would night launches. Lighting and skyglow would
23 increase during monthly pre-launch periods, when lighting would be positioned to illuminate the
24 assembled rocket on the launch pad and ground tasks at the Vertical Launch Facility would increase for
25 one or two nights (dusk to dawn). Lighting and skyglow during the pre-launch period would be most
26 noticeable at locations along the western shoreline of the wilderness, but would typically be obscured
27 by vegetation in inland portions of the wilderness. One night launch annually could have visible high-
28 intensity LED launch pad lighting, generating noticeable sky glow and potential glare spots (see Section
29 4.13.1.2, *Visual Effects, Proposed Action, Operation*). Artificial lighting and skyglow associated with daily
30 operations and pre-launch operations may detract from the perception of solitude for up to
31 72 wilderness visitors on a daily basis.

32 Overnight wilderness visitors are required to camp at one of three designated wilderness campgrounds:
33 Hickory Hill, Yankee Paradise, or Brickhill Bluff (NPS, 2017c) (Exhibit 3.12-2). Both the Hickory Hill and
34 Yankee Paradise sites are inland, with a vegetative buffer between them and the proposed Spaceport
35 Camden site. No lights would be directly visible at these inland campgrounds and most skyglow would
36 be obscured by the interceding vegetation. The Brickhill Bluff campground has a relatively unobstructed
37 view of the proposed spaceport site, thus campers at this location are more likely to experience
38 negative impacts from lighting. Brickhill Bluff campers would likely see the hazard lights on the towers
39 and possibly some direct lighting and skyglow from minimal security lighting. Increased signs of
40 modernization would be visible by up to 24 wilderness campers at Brickhill Bluff, which would detract
41 from solitude during their wilderness experience. As described in Section 4.13.1.1, *Visual Effects,*
42 *Proposed Action, Construction*, measures would be taken to reduce light emissions and a Light
43 Management Plan would be developed. These measures are expected to reduce the level of impacts to
44 Brickhill Bluff wilderness campers. In addition, the other two wilderness camping areas located in the
45 interior of the Cumberland Island Wilderness would not be impacted by light emissions, and solitude
46 would not be degraded for wilderness campers at Hickory Hill and Yankee Paradise. Therefore,

1 construction-related lighting may cause long-term, moderate adverse impacts to the solitude and
2 primitive or unconfined recreation quality at and around Brickhill Bluff. However, impacts would be
3 localized and would not permanently degrade this quality throughout the entire Cumberland Island
4 Wilderness and as such would not be significant.

5 Within Cumberland Island Wilderness, light emitted from the rocket may be obscured by vegetation for
6 portions of the launch, but views would be clear for most viewers in open areas and along the
7 shorelines. Visibility of the airborne rocket would only be a few minutes, but the experience of solitude
8 within the wilderness would be interrupted during this brief period. Up to 72 campers would be
9 authorized to remain within the wilderness during any given launch event, thus this would be the
10 maximum number of visitors who may experience a brief degradation of solitude quality. However,
11 public notification would be provided prior to each launch event. Therefore, any interruption of solitude
12 would not be unexpected and would be temporary and short-term, concluding after the launch/landing
13 activity.

14 Artificial light associated with proposed Spaceport Camden daily operations would result in long-term
15 and moderately adverse impacts to the solitude and primitive or unconfined recreation quality. In
16 addition, artificial light from pre-launch operations would result in short-term, moderate adverse
17 impacts. Finally, artificial light associated with launches/landings would result in short-term, moderate
18 to high adverse impacts to the solitude and primitive or unconfined recreation quality. However,
19 permanent degradation to this quality throughout the entire Cumberland Island Wilderness is not
20 anticipated and impacts would not be considered to be significant. To minimize unnecessary light and
21 light trespass outside of the Spaceport Camden property, a Lighting Management Plan would be
22 developed. The plan would specify lighting types, directional controls, and dimming mechanisms.

23 **Access Restrictions.** Closure areas for wet dress rehearsals or static fire engine tests would not include
24 any portion of Cumberland Island. As shown in Exhibit 2.1-10 and Exhibit 2.1-11, various portions of
25 Cumberland Island Wilderness will be closed to the public during launches/landings for human safety
26 concerns. The exact closure area will depend on the actual launch trajectory and will be coordinated
27 with FAA, NPS, USFWS, and GDNR. Camden County and/or the launch operator would notify the public
28 anywhere between one month to three days prior to a launch/landing operation requiring a closure
29 (Sections 2.1.2.3, *Representative Launch*, and 2.1.2.5, *Pre-Launch Activities*). As described in Section
30 4.9.1.2, *Land Use, Proposed Action, Operation*, permitted overnight campers and residents of
31 Cumberland Island would be considered “authorized persons” and could remain in the area if they
32 wished. Therefore only day-use visitors of wilderness would be restricted access on the proposed
33 12 launch/landing days, annually. The duration of the closure would last up to 12 hours on each
34 launch/landing day, with 4 to 6 hours being typical. Restricting the day-use visitors of wilderness for any
35 portion of a day would prohibit all recreational activities within Cumberland Island Wilderness during
36 that time period, reducing opportunities for the public to experience wilderness. While other areas of
37 Cumberland Island Wilderness would remain open, restricting access to portions of the wilderness area
38 would prevent visitors from experiencing unconfined recreation by not allowing them to travel freely
39 through the area without restriction. Access restrictions associated with launch/landing operations
40 would result in short-term, minor to moderate adverse effects to the solitude or primitive and
41 unconfined recreation quality; however, impacts would not permanently degrade this quality and
42 therefore impacts would not be significant.

43 **Summary of Impacts to Wilderness**

44 Table 4.9-2 shows potential impacts to all wilderness qualities of Cumberland Island from proposed
45 Spaceport Camden construction and operation activities.

Table 4.9-2. Impacts to Cumberland Island Wilderness Qualities for Alternative 1

Proposed Activity		Stressors	Wilderness Quality Potentially Impacted				
			Untrammeled	Natural	Undeveloped	Solitude or Primitive & Unconfined Recreation	Other Features of Value (Cultural/Historic Resources)
Construction	General Construction	Noise	o	o	o	-S	o
		Visual Intrusion	o	o	o	--S	o
		Light Emissions	o	-	o	--S	o
	Pile Driving	Noise	o	o	o	-S	o
Operation	Daily Operations	Noise	o	o	o	-S	o
		Visual Intrusion	o	o	o	--S	o
		Light Emissions	o	-	o	--S	o
	Launches / Landings	Noise	o	o	o	-S	o
		Visual Intrusion	o	o	o	-S	o
		Light Emissions	o	-	o	-S	o
		Access Restrictions	o	o	o	-P	o
	Support Activities*	Noise	o	o	o	-S	o
		Light Emissions	o	-	o	-S	o

Notes: o = No impact; - = Adverse, short-term impact; -- = Adverse, long-term impact; S = Solitude; P = Primitive and unconfined recreation.

* Includes static fire engine tests, dry rehearsals, and wet rehearsals.

In addition to analysis of the individual wilderness qualities above, impact to the overall wilderness character of Cumberland Island Wilderness was also assessed. Baseline conditions described in Section 3.9.3, *Land Use, Existing Conditions*, suggest that, at a minimum, the untrammeled and undeveloped qualities of Cumberland Island Wilderness are degraded. Since these qualities would not be impacted by proposed Spaceport Camden activities, additional degradation would not occur. Of the five wilderness qualities that are present within Cumberland Island Wilderness, only two are expected to experience adverse impacts: natural and solitude or primitive and unconfined recreation. Most impacts would be short-term and are not expected to permanently degrade these wilderness qualities. For the long-term impacts from the visual presence of the towers/facilities and lighting/skyglow, they are only experienced by wilderness visitors on the western shoreline facing the proposed spaceport site. Since this analysis assumes that all qualities are equally weighted, the overall wilderness character of Cumberland Island Wilderness may be slightly degraded from the proposed Spaceport Camden construction and operation activities, primarily only for visitors on the western shoreline of the wilderness.

4.9.2 Ocean-Landing Only Alternative

4.9.2.1 Construction

Potential land use impacts associated with this alternative would be very similar to those described for the Proposed Action. Slightly less property on the proposed site would be developed and changed to an industrial use because the Landing Zone Facility and its associated laydown areas and infrastructure would not be required.

Cumberland Island Wilderness

Potential impacts to wilderness qualities from construction activities under this alternative would be the same as those described for the Proposed Action.

4.9.2.2 Operation

Potential land use impacts that could result from Spaceport Camden operations would be the same as those described for the Proposed Action.

Cumberland Island Wilderness

Under this alternative, up to 12 ocean landings would occur per year, potentially reducing the total number of times area closures would occur within Cumberland Island Wilderness. As described in Section 4.9.1.2, *Land Use, Proposed Action, Operation*, restricting access to any portion of wilderness for launches/landings would temporarily degrade the solitude and primitive or unconfined recreation quality of Cumberland Island Wilderness. However, since fewer closures would occur under this alternative compared to the Proposed Action, adverse impacts would be of a lesser extent and, similarly, the overall wilderness character of Cumberland Island Wilderness would not be degraded.

4.9.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden, and no spaceport facilities would be constructed. Since these activities would not take place, the existing property use would not change and the property would remain in its current state. In addition, no impacts to the Cumberland Island Wilderness would occur.

4.10 Natural Resources and Energy Supply

During construction and operation of Spaceport Camden facilities, energy (electricity and fuels) and natural resources (water and construction materials) would be consumed. This section discusses the potential impacts to energy and natural resources that could result from activities under each alternative.

For impact analysis, the estimated amount of natural and energy resources that are expected to be needed for a project were evaluated and compared to the local context of supply and demand to determine if the Proposed Action would cause demand to exceed available or future supplies of these resources.

4.10.1 Proposed Action

4.10.1.1 Construction

Natural Resources

FAA Order 1050.1F states that the use of natural resources other than for fuel need to be examined only if the action involves a need for unusual materials or those in short supply. At this time, no unusual materials would be used for the construction activities at Spaceport Camden. However, due to the size and nature of the roadways (regular and heavy), facilities, and associated support structures, a large amount of asphalt and concrete would be required.

Table 4.10-1 shows the total volume of asphalt and concrete that would be required to complete all construction activities at Spaceport Camden under the Proposed Action. It was estimated that there would be 823,200 square feet of new roadway and 637,800 square feet of new concrete structures, requiring 333,804 cubic feet of asphalt and 1,266,300 cubic feet of concrete, respectively. Due to Spaceport Camden's relatively remote location, supplies of asphalt and concrete would primarily come from the Brunswick, Georgia and Jacksonville, Florida areas (see Chapter 3, *Affected Environment*, Section 3.10.3.3, *Energy Supply*). It is anticipated that these providers would have sufficient supply of asphalt and concrete to meet the requirements of construction activities at Spaceport Camden as well as other construction projects in the area.

Table 4.10-1. Estimated Total Volumes of Asphalt and Concrete Required for Construction – Proposed Action

Structure	Cubic Feet	Cubic Yards
Asphalt		
Perimeter security road	18,750	694
Other pavement sections	26,400	978
Heavy pavement sections	288,654	10,691
Total	333,804	12,363
Concrete		
Launch Pad Complex		
Launcher Track	250,020	9,260
Launch Pad	48,060	1,780
Lightning Towers (four)	63,990	2,370
Flame Track	4,590	170
Helium and Nitrogen Tank Pad	75,060	2,780
Liquid Oxygen Tank Pad	52,650	1,950
Shop Building	15,120	560
Office/Engineering Building	15,120	560
Integration Building	300,240	11,120
Landing Pad Complex		
Landing Pad	400,140	14,820
Storage Areas	39,960	1,480
Shop Building	1,350	50
Total	1,266,300	46,900

Note: To convert from cubic feet to cubic yards, multiply by 0.037. Rounded to nearest whole number.

Energy Supply

New infrastructure or improvements to existing infrastructure would be required to support Spaceport Camden. Proposed changes to infrastructure at the site of Spaceport Camden are discussed in Section 2.1.1.6, *Infrastructure*. With the exception of the existing dock on Floyd Creek (see Section 2.1.1.6, *Infrastructure*), there are no structures that could be converted to support spaceport operations and there is very little infrastructure (i.e., roadways and water, electricity, and communications systems) available on the site. Therefore, the majority of the facilities and most of the infrastructure proposed for Spaceport Camden would be new. Improvements to the site would include improvements to existing and construction of new roadways, installation of new electrical and water distribution and septic systems, pouring of foundations, and building structures. Construction equipment and portable generators (for single phase and three-phase electric power) would be required for these activities and would require gasoline and diesel fuels to operate. Because of the minimal electrical requirements (approximately 500 KVA per day) and the proximity of readily available sources of diesel and gasoline fuels, it is unlikely that the availability of these fuels to other users in the area would be impacted. No other energy sources (i.e., coal or natural gas) would be required for construction activities. Therefore, no significant impact to the energy supply is anticipated as a result of construction activities.

4.10.1.2 Operation**Natural Resources**

The groundwater supply of the Floridan aquifer is the only natural resource that has the potential to be impacted by Spaceport Camden operations. All water used for Spaceport Camden operations would be provided by two deep wells located on the Bayer CropScience property authorized to withdraw a combined 1.7 million gallons of water daily. As discussed in Section 2.1.1.6, *Infrastructure*, 12-inch water lines would be run underground alongside newly-constructed launch site roadways to provide water to the site. Onsite treatment facilities would be used to treat the water from the wells prior to entry into the distribution system and water could be used for both potable and non-potable purposes. Total water usage during site operation is estimated to be approximately 11,500 gallons per day with a peak usage of approximately 405,000 gallons per day. This peak usage would only occur if the water deluge system (which could use up to 250,000 gallons per launch) was activated (see Chapter 2, *Proposed Action and Alternatives*, Section 2.1.1.2, *Vertical Launch Facility*). Both nominal and peak daily water requirements are well below the authorized usage limit of the two onsite wells. Therefore, no impact to the groundwater supply of the Floridan or other regional aquifers is expected as a result of Spaceport Camden operations.

Septic systems would be used at each of the four facilities to manage sanitary sewage. Commercial grade onsite sewage disposal (septic) systems would be utilized to treat the wastewater generated at each facility. Septic systems are sized based on the anticipated daily sewage flow. The anticipated flow for the site would be nearly 60,000 gallons per day (12,500 at the Launch Control Center Complex, 25,000 at the Alternate Control Center and Visitor Center, 2,500 at the Landing Zone, and 19,000 at the Vertical Launch Facility). The Georgia Department of Health and the Camden County Department of Health would regulate and permit and any all septic systems installed at Spaceport Camden, as applicable. Because all sewage would be treated onsite, there would be no impact to local municipal wastewater treatment utilities resulting from Spaceport Camden operations.

Energy Supply

As discussed in Section 3.10.3.3, *Energy Supply*, electricity to the Spaceport Camden would be provided by Georgia Power. Under the Proposed Action, it is estimated that the maximum electrical demand

would be 7,500 kVA/day. The proposed new distribution system would consist of an extension of the aerial distribution system (described in Chapter 3, *Affected Environment*, Section 3.10.3.1, *Natural Resources*) from existing offsite transmission lines onto the site and along the site roadways to areas near the new facilities. The system would then transition to underground primary cables which would extend to multiple pad mounted transformers located near each building and load center. The service to all major buildings would be at 480Y/277 volts, three-phase, four wire which would then be transformed onsite to the appropriate needs of the specific subsections of the facilities. The maximum electrical demand would be within the capacity of the new and existing electrical infrastructure and because the electrical transmission line would only provide electricity to Spaceport Camden facilities, other system users would not be impacted by Spaceport Camden operations.

Other energy sources required for Spaceport Camden operations include various propellant fuels, pressurants, and propellants to be used by the launch vehicles, as well as diesel and gasoline to be used by ground equipment, backup generators, and barge tugs. Natural gas would not be used during Spaceport Camden operations. The propellant fuels used by the launch vehicles and the quantities of each stored onsite are presented in Table 4.10-2. Approximately 35,000 gallons of diesel would be stored onsite at the Vertical Launch Facility, Launch Control Center Complex, and Alternate Control Center and Visitor Center. Propellants, gasoline, and diesel fuel would be obtained from commercial sources and transported to the storage facilities via tanker truck. The use of these propellants and fuels is not expected to exceed the available supply of the surrounding area or in the region. Therefore, no impacts to energy supply are expected.

Table 4.10-2. Propellant, Pressurant, and Fuel Quantities Stored on Site

Launch Vehicle Fuels/Propellants	Quantity Stored on Site
Liquid Oxygen	Up to 350,000 gallons stored in up to six tanks installed at the Vertical Launch Facility.
RP-1	Up to 200,000 gallons stored in up to four tanks at the Vertical Launch Facility.
Helium	10,000 to 15,000 gallons stored in high pressure tube banks at the Vertical Launch Facility plus another 7,500 gallons stored at the Launch Control Center Complex.
Nitrogen	25,000 to 50,000 gallons stored in up to two liquefied nitrogen storage tanks and four gaseous nitrogen storage tanks at the Vertical Launch Facility plus another 22,400 gallons at the Launch Control Center Complex.
Hydrazine	Up to 2,000 gallons stored at the satellite fuel storage area of the Launch Control Center Complex.
Payload Fuel (UMDH, MMH, and NTO)	Up to 5,500 pounds of payload fuel could be stored in above-ground storage tanks in the satellite fuels storage area of the Launch Control Center Complex. Payload fuel would be stored on a single-mission basis as launch operators would not typically store bulk quantities of these propellants in large tanks. These propellants would be stored
Diesel Fuel	35,000 gallons at the Vertical Launch Facility, Launch Control Center Complex, and Alternate Control Center and Visitor Complex in up to seven storage tanks
Gasoline	minimal amounts stored onsite

Notes: MMH = monomethylhydrazine; NTO = nitrogen tetroxide; UMDH = unsymmetrical dimethyl hydrazine.

To convert from gallons to liters, multiply by 3.7854.

EO 13123, *Greening the Government through Efficient Energy Management*, encourages the use of renewable energy within facilities and activities. The EO also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in its facilities. Consistent with NEPA and the CEQ regulations, FAA encourages the development of facilities that exemplify high standards of design including principles of sustainability. To achieve this goal, facility design at Spaceport Camden could include principles outlined in the Leadership in Energy and

Environmental Design (LEED®) building certification as outlined by the U.S. Green Building Council. Such principles include embracing the natural environment, utilizing available alternative energy sources, and reducing overall energy demand.

In addition, facility construction and operation could also include practices and procedures for design and energy consumption as outlined in Georgia State Executive Order 04.24.08.02 and the Georgia State Minimum Standard Energy Code.

4.10.2 Ocean-Landing Only Alternative

4.10.2.1 Construction

Natural Resources

Conditions described for the environmental consequences under this alternative would be the same as described in Section 4.10.1.1, *Construction*, with the exception that, because this alternative does not include the potential for first-stage landings at Spaceport Camden, a Landing Zone Facility would not be constructed. Differences in changes between the Proposed Action and the Ocean-Landing Only Alternative are described in Section 2.2.1.6, *Infrastructure*. Proposed improvements to the roadway network on the site would be the same as those discussed in Section 2.1.1.6, with the exception of a reduction in the total length of heavier road by 11,250 linear feet. The resulting changes in the volumes of asphalt and concrete required for this alternative are identified in Table 4.10-3. Under this alternative, the total estimated amount of asphalt required would reduce to 322,554 cubic feet and the total amount of concrete required would reduce to 824,850 cubic feet.

Table 4.10-3. Estimated Total Volumes of Asphalt and Concrete Required for Construction – Ocean-Landing Only Alternative

Structure	Cubic Feet	Cubic Yards
Asphalt		
Perimeter security road	18,750	694
Other pavement sections	26,400	978
Heavy pavement sections	277,404	10,274
Total	322,554	11,946
Concrete		
Launch Pad Complex		
Launcher Track	250,020	9,260
Launch Pad	48,060	1,780
Lightning Towers (four)	63,990	2,370
Flame Track	4,590	170
Helium and Nitrogen Tank Pad	75,060	2,780
Liquid Oxygen Tank Pad	52,650	1,950
Shop Building	15,120	560
Office/Engineering Building	15,120	560
Integration Building	300,240	11,120
Total	824,850	29,530

Note: To convert from cubic feet to cubic yards, multiply by 0.037. Rounded to nearest whole number.

Because the Ocean-Landing Only Alternative does not include the construction of a Landing Zone Facility, the extension of the water system to such a facility would not be required, thereby reducing the total length of water lines by approximately 1 mile. Annual and peak water system usage would be the same as described in Section 4.10.1.1, *Construction*.

Energy Supply

Conditions described for the environmental consequences under this alternative would be the same as described in Section 4.10.1.1, *Construction*, except the Ocean-Landing Only Alternative would not require the extension of electric power to Landing Zone facilities, thereby reducing the total length of power transmission lines by approximately 1 mile. Although overall power requirements for construction under this alternative would be less than for the Proposed Action due to a reduced number of facilities, the difference is not expected to be substantively different from that described in 4.10.1.1, *Construction*.

4.10.2.2 Operation

Potential impacts to Natural Resources and Energy Supply from the operation of Spaceport Camden under this alternative would be the same as those described in Section 4.10.1.2, *Operation*. Although overall power requirements for operation under this alternative would be less than for the Proposed Action due to a reduced number of facilities, and additional quantities of diesel fuels would be required for barge tugs, the difference is not expected to be substantively different from those described in Section 4.10.1.2, *Operation*.

4.10.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License to the Camden County Board of Commissioners. No activities related to constructing or operating a commercial spaceport would occur at the site. It is assumed that the property, currently under private ownership, would either remain unused or be used for purposes not involving FAA and would be maintained in accordance with its current industrial zoning. Any changes to current energy usage or natural resource consumption at the property and surrounding areas would continue to be affected by ongoing and future activities associated with Union Carbide Corporation, Bayer CropScience, and other entities utilizing natural and energy resources throughout the county.

4.11 Noise and Noise-Compatible Land Use

This section concentrates on potential effects of noise on humans and structures. The ROI for noise and noise-compatible land use includes Spaceport Camden and surrounding areas in which the sounds of the proposed construction and operations would be heard.

Noise analysis is based on the *Launch Vehicle Noise Study for Spaceport Camden's Environmental Impact Statement* (BRRC, 2017), as provided in Appendix C, *Noise*.

Noise impacts on the respective resources are discussed in Section 4.2, *Biological Resources*, Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources* (e.g., historic structures), Section 4.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*, Section 4.14, *Water Resources*, and Section 4.6, *Farmlands*. Noise levels that could be generated by a catastrophic rocket failure are not discussed in detail as such events are unlikely to occur. The hazard area, which is evacuated of non-authorized persons prior to launch is designed to minimize risk to people. Any structural damage claims following a catastrophic failure would be assessed and handled appropriately.

Noise impacts are analyzed to determine increases in dBA DNL within the ROI associated with proposed spaceport construction and operation, the potential for people exposed to elevated noise levels during launch, landing, and static fire events to become annoyed by the noise, and whether there would be a

risk of damage to structures due to noise. The potential reactions of visitors to designated wilderness area on Cumberland Island National Seashore are of particular interest. Social surveys conducted on the reactions of backcountry visitors to other National Parks to aircraft overflight noise are not directly applicable to the sounds generated by the Proposed Action (e.g., rocket launch or distant construction noise).

4.11.1 Proposed Action

The construction of Spaceport Camden would generate localized noise, and the operation of the spaceport would generate noise over a larger area. Proposed construction would take place over approximately 15 months as described in Section 2.1.1, *Construction – Activities and Facility Descriptions*. Proposed operations would include up to 12 MCLV launches, 12 landings, and 12 static fire events per year as well as activities related to preparations for a launch (e.g., patrols of the evacuation area using vehicles).

4.11.1.1 Construction

Construction noise would occur at the facility and infrastructure locations described in Section 2.1.1.1, *Launch Site Construction Activities*, through Section 2.1.1.6, *Infrastructure*. Construction would typically occur during normal working hours (8:00 a.m. to 5:00 p.m.) on Monday through Friday. Noise levels at various distances from construction equipment types expected to be used for the construction of roads and facilities are listed in Table 4.11-1.

Table 4.11-1. Noise Levels Associated with Construction Equipment

Equipment Type	Maximum A-weighted Noise Level ($L_{A,max}$) at 50 feet	Maximum A-weighted Noise Level ($L_{A,max}$) at 2.5 miles	Maximum A-weighted Noise Level ($L_{A,max}$) at 3.5 miles	Use During Roadway Construction	Use During Facilities Construction
Excavator	81	32	29	Y	Y
Grader	85	37	34	Y	Y
Paver	77	29	26	Y	Y
Roller	80	32	29	Y	Y
Crane	81	32	29	N	Y
Concrete pump truck	81	33	30	N	Y
Man Lift	75	26	23	N	Y
Pile driver	101	53	50	N	Y
Welding	74	26	23	N	Y
Support Vehicles (Pickup truck)	75	27	24	Y	Y
Support Equipment (generator)	81	32	29	Y	Y

Source: (FHWA, 2006)

The FHWA's Roadway Construction Noise Model was used to estimate noise levels under a scenario in which one of each type of equipment expected to be used for roadway construction and facilities construction operates in one location during one workday. Noise levels would not exceed 65 dBA DNL at distances of greater than 500 feet from roadway construction or at distances of greater than 1,500 feet from facilities construction (FHWA, 2006). The closest residence to the proposed construction is about 2.5 miles due west of the closest proposed construction site, and structures associated with a resort facility are located about the same distance due south of the closest

1 construction. Upland portions of Cumberland Island Seashore are located about 3.5 miles east of the
2 closest proposed construction. At distances of 2.5 and 3.5 miles from the construction site, maximum
3 noise levels generated by all equipment types except the pile driver would be below the median
4 background sound level (approximately 40 dBA). The maximum noise level while pile driving is
5 underway would be approximately 53 dBA at a distance of 2.5 miles and 50 dBA at a distance of
6 3.5 miles. Pile driving noise would be audible as a distant thumping sound under typical environmental
7 conditions. It is anticipated that pile supported facilities would include the launch pad and landing pad
8 and that pile driving activities would occur over a period of a month for each location.

9 Audible construction noise is inconsistent with an expectation of natural quiet in Cumberland Island's
10 designated wilderness area and could disrupt visitors' appreciation of the island's typically quiet and
11 peaceful environment. Because construction activities would typically occur during the normal working
12 day, noise impacts would occur to daytime activities (e.g., hiking), but would not disturb nighttime
13 activities (e.g., star gazing, sleeping). Any construction during dark hours would likely be in the early
14 evening during winter months when the days are shorter. During a single work-day in which all of the
15 equipment types listed in Table 4.11-1 are used, construction noise levels experienced at a distance of
16 2.5 miles would be about 46 dBA DNL while construction noise levels at 3.5 miles would be about
17 43 dBA DNL, well below established land use compatibility thresholds. However, while background
18 noise also consists of boat traffic, aircraft overflights, and other activities that would detract from the
19 intended wilderness experience, it is recognized that, for people visiting during the two-month period in
20 which pile driving is underway, any audible construction noise could be disruptive of the intended
21 wilderness experience.

22 Traffic noise from a heavy-duty diesel truck traveling 50 miles per hour is approximately 85 dBA at
23 50 feet (California Department of Transportation, 1998). Roadways in the area are currently used by
24 heavy trucks as part of logging operations and other ongoing activities. Small increases in noise levels
25 along truck routes would be expected as a result of the operation of delivery trucks supporting
26 Spaceport Camden operations.

27 Construction noise would be temporary, lasting only the duration of the construction project, and would
28 be limited to normal working hours. The proposed construction activities would not be expected to
29 result in significant community noise impacts.

30 Occupational noise exposure prevention procedures, such as hearing protection, would be required at
31 the construction sites to comply with all applicable OSHA occupational noise exposure regulations.
32 Therefore, significant impacts to workers at the construction sites from proposed construction related
33 activities are not anticipated.

34 In summary, construction noise would be audible during certain phases of construction (e.g., pile
35 driving) at the closest noise-sensitive locations. Although the distant thumping of pile driving heard at
36 Cumberland Island National Seashore (approximately 50 dB $L_{A,max}$ at a distance of 3.5 miles) could
37 interfere with visitor's expected backcountry wilderness experiences, pile driving would last only about
38 two months and would be limited to normal working hours. The proposed construction activities would
39 not be expected to result in significant community noise impacts.

40 **4.11.1.2 Operation**

41 Small increases in noise levels along Harrietts Bluff/Union Carbide Road and other access roads would
42 be expected as a result of the operation of delivery trucks and other personnel vehicles. During times
43 when final preparations for a launch are not under way, approximately 75 persons per day could
44 commute to and from Spaceport Camden. During two weeks of surge operations immediately prior to

1 and following a launch, up to 450 persons per day could move to and from Spaceport Camden. Ground
2 transportation during a launch campaign would include up to 14 heavy trucks making deliveries to the
3 Spaceport Camden. Increased ground vehicle traffic noise levels would typically be greatest during
4 commuting hours. Traffic on Harrietts Bluff Road has historically been dominated by local residential
5 traffic and employee, delivery, and pick up from the Bayer CropScience/Union Carbide Corporation
6 property. In its heyday, there were over 400 employees onsite, and toward the end of operations
7 (2012), over 80. It is envisioned that similar or less traffic than the industrial days may be present in the
8 area for between-launch and pre-launch periods. It is possible that visitors to Spaceport Camden could
9 choose to travel by helicopter. No specific plans have been made to accommodate helicopter transport,
10 and it would not be expected to be common. Operations at Spaceport Camden would occur primarily
11 during normal working hours (8:00 a.m. to 5:00 p.m., Monday through Friday), but hours of operation
12 would increase during launch campaigns. Noise sources during operations would include non-road
13 equipment (e.g., forklifts), heavy machinery (e.g., pumps), and vehicles moving around within Spaceport
14 Camden. Much of the activity, including payload checkout, spacecraft propellant loading, and payload
15 encapsulation would take place indoors resulting in minimal noise levels experienced in nearby areas.
16 Operations tempo and associated localized noise would increase during launch campaigns and decrease
17 again following launch completion.

18 As was the case during Bayer CropScience/Union Carbide Corporation/Thiokol operations on the site,
19 during launch campaigns, loudspeakers located at Spaceport Camden facilities would be used to make
20 announcements to personnel on Spaceport Camden in the event of an emergency or as part of clearing
21 the launch site prior to a launch. Loudspeaker systems, which would not normally be used outside of
22 launch campaigns, would be designed and positioned to allow clear communication with personnel on
23 Spaceport Camden, and would be directed towards the interior of Spaceport Camden. This analysis
24 assumes a speaker configuration typical for this application with a maximum power rating of 25 Watts, a
25 sensitivity of 110 dB at 1 Watt and a distance of 3 feet, and grouped in clusters of two. At the closest
26 residence to Spaceport Camden, which is located about 2.5 miles from the proposed Spaceport Camden
27 control center, loudspeakers would not be expected to exceed 55 dB $L_{A,max}$. At the closest upland
28 portion of Cumberland Island National Seashore, located about 3.4 miles from the launch pad,
29 loudspeakers would not be expected to exceed 52 dB $L_{A,max}$. At no location either on or off of Spaceport
30 Camden property would loudspeaker use pose a risk to hearing. Loudspeakers would be audible at
31 locations outside of Spaceport Camden, but not at levels that would disrupt conversation. The duration
32 and sound level of announcements would not generate enough noise to add measurably to cumulative
33 DNL at and near Spaceport Camden which includes rocket launch, landing, and static fire test event
34 noise. Loudspeaker use as part of up to 12 launch campaigns per year would not be expected to result
35 in significant community noise impacts.

36 Table 4.11-2 lists maximum A-weighted noise levels generated by vehicles that would be used during
37 clearing and patrolling the evacuation area. In order to accomplish the required survey activities,
38 manned and unmanned (i.e., drone) aircraft may operate within the 2,000-foot vertical avoidance area
39 that has been established above Cumberland Island National Seashore per FAA Advisory Circular 91-36,
40 *Visual Flight Rules Flight Near Noise-Sensitive Areas*. Because evacuation of visitors and residents would
41 generally occur before operations of these aircraft begin, human noise impacts would be limited.
42 Impacts on biological resources are discussed in Section 4.2, *Biological Resources*.

43 It is possible that helicopters could be used to move people or items to and from Spaceport Camden. If
44 this were to occur, it would occur on an occasional basis, and no single flight path or landing location
45 would be designated. Helicopters used would likely be smaller than the military helicopters that
46 sometimes operate in the area in support of the mission at nearby Naval Submarine Base Kings

Bay. Direct overflight by a Bell 222 helicopter at 500 feet above ground level generates an $L_{A,max}$ of around 77 dBA. Noise levels associated with this representative civilian helicopter flyover event were calculated using the Air Force's Flyover Noise Calculator under standard acoustic atmospheric conditions (59°F and 70 percent relative humidity). If helicopter operations were to occur at Spaceport Camden, any overflights of populated areas would result in noise events that would be brief and infrequent. Helicopter noise would not be frequent or intense enough to have any quantifiable effect on overall DNL at and near Spaceport Camden.

Table 4.11-2. $L_{A,max}$ Associated with Vehicles Used in Clearing and Patrolling the Evacuation Area

Vehicle Description	$L_{A,max}$ (dB) at Distance of 200 feet
Motorboat ¹	74
Fixed-wing propeller-driven aircraft ²	70
Small Unmanned Aerial Vehicle ³	34
Ground vehicle (e.g., pickup truck) ⁴	63

Notes: dB = decibels; dBA = A-weighted decibels; $L_{A,max}$ = maximum A-weighted OASPL during the noise event.

¹ The Coast Guard recommends motorboat noise levels not exceed 86 dBA when at full throttle and measured at a distance of 50 feet. Although Georgia has not adopted this maximum by law, most commonly-used motorboats are compliant. Assuming 6 dB loss per doubling of distance, noise levels would be expected to be less than 74 dB at a distance of 200 feet (COPPerformance, 2005).

² Cessna 152 used as representative, noise level from Flyover Noise Calculator under standard acoustic conditions (59°F and 70% relative humidity) for aircraft at 40% power

³ For small Unmanned Aerial Vehicles, the propeller is the dominant noise source. Measured noise levels at typical high-power revolutions per minute are roughly 70 dBA at a distance of 3 feet (Leslie, Wong, & Auld, 2008), and assuming 6 dB loss per doubling of distance, would be approximately 40 dB at 200 feet.

⁴ Pickup truck measured noise levels at distance of 50 feet from Roadway Construction Noise Model equipment noise level database (FHWA, 2006). Noise level at 200 feet estimated assuming 6 dB loss per doubling of distance.

Under the Proposed Action, up to 12 MCLV launch operations, 1st stage landing operations, and static fire events would be conducted per year. In the early part of launch trajectory, the ascent from the launch pad would be approximately vertical. As the vehicle ascends further, its horizontal motion would slowly increase with the vehicle traveling on a heading between 83° (slightly north of due east) and 115° (approximately east southeast). The 1st Stage landing trajectory would approximate the same path followed during the launch touching down on the landing pad. On re-entering the atmosphere, the vehicle would light its engines briefly. This engine burn would occur at a very high altitude, and would not be audible on the ground. A second engine burn would occur as the vehicle comes closer to the surface, and noise generated by this second burn would be audible on the ground. Static engine tests would be conducted with the vehicle stationary on the launch pad. Most launches and landings would be conducted during the day. However, up to one launch and one landing per year could be conducted during the late-night time period between 10:00 p.m. and 7:00 a.m. All static fire events would take place during daylight hours.

Noise generated during subsonic portions of rocket operations were calculated using the FAA-approved RUMBLE noise modeling method (FAA, 2016a). Modeling was conducted using a single set of nominal atmospheric conditions, and noise levels experienced could vary slightly based on variable atmospheric conditions. Portions of the launch and landing trajectories would be accomplished at speeds greater than the speed of sound. Sonic booms generated during supersonic segments of the trajectories were modeled using the program PCBOOM. Methods used to model vehicle noise levels are discussed further in Appendix C, *Noise*.

As discussed in Section 3.11.2, *Regulatory Setting*, DNL is the primary noise metric used to assess community noise impacts. DNL was calculated based on the noise energy generated launch and landing on each of three representative trajectories between 83 degrees and 115 degrees (see Appendix C,

Noise). The cumulative total noise energy generated by proposed launch, landing, and static fire events would result in noise levels greater than 65 dBA within 0.8 mile of the launch pad and within 0.4 mile of the landing pad. These areas include 236 acres of waterways that are within Spaceport Camden but not owned as part of Spaceport Camden (Exhibit 4.11-1). Noise level greater than 65 dBA DNL do not affect land areas outside Spaceport Camden. All land use categories are nominally compatible at noise levels below 65 dB DNL per guidelines found in 14 CFR Part 150: Appendix A. However, because the area surrounding Spaceport Camden includes places where the quiet setting is a recognized attribute and part of the purpose of the area, this EIS includes consideration of noise metrics supplemental to DNL.

During launch, landing, and static fire events, noise levels near the launch and landing pads would temporarily exceed levels that are safe for human hearing. These areas are closed to all personnel during the launch and landing operation. As noted in Section 3.11.1, *Definition and Description*, maximum A-weighted OASPL ($L_{A,max}$) noise levels greater than 115 dBA exceed OSHA guidelines for hearing conservation for a short time at least (see Section 3.11.2, *Regulatory Setting*). To assess the potential hearing conservation risk, $L_{A,max}$ associated with launch, landing, and static fire events were calculated. The area affected by elevated noise levels during launches and landings varies based on vehicle trajectory. Exhibit 4.11-2 shows a composite of maximum noise levels (i.e., the largest spatial extent affected) during launches on the 83-degree, 100-degree or 115-degree representative trajectories. Noise levels generated by launches and landings on each specific trajectory are slightly lower in certain areas than the composite which reflects the maximum noise level under any of the trajectories (see Appendix C, *Noise*).

As shown in Exhibit 4.11-2, launch $L_{A,max}$ would exceed 115 dBA within a radius of 0.7 mile from the launch pad. Landings on any of the three representative trajectories would generate $L_{A,max}$ exceeding 115 dBA within 0.4 mile of the landing pad (Exhibit 4.11-3). These areas are closed to all personnel during the launch and landing operation.

Static fire engine tests involve the rocket remaining on the launch pad with the rocket plume being directed through the flame trench throughout the duration of the event. The distinctive shape of the $L_{A,max}$ noise contours shown in Exhibit 4.11-4 is a result of the rocket plume being re-directed by the trench. Because the orientation of the rocket would be the same for all static fire events, a single set of $L_{A,max}$ contours describes all events. Static engine test noise is highly directional, with maximum levels in lobes that are at about 45 degrees from the main direction of the deflected exhaust.

During a static fire engine test, noise levels can reach 115 dBA $L_{A,max}$ at up to 0.4 mile from the launch pad in directions that receive the highest noise levels. These areas are closed to all personnel during the launch and landing operation. Static fire engine test noise would also differ from launch and landing noise in that the noise level would remain constant throughout the 2 to 7 second duration of the event.

Launch and landing noise levels vary over the course of the event as the vehicle moves along its trajectory. The area outside of Spaceport Camden exposed to levels greater than 115 dBA $L_{A,max}$ would be limited to waterways within Spaceport Camden but not owned as part of Spaceport Camden and 23 acres located southwest of the landing pad. The 23 acres are currently used for forestry and are uninhabited.

Maximum unweighted OASPL (L_{max}) noise levels of 111 dB have been associated with 1 structural damage claim submitted for each 1,000 households affected, and 120 dB L_{max} has been associated with one damage claim out of every 100 households affected (see Section 3.11.2, *Regulatory Setting*). For launch events on any of the three representative trajectories, L_{max} in excess of 120 dB would be limited to a radius of 2.9 miles of the launch pad and L_{max} in excess of 111 dB would be occur within a radius of

7.7 miles (Exhibit 4.11-5). Landing events on any of the three representative trajectories would result in $L_{\max}$ exceeding 120 dB within 0.7 mile of the landing pad and 111 dB within 2 miles of the landing pad (Exhibit 4.11-6). During a static fire engine test, noise levels can reach 120 dB $L_{\max}$ at up to 1.8 miles from the launch pad and can reach 111 dB $L_{\max}$ at 4.5 miles from the landing pad in directions that receive the highest noise levels (Exhibit 4.11-7). Structures that contain fluids, such as septic tanks and pipelines, are typically designed to be resilient to induced vibrations at intensities that would be experienced outside of Spaceport Camden boundaries as a result of Spaceport Camden operations. Natural structures, such as sand dunes and creek banks, could experience vibrations similar to those that occur as a result of natural events such as thunder or the passage of land animals. Noise would not be expected to noticeably accelerate erosion of creek banks or dunes.

No known inhabited structures are located in areas that would be exposed to noise levels exceeding 120 dB $L_{\max}$ during launches, landings, or static engine test fires. Potential effects of noise on ruins and other uninhabited structures of cultural or historical significance are discussed in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*. Areas exposed to noise levels exceeding 111 dB $L_{\max}$ would include residential areas along Harrietts Bluff Road/Union Carbide Road, scattered residences in other unincorporated portions of Camden County, and the southern tip of Jekyll Island in Brunswick County. Naval Submarine Base Kings Bay would be affected by noise levels below 111 dB $L_{\max}$. Structures built on Spaceport Camden would be constructed to withstand noise energy and noise-induced vibrations associated with nearby rocket operations.

Exhibit 4.11-8 shows A-weighted OASPL time histories at the closest residence and at the Settlement during a launch event. Although the launch event begins at time zero (i.e., at the far-left of the graph), it takes approximately 20 seconds for launch noise to propagate from the launch pad the points of interest. The time at which the maximum noise level occurs depends on the thrust profile of the rocket during ascent, the directions relative to the rocket in which the most noise propagates, weather and wind conditions at the time of the launch, and the location of the points of interest relative to the flight path. It is worth noting that the $L_{A,\max}$ at the closest residence (4.1 miles west of launch pad) would be higher than the $L_{A,\max}$ experienced at the Settlement (4.6 miles east of launch pad), but that the noise level would decrease more rapidly following the noise maximum at the closest residence than at the Settlement. This difference is a result of the rocket beginning to track towards the southeast (i.e., in the general direction of the Settlement and away from the closest residence) after the initial vertical ascent. The time-history for locations farther away from the launch pad would be similar to those presented, although the noise levels would be lower throughout launch events at more-distant locations.

At the closest residence and the Settlement, launch noise levels would exceed 66 dBA, the level above which speech intelligibility between two people standing 3 feet apart drops below 95 percent. At the closest residence, the sound would remain above 66 dBA for slightly more than 1 minute, and the noise level at the Settlement would remain above 66 dBA for slightly more than 2 minutes. Noise levels at both representative locations would remain well below 115 dBA, the conservative threshold above which hearing protection might be considered in accordance with OSHA. Launch noise levels at the closest residence and the Settlement would decrease to below median ambient noise levels - approximately 40 dB - after 4 minutes and 4.5 minutes, respectively. The precise amount of time during which the rocket would remain audible (i.e., distinguishable from background) would depend on background sound levels, which vary between times and places, as well as minor variations between events based on variable atmospheric conditions.

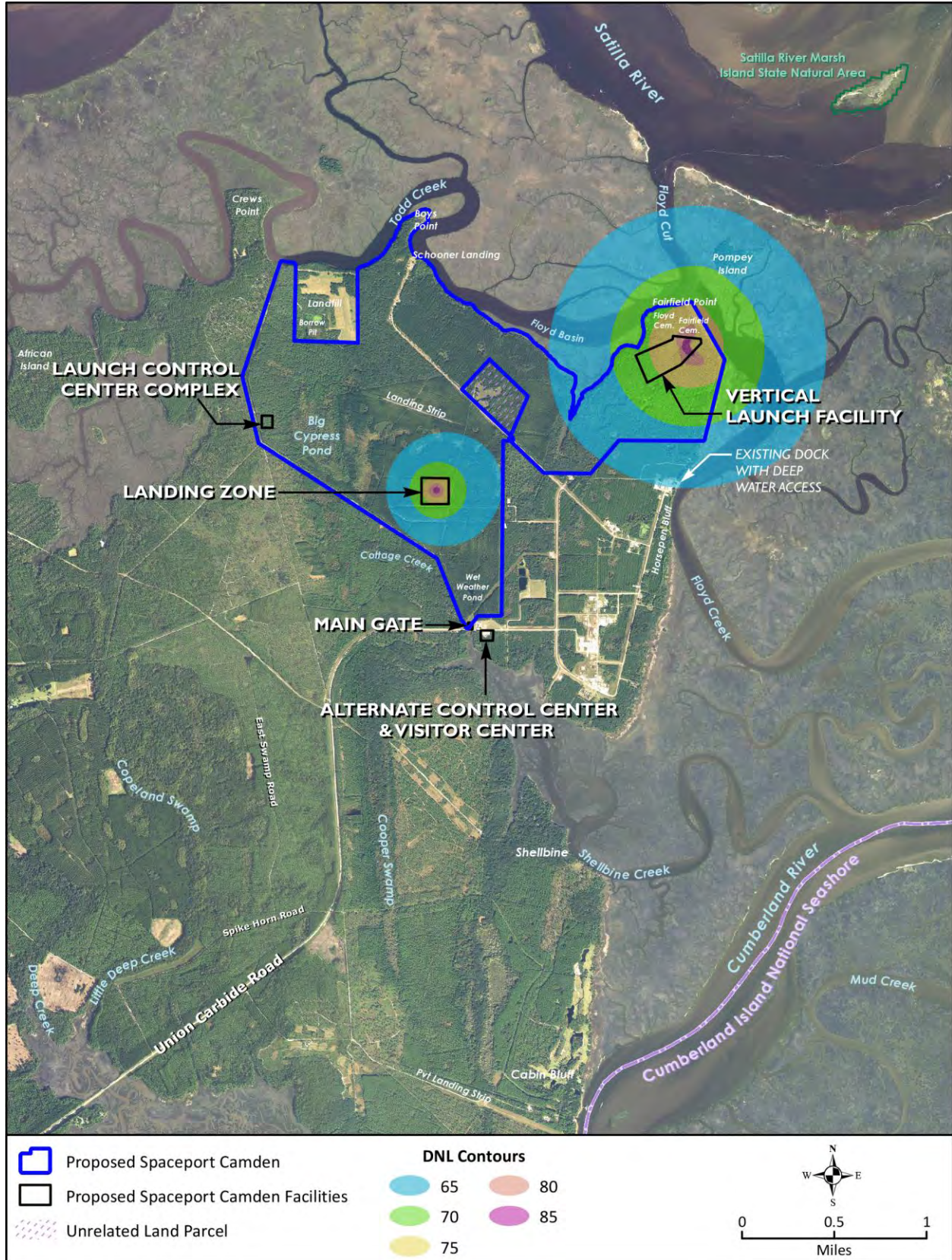


Exhibit 4.11-1. DNL Contours for MCLV Operations at Proposed Spaceport Camden

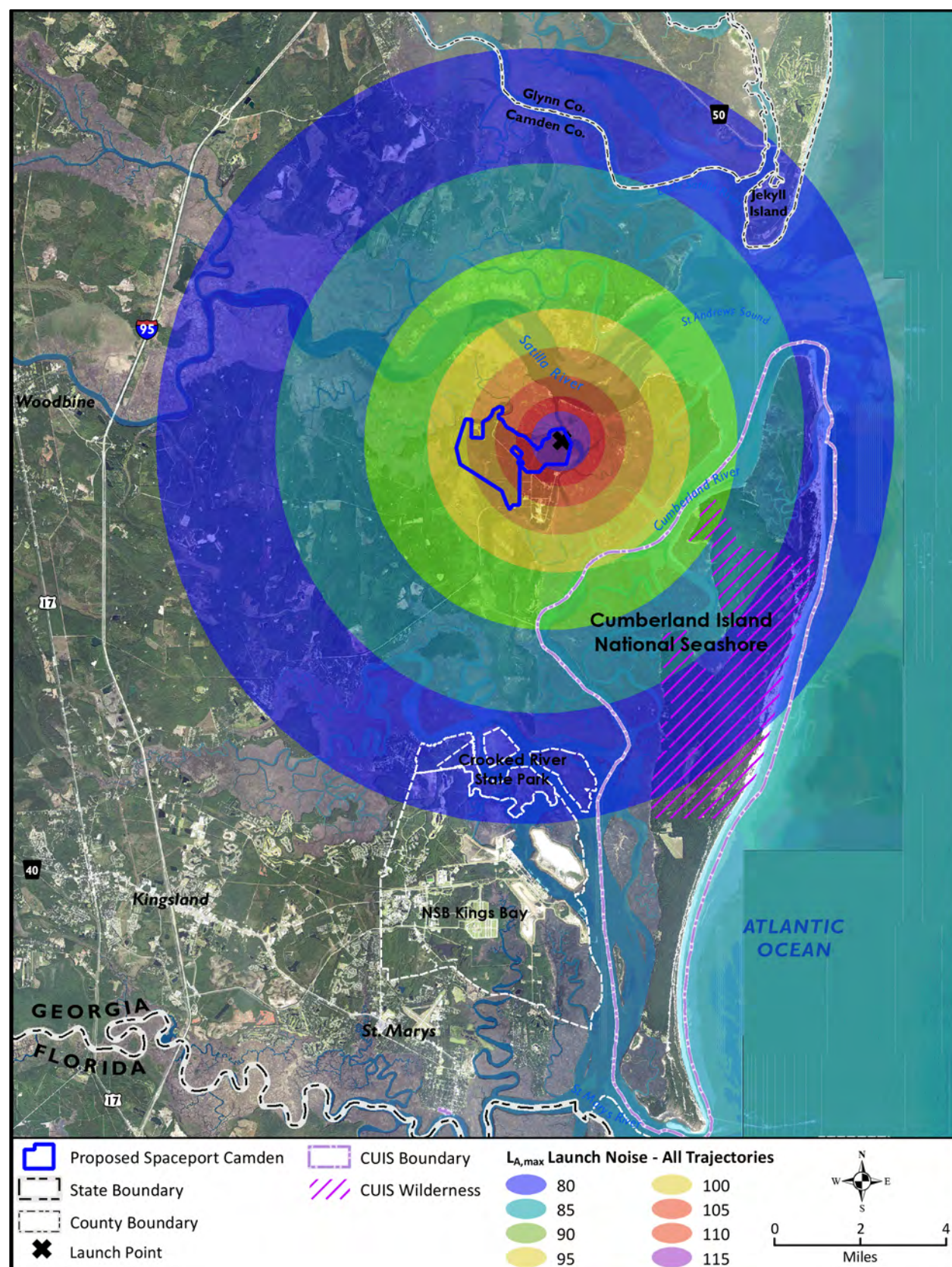


Exhibit 4.11-2. Composite of $L_{A,max}$ Contours for a MCLV Launch at Proposed Spaceport Camden

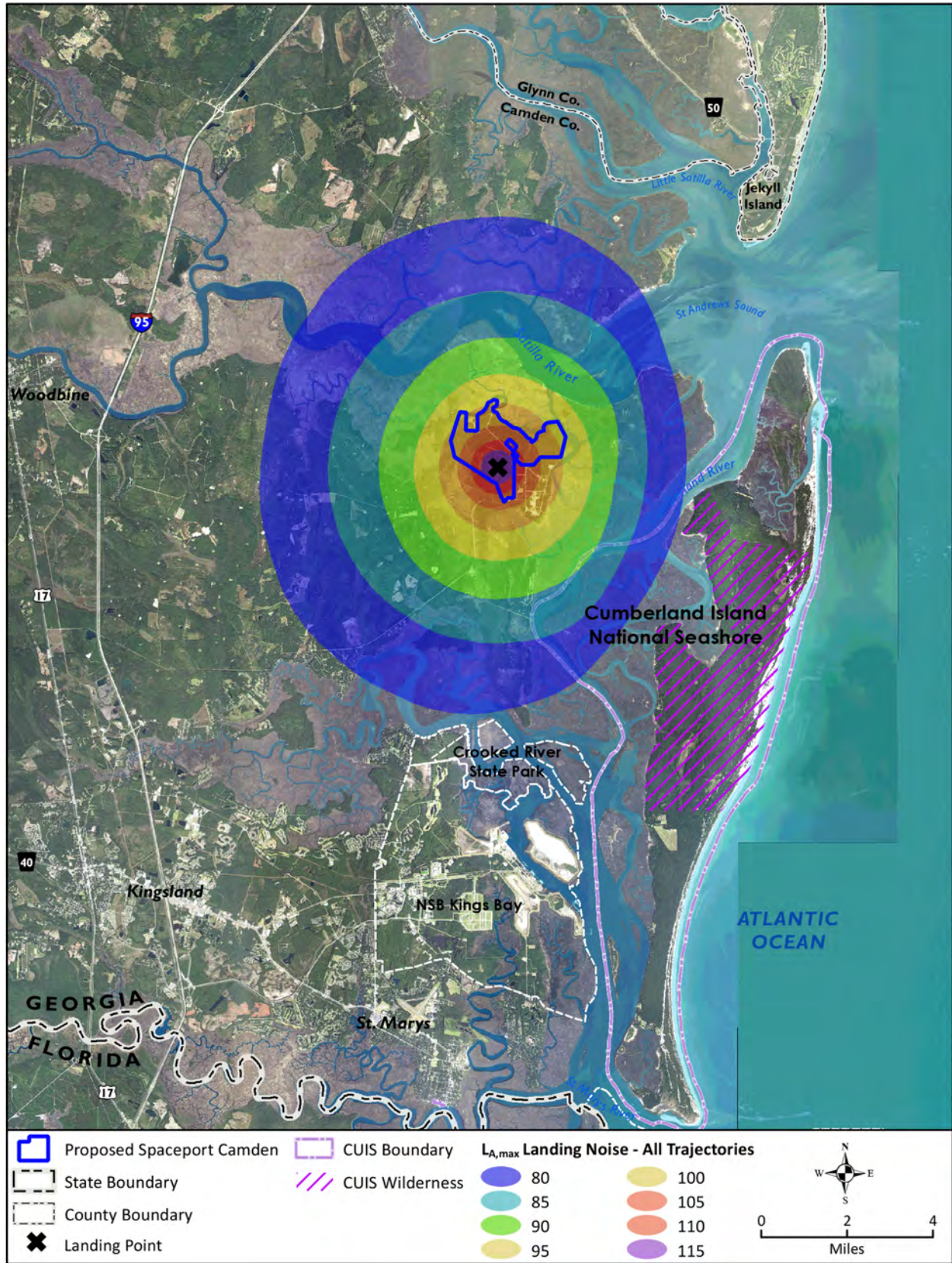


Exhibit 4.11-3. Composite of $L_{A,max}$ Contours for a MCLV Landing at Proposed Spaceport Camden

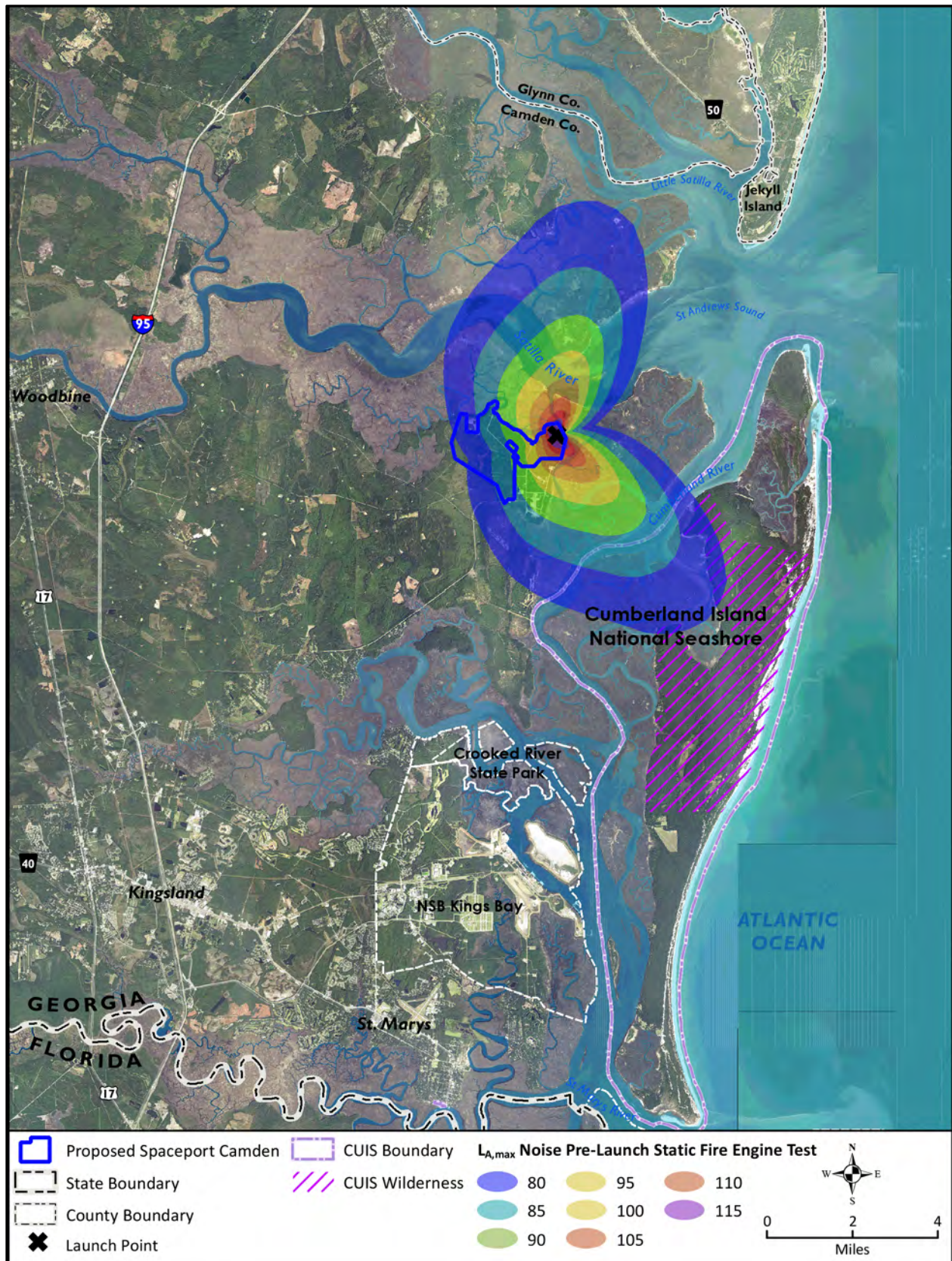


Exhibit 4.11-4. L_{A,max} Contours for a MCLV Static Fire Engine Test at Proposed Spaceport Camden

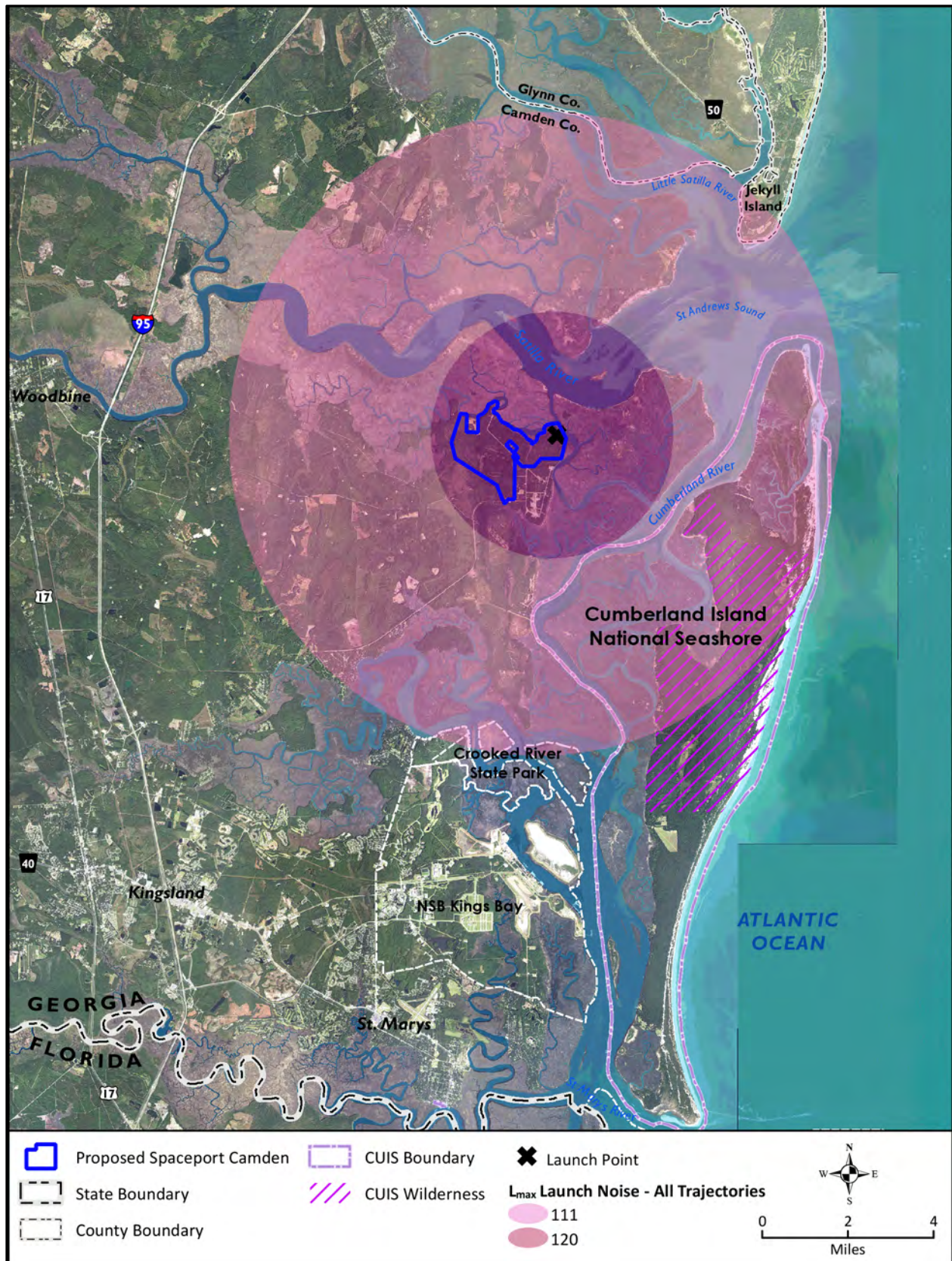


Exhibit 4.11-5. Composite of L_{max} Contours for a MCLV Launch at Proposed Spaceport Camden

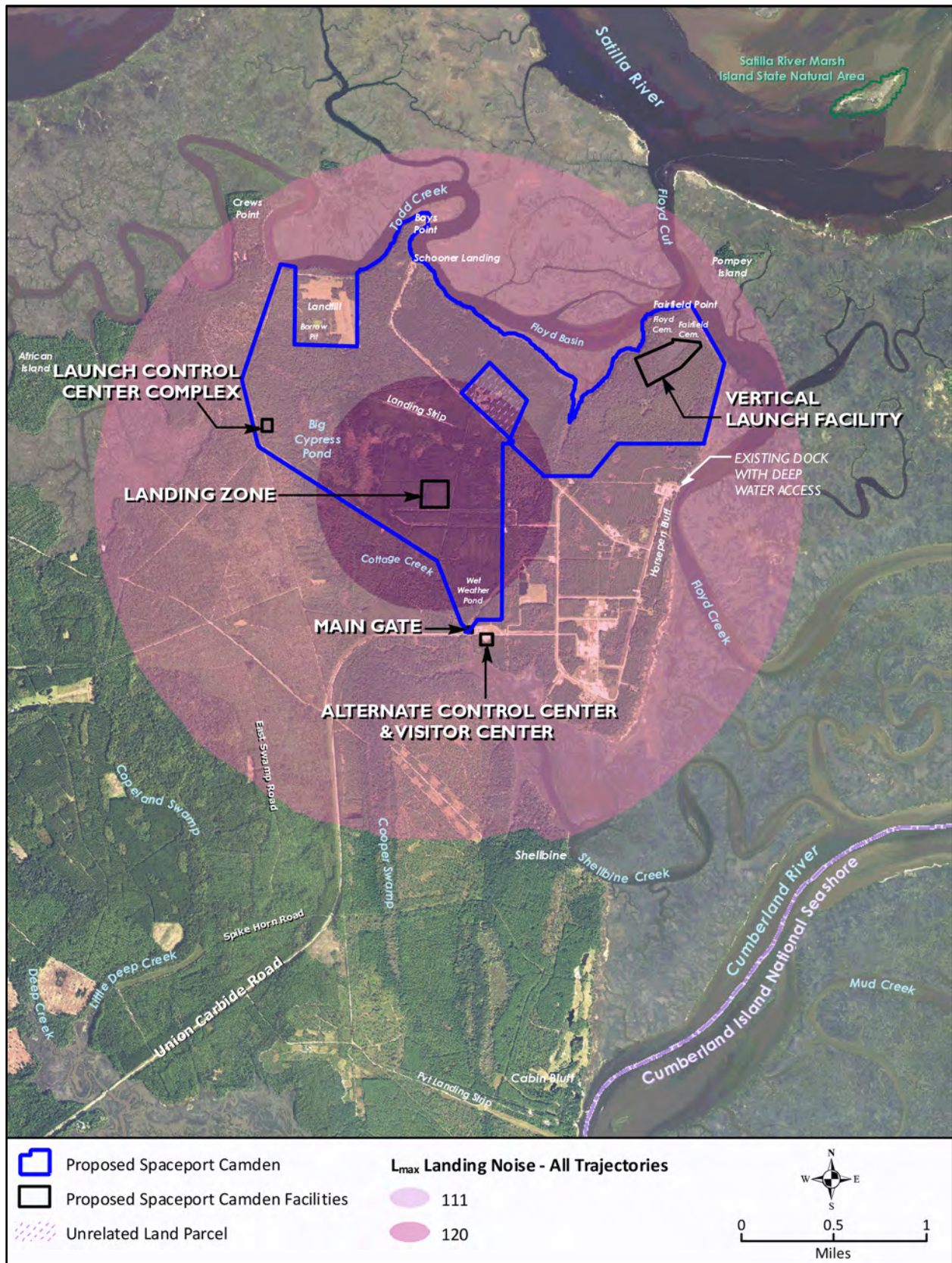


Exhibit 4.11-6. Composite of L_{max} Contours for a MCLV Landing at Proposed Spaceport Camden

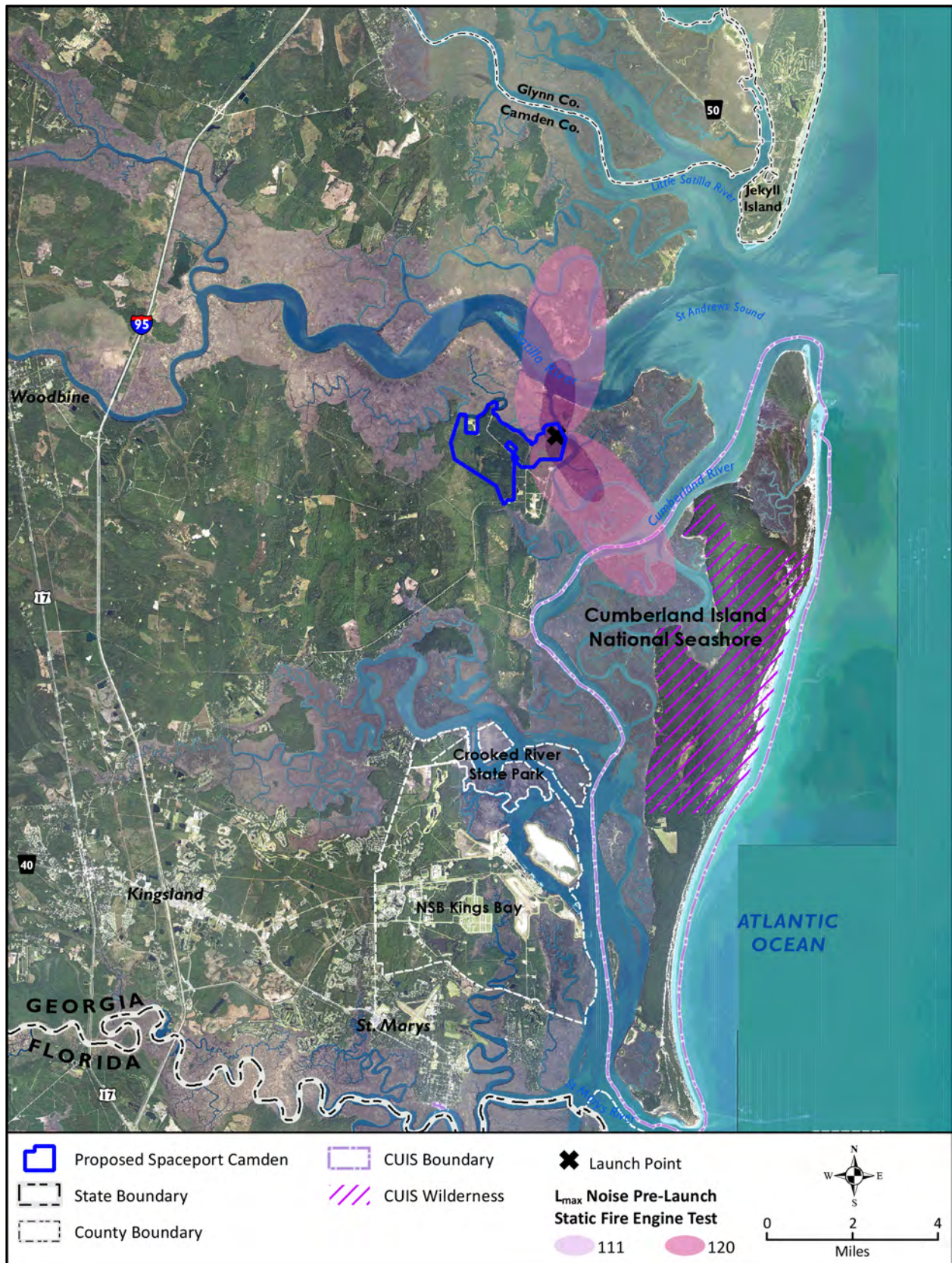


Exhibit 4.11-7. L_{max} Contours for a MCLV Static Fire Engine Test at Proposed Spaceport Camden

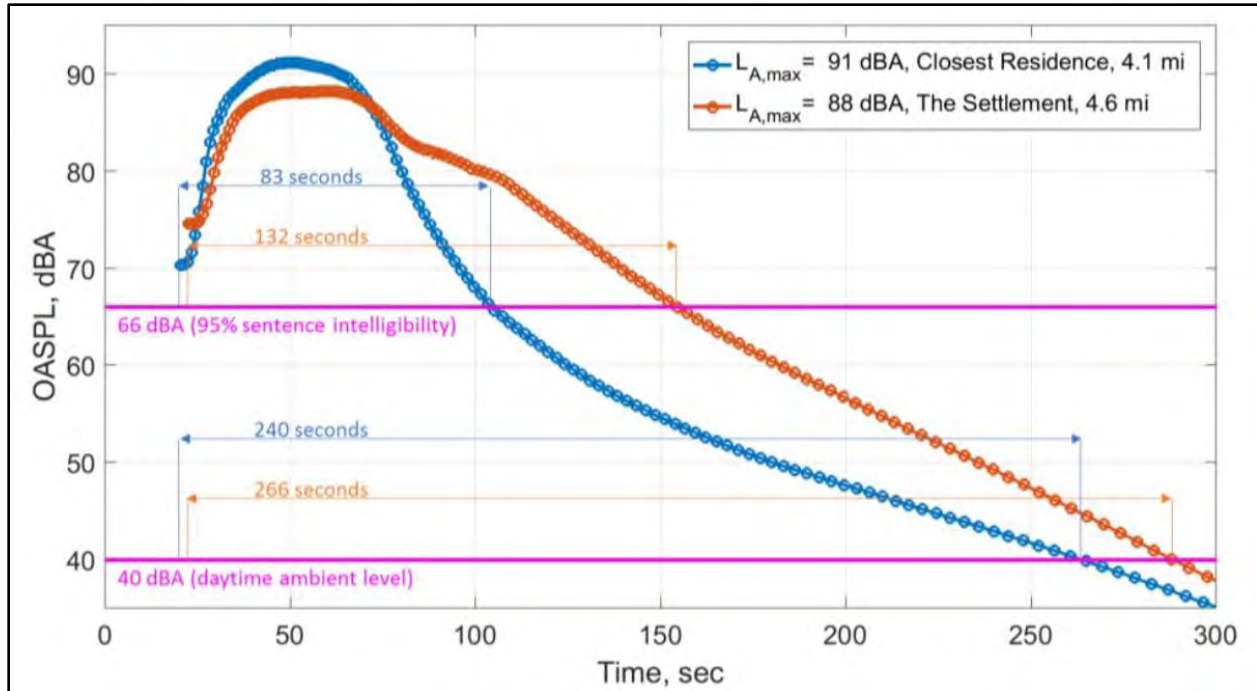


Exhibit 4.11-8. A-Weighted OASPL Time Histories at Representative Points of Interest

Table 4.11-3 lists numerically noise levels and noise durations at the closest residence and the Settlement during launch, landing, and static test events. The table presents the highest decibel level or time duration associated with any of the three representative launch trajectories.

Table 4.11-3. Specific Point Noise Analysis Results

Noise Metric	Closest Residence			The Settlement on Cumberland Island		
	Launch	Landing	Static Test	Launch	Landing	Static Test
$L_{A,max}$ (dBA)	91	91	70	88	74	75
Time above 66 dBA (seconds)	83	23	7	132	28	7
Time above 40 dBA (seconds)	240	23	7	266	30	7
SEL (dBA)	106	102	79	105	86	83
L_{max} (dB)	117	108	93	115	93	102

Notes: dB = decibels; dBA = A-weighted decibels; L_{max} = maximum decibel level; SEL = sound exposure level.

See Appendix C, *Noise*, for additional details regarding calculation methods and modeling inputs.

Noise levels would remain well below levels at which hearing loss would be of concern during all operations. At the closest residence, noise levels would exceed 66 dBA, the level at which speech interference becomes likely, for 83 seconds during launches, 23 seconds during landings, and for 7 seconds during static tests. In a year in which the maximum 12 launches, 12 landings, and 12 static tests are conducted from Spaceport Camden, noise levels would be high enough to disrupt conversation for a cumulative total of 23 minutes over the course of the year. Rocket noise generated during launches, landings, and static fire events would exceed ambient noise levels (40 dBA) for a cumulative total of 54 minutes over the course of the year. At the Settlement, noise levels during launch, landing, and static fire events would exceed 66 dBA for 132, 28, and 7 seconds, respectively, resulting in a cumulative total of 33 minutes above 66 dBA over the course of the year. Rocket operations noise levels would exceed

1 ambient noise levels for a cumulative total of 61 minutes over the course of a year including the
2 maximum number of launches, landings, and static fire events.

3 Because only up to one launch and one landing event per year would occur during the late-night time
4 period between 10:00 p.m. and 7:00 a.m. when most people are asleep, potential impacts on sleep
5 would be limited to two late-night events per year (one launch and one landing) at most. Static engine
6 fire events would only occur during the day time and would not be expected to affect sleep. Although
7 the likelihood of sleep disturbance is strongly influenced by several factors specific to the sleeper (e.g.,
8 depth of sleep and familiarity with the noise source), behavioral studies have shown a relationship
9 between the average probability of awakening and the A-weighted SEL of the potentially-disturbing
10 noise (ANSI, 2008). Typical residences provides at least 17 dB outdoor to indoor sound level attenuation
11 if windows are open. At the closest residence, if windows were open, a late-night launch event could be
12 expected to result in 13 percent probability of being temporarily awakened, and a late-night landing
13 could be expected to result in 11 percent probability of awakening. At the Settlement, in a structure
14 with windows open, a late-night launch would result in a 12 percent chance of sleep disturbance, and a
15 late-night landing would result in a 6 percent chance of sleep disturbance. People sleeping outdoors or
16 in tents are not benefitted by structural noise level reduction. People sleeping outdoors at the closest
17 residence (or location at equivalent distance from the launch and landing pads) during a late-night
18 launch would have a 20 percent chance of awakening while a late-night landing would result in 18
19 percent probability of awakening. At the Settlement (or places at equivalent distance to the launch and
20 landing pads) a late-night launch could result in a 20 percent probability of outdoor sleepers being
21 temporarily awakened, and a late-night landing could result in a 12 percent probability of temporary
22 sleep disturbance among outdoor sleepers.

23 During launches, maximum un-weighted noise levels at the closest residence and the Settlement would
24 be greater than 111 dB L_{max} but less than 120 dB L_{max} , a noise level associated with between one damage
25 claim per 1,000 households and one damage claim in 100 households. Landings and static fire events
26 would generate noise levels associated with less than one damage claim in 1,000 households.

27 Whether a sonic boom is heard on the ground and the intensity of the boom are highly dependent on
28 the specific trajectory and atmospheric conditions at the time of flight. Sonic boom overpressure
29 contours were calculated using the program PCBOOM using the three representative MCLV launch and
30 landing trajectories. The contours reflect a nominal atmospheric temperature, relative humidity, and
31 pressure profile for altitudes developed based on data from several sources (see Appendix C, *Noise*, for
32 details). Exhibit 4.11-9 and Exhibit 4.11-10 show peak overpressure contours associated with launches
33 and landings on each of the representative trajectories (i.e., 83, 100, and 115 degrees). Because actual
34 launch and landing trajectories would be at a heading between 83 and 115 degrees, the area potentially
35 affected by sonic booms at any trajectory in that range is shown as a shaded area.

36 Sonic booms at overpressures between 0.25 and 0.5 psf would be expected to be audible in low ambient
37 noise settings, but would not have any potential to damage structures. Although damage to structures
38 is possible at overpressure between 0.25 and 0.5 psf, it would be very rare. Glass, which is typically the
39 structural element most sensitive to sonic boom, has a breakage rate between one in a billion and one
40 in a million (Plotkin & Sutherland, 1989). In laboratory tests, properly installed glass did not break even
41 at overpressures up to 10 psf (White, 1972). The potential for damage to structures in good condition is
42 low for the expected exposures, which would be below 2 psf. The potential for noise induced hearing
43 loss in humans as a result of sonic booms is negligible, as noise levels on land are well below the hearing
44 conservation criteria which is approximately 4 psf.

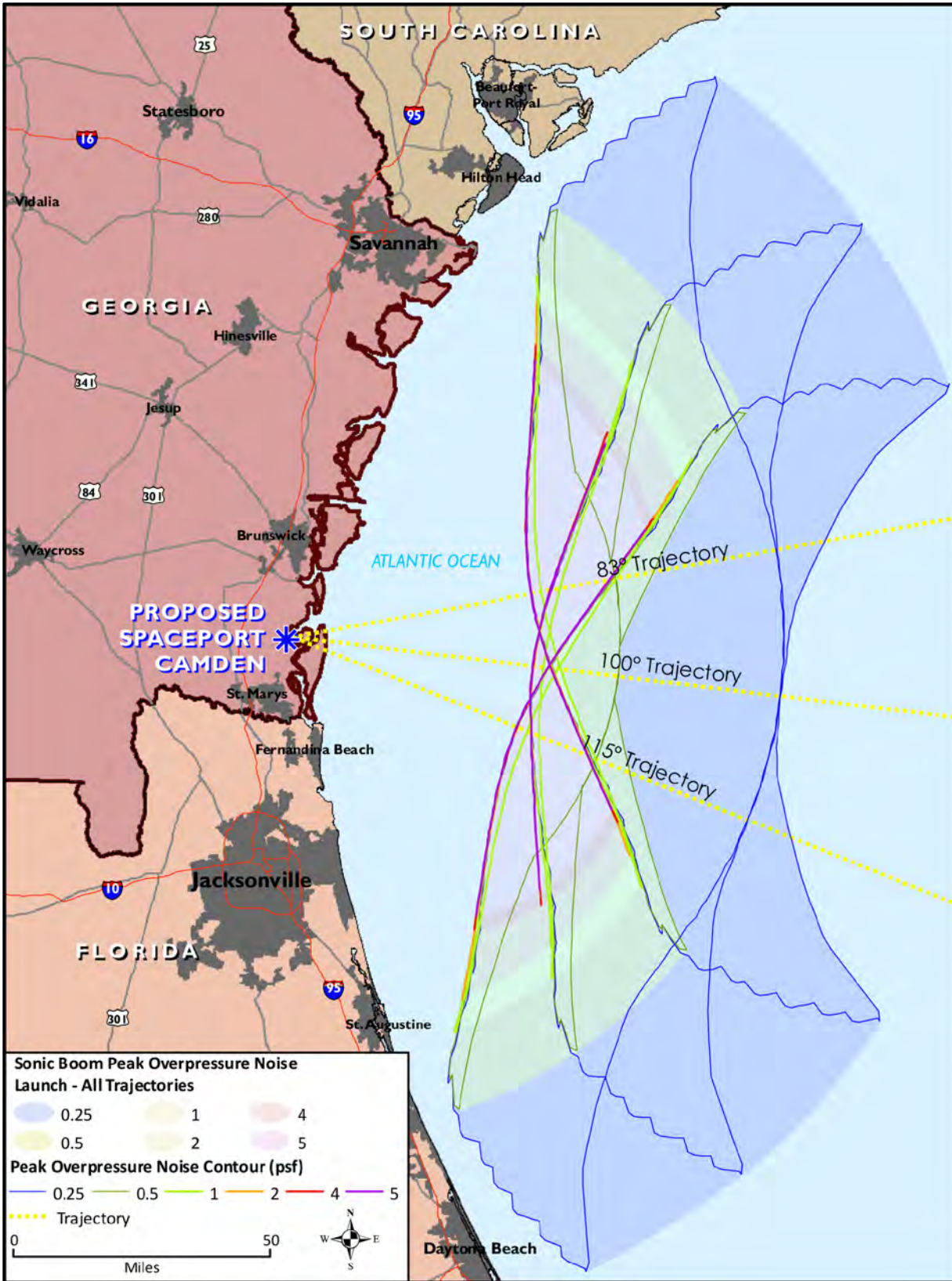


Exhibit 4.11-9. Composite of Sonic Boom Peak Overpressure Contours for a MCLV Launch from Proposed Spaceport Camden

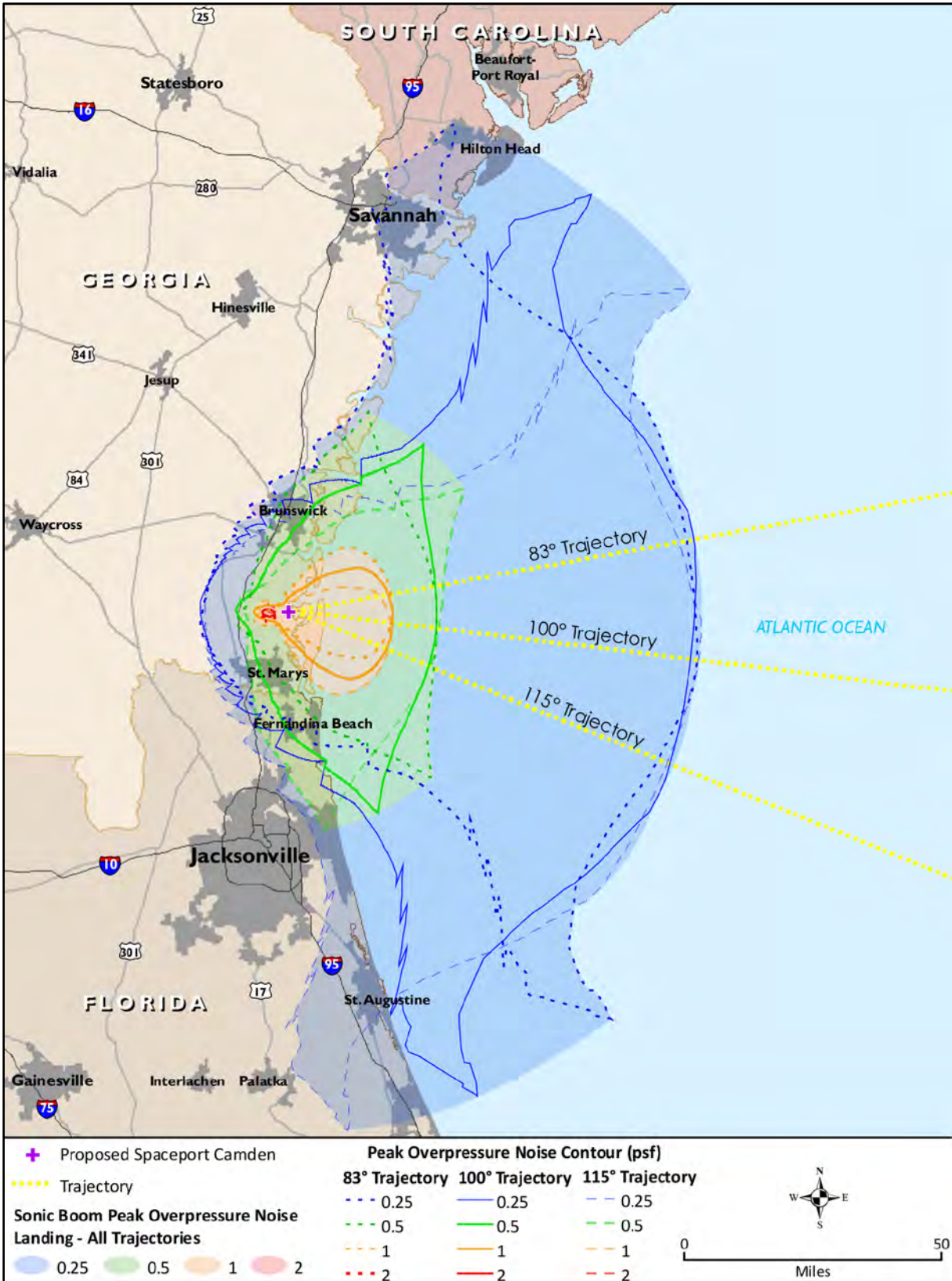


Exhibit 4.11-10. Composite of Sonic Boom Peak Overpressure Contours for a MCLV Landing at Proposed Spaceport Camden

Launches would not normally generate sonic booms at or above 0.25 psf on land (Exhibit 4.11-9). As can be seen in the exhibit, the size of the sonic boom footprint associated with any individual launch would be the same regardless of the trajectory followed but the location of the footprint is dependent on the trajectory. As listed in Table 4.11-4, approximately 4,958 square miles of the ocean's surface would experience overpressures above 0.25 psf during launches, but a much smaller area (10 square miles) would experience overpressures above 4 psf.

Table 4.11-4. Area Affected by Sonic Boom Overpressure During Launches

Overpressure (psf)	Area Affected (square miles)
0.25 – 0.5	4,958
0.5 – 1	994
1 – 2	123
2 – 4	8
4 – 5	6
> 5	4

Note: psf = pounds per square foot.

Launches would not normally generate sonic booms above 0.25 psf on land.

First stage landings at the Spaceport Camden landing pad would generate sonic booms that would fall, at least partially, on land (Exhibit 4.11-10). As is the case with launch sonic boom footprints, the location but not the size of the landing sonic boom footprints would be dependent on the flight trajectory followed. Approximately 3 square miles would be affected by overpressures between 2 and 3 psf during landing events (Table 4.11-5). The land area affected by this overpressure level under any trajectory between 83 and 115 degrees, contains no residences or other structures that are apparent in aerial photography. Roughly 345 total square miles of surface area, mostly located off shore in the Atlantic Ocean, would be affected at overpressures between 1 and 2 psf. Land areas affected at between 1 and 2 psf could include inhabited portions of Jekyll and Cumberland Islands as well as inland areas that contain no visible residences. Overpressures between 0.5 and 1 psf would affect inhabited land areas in McIntosh, Glynn, Camden, Nassau, and Duval Counties. Naval Submarine Base Kings Bay would be affected at this overpressure level under certain landing trajectories. Overpressures between 0.25 and 0.5 psf would affect portions of these counties as well as portions of Chatham, Saint John's, Putnam, and Flagler Counties.

Table 4.11-5. Area Affected by Sonic Boom Overpressure During Launches and Landings

Overpressure (psf)	Area Affected (square miles)
0.25 – 0.5	6,196
0.5 – 1	1,264
1 – 2	345
2 – 3	3

Notes: psf = pounds per square foot.

Landings at the Spaceport Camden landing area would affect land areas at less than 2 psf with the amount of land area affected depending on the specific landing trajectory.

The sonic boom noise levels generated during launches and landings would not materially increase the area exposed to noise levels of 65 dBA DNL or greater when combined with propulsion noise. The highest overpressure expected to occur on land (i.e., 2 psf), when experienced 12 times per year, results in noise levels equivalent to 60 dBA DNL as calculated using the methods described in American National Standards Institute 12.9, part 4, Annex B. The areas affected by launch and landing sonic boom noise equivalent to 60 dBA DNL are geographically separated from the area exposed to propulsion noise

1 above 65 dBA DNL such that the two types of noise do not yield substantive increase in area exposed to
2 65 dBA DNL.

3 Noise at Cumberland Island National Seashore would be of particular concern because of the
4 expectation among visitors of a completely natural soundscape. The Settlement was selected as a
5 representative location on Cumberland Island National Seashore for detailed analysis. During launches,
6 noise levels at the Settlement would be high enough to interfere with speech (i.e., exceeding 66 dBA) for
7 slightly more than two minutes. Noise would exceed median ambient sound levels (i.e., approximately
8 40 dBA) for roughly 4.5 minutes. Over the course of a year with the maximum number of launches,
9 landings, and static fire events, 66 dBA would be exceeded for a total of 33 minutes and 40 dBA would
10 be exceeded for a total of 61 minutes. Up to one launch and one landing per year would be conducted
11 between 10:00 p.m. and 7:00 a.m., resulting in a 20 percent chance and 12 percent chance, respectively,
12 of outdoor sleepers at or near the Settlement being awakened. During launches, maximum sound levels
13 between 111 and 120 dB would be experienced in the Plum Orchard Historic District, the High Point –
14 Half Moon Bluff Historic District, Brickhill Campground, and approximately 67 residential structures
15 located on Cumberland and Little Cumberland Islands. These maximum sound levels of 111 dB have
16 been associated with one damage claim per 1,000 households, and maximum sound levels of 120 dB
17 have been associated with one damage claim in 100 households. Sonic booms generated during
18 departure would not be audible on Cumberland Island, but first stage landings would generate sonic
19 booms of between 0.5 and 2 psf on the island. Sonic booms at these intensities are associated with a
20 low risk of structural damage, and have a distinctive sound signature that would be easily noticeable.

21 Visitors to Cumberland Island National Seashore can be assumed to appreciate the quiet natural setting
22 of the island and to, conversely, be particularly sensitive to non-natural sound events. However, people
23 that would be on Cumberland Island National Seashore during rocket launches would not necessarily be
24 representative of typical backcountry National Park visitors. Only authorized people would be on the
25 island and all would be aware that a rocket launch was planned. Also, it is possible that some visitors to
26 the island may view the rocket launches in a positive light and therefore may be less likely to be
27 annoyed by the noise than they would be if the noise source were more commonplace. Because rockets
28 generate such a distinctive sound, and because listener's feelings about rocket launches can be expected
29 to have a strong effect on their reactions to the rocket's noise, previous social surveys conducted on
30 people's reactions to aircraft noise in National Parks would not be good predictors of people's reactions
31 to rocket noise. Although it is likely that some fraction of visitors to Cumberland Island National
32 Seashore would be bothered by the disruption of the wilderness soundscape that would occur during
33 Spaceport Camden launch events, research conducted to date does not support accurate estimates of a
34 specific percent of visitors that would be annoyed.

35 In summary, noise levels during launches, landings, and static fire events would be quite high in areas
36 surrounding Spaceport Camden, but each event type would occur only up to 12 times per year. No land
37 area outside of Spaceport Camden would be exposed to noise levels of 65 dBA DNL. Although individual
38 noise events would temporarily alter the quiet setting that is a defining feature in surrounding areas
39 (e.g., Cumberland Island), rocket noise events would be infrequent. Activities other than rocket
40 launches (e.g., construction, loudspeaker announcements, etc.) would result in temporary localized
41 noise level increases primarily affecting the area on and immediately surrounding Spaceport Camden.
42 Because the sound environment in noise-sensitive locations near Spaceport Camden would be
43 unchanged during the vast majority of the year, current land uses (e.g., recreation, residences,
44 commercial, etc.) would remain compatible. Because the area exposed to greater than 115 dBA $L_{A,max}$ is
45 uninhabited and because sonic boom overpressures experienced on land would be below 4 psf, the
46 potential for noise induced hearing loss would be negligible. Structures in portions of unincorporated

Camden County would be exposed to noise levels between 111 dB and 120 dB L_{max} , which have been associated with between one damage claim per 1,000 households affected and one damage claim per 100 households. Sonic booms of between 0.5 and 2 psf, which would occur on land as a result of first stage landings, would be associated with a very low risk of damage to structural elements including windows, particularly if the structure is not in good repair. Tests have shown the risk of damage to glass, which is typically the most sensitive structural element, at between 1 in 1 billion and 1 in 1 million (depending on the condition of the glass) when exposed to 1 psf sonic booms. Noise levels at two nearby noise-sensitive locations, the closest residence and the Settlement on Cumberland Island would be exposed to noise levels expected to disrupt normal speech (i.e., 66 dBA) for less than 132 seconds during each noise event. In cumulative total, over the course of a year, these two locations would be exposed to noise levels exceeding 66 dBA for up to about half an hour. Subsonic and supersonic noise events would occur at Naval Submarine Base Kings Bay, but events would not be at an intensity that would be of concern. Certain people exposed to elevated noise levels during launch, landing, and static fire events could become annoyed by the noise, and there would be a very low risk of damage to structures due to noise. However, the noise events would be infrequent and would not be expected to result in significant impacts.

4.11.2 Ocean-Landing Only Alternative

4.11.2.1 Construction

Construction required under Ocean-Landing Only Alternative would be the same as under the Proposed Action except that the Landing Zone and its associated support infrastructure would not be built. Noise levels generated by construction would be the same as under the Proposed Action, but construction activities (including pile driving) would not occur at the Proposed Action landing zone site (Section 4.11.1.1, *Construction*).

4.11.2.2 Operation

Operations would be the same under Ocean-Landing Only Alternative as under the Proposed Action except that first stage landings would not occur at Spaceport Camden. The number of launches per year, launch headings, and launch noise levels would all be the same as described for the Proposed Action (Section 4.11.1.2, *Operation*). As is the case under the Proposed Action, sonic booms associated with launches would not affect land areas. Because first stage landings would not occur at Spaceport Camden, noise levels would not exceed 65 DNL in the area surrounding the Proposed Action landing zone site, and sonic booms associated with landings would not occur on land.

First stage landings would occur on a barge located several hundred miles off shore in Atlantic Ocean. Subsonic and supersonic noise generated during barge landings would not be audible on any land areas. A hazard area would be established surrounding the barge that would be confirmed free of non-participating vessels prior to barge landings. Subsonic and supersonic segments of first stage landings would generate sound that could be audible to crews of vessels operating outside of the hazard area but still within a few dozen miles of the landing barge. However sound levels outside the hazard area would not be sufficiently loud to results in risk to hearing, and would be transient in nature. Noise impacts to boat crews operating near barge landings would be expected to be minimal.

4.11.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a launch site operations license. The proposed construction and launch activities would not occur, and no changes to existing noise levels would occur. Noise levels at the location would continue to be affected by ongoing activities unrelated to spaceport activities. There would be no significant noise impacts under the No Action Alternative.

4.12 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

The socioeconomics impact analysis focuses on the regional economic impacts, both direct and indirect, of construction and operation of Spaceport Camden. In addition to those issues/resource areas identified in Section 3.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*, potential socioeconomic impacts that were identified by commenters during the public scoping period are also addressed, which include the following:

- Potential negative impacts to local ocean-based commerce (fisheries, crabbing, oysters, and shrimping) due to possible hazard area closures
- Financial viability of the Proposed Action and the effect on the local economy
- Changes to employment including the potential types and longevity of jobs created
- Financial impacts including costs and returns to taxpayers
- Potential changes to county services or funding
- Environmental and health impacts to children and pregnant women from noise and air pollutants.
- Potential effects to schools
- Beneficial impacts to tourism and other economic activity
- Property values to homes located in trajectory
- Costs to the public (i.e., taxes, damages, liability, insurance rates, evacuations)

Many concerns expressed by members of the public were potential costs to taxpayers and the public. Costs and benefits associated with construction, operation, and maintenance of the spaceport are not available at this time because designs are still in the notional phase. Therefore, only a qualitative assessment of the potential economic impacts associated with the Proposed Action and alternatives are discussed in this section. The economic impacts analysis divides effects into three components: direct, indirect, and induced. Direct effects are the change in employment and income generated directly by the expenditures of the incoming or outgoing personnel. To produce the goods and services demanded by the incoming personnel, businesses, in turn, may need to purchase additional goods and services from other businesses. The employment and incomes generated by these secondary purchases would result in the indirect effects. Induced effects are the increased household spending generated by the direct and indirect effects. The overall effect from the economic impact analysis is the total number of jobs created throughout the ROI by the direct, indirect, and induced effects.

To determine whether the local housing market could support the full-time employment (i.e., incoming population) associated with the Spaceport Camden, several assumptions were made. The first assumption was that any full-time employment positions would be filled by persons migrating into the

1 area. The second assumption was that the total number of homes required to support the incoming
2 population would be equal to the total number of direct full-time positions associated with the
3 Proposed Action and alternatives. This number was compared with the number of vacant housing units
4 in the ROI as defined by the American Community Survey five-year estimate for 2011–2015. If the
5 number of incoming full-time employees would not exceed the number of vacant housing units as
6 defined by the American Community Survey estimates, the housing market in the ROI was anticipated to
7 be able to support the incoming population. Other housing impacts considered in the analysis are the
8 potential changes in property values for homes in close proximity to the spaceport or under the
9 potential trajectories. Many factors influence housing prices; therefore, published research on potential
10 impacts associated with spaceport operations was reviewed to determine potential impacts on housing
11 values.

12 Population, employment, and public services were analyzed by considering the overall percentage
13 change to the county baseline conditions. Public services were analyzed by considering the capacity,
14 staffing, and infrastructure available to support the permanent and temporary incoming populations
15 and potential change in the demand in services during operation.

16 Potential closures, restricted access, and changes in noise could potentially impact recreational and
17 commercial participants in the ROI, which could affect economic activities. To assess potential impacts
18 associated with closures and restricted access the duration and frequency of the closures were
19 considered and potential noise interruptions that could affect the visitors experience are considered.

20 FAA emphasizes that the environmental justice populations need to have opportunities to provide
21 community input, and for this EIS, the public scoping meeting for community input was conducted with
22 extensive notice in Camden County, Georgia (see Section 1.5, *Public Involvement*). In addition, as
23 explained in Section 1.5, FAA requested input from government agencies, Native American tribes,
24 organizations, interest groups, and the public on issues of concern and alternatives to be analyzed.

25 Potential impacts that constitute a disproportionate impact on minority and low-income populations
26 and that also pose environmental or health risks to children include an increase in noise from
27 construction and operation of the spaceport, changes in air quality and water quality, and additional
28 health and safety risks associated with launches. To determine whether there exists a disproportionate
29 impact on environmental justice populations from noise, the environmental justice populations within
30 the affected area or ROI (defined as the area under the safety hazard area and the area under which
31 noise exceed 65-dB day-night average) are compared to the environmental justice populations within
32 the county where the affected area is located, also referred to as the community of comparison. If the
33 ROI exceeds the percent of minority and low-income populations than the community of comparison,
34 then there would be disproportionate impacts, and mitigation measures would likely be necessary. If
35 the proportion of minority and low-income populations in the ROI does not exceed the proportion of
36 minority and low-income populations in the community of comparison, then there would be no
37 disproportionate impacts to environmental justice anticipated.

38 The magnitude of potential impacts can vary greatly depending on the location of the potential
39 trajectory. If potential socioeconomic changes were to result in substantial shifts in population trends or
40 a decrease in regional spending or earning patterns, those effects would be considered adverse. Factors
41 to consider that may be applicable to socioeconomic resources, if they are interrelated with natural or
42 physical environmental impacts (see 40 CFR §1508.14), include, but are not limited to, situations in
43 which the Proposed Action or alternatives would have the potential to do the following:

- 44 • Induce substantial economic growth in an area, either directly or indirectly (e.g., through
45 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
- Produce a substantial change in the community tax base

Based on the above factors, when considered within the context and intensity of identified impacts, FAA has not identified any significant adverse impacts associated with socioeconomics, disproportionate impact on minority and low-income populations, or environmental or health risks to children under the Proposed Action or Ocean-Landing Only Alternative.

4.12.1 Proposed Action

4.12.1.1 Construction

Socioeconomics

Employment and Income

As stated in Section 2.1.1, *Construction – Activities and Facility Descriptions*, there would be 40 to 50 jobs associated with construction of the four new facilities and 20 employees for construction of infrastructure required to support the facilities. The employment associated with the construction activities would provide temporary benefits to the community from the direct and indirect employment and income from the use of local labor and supplies and expenditures. Benefits associated with the construction activities would be temporary, lasting for the duration of the construction activities, which is estimated to be up to 15 months.

Economic Activity

A change in environmental conditions such as air quality or noise during construction activities could lead to a change in economic activity from disturbance, restriction in access, or ability to perform income-generating activities. During the construction phase, no significant impacts on air quality would be anticipated since the estimated emissions from construction would not cause an exceedance of any NAAQS (see Section 4.1.1.1, *Construction*). Construction noise during the 15-month construction period could negatively affect visitors' experience of the National Park, particularly visitors who seek natural quiet and sounds of nature (see Section 4.11.1.1, *Construction*). While visitors may report noise interference with the natural quiet environment due to spaceport construction activities, noise impacts associated with construction activities would not be anticipated to result in significant adverse impacts to economic activity from a decrease in regional spending or earning patterns.

Population and Housing

Population and housing would not be significantly impacted by the additional jobs associated with the construction of the spaceport, since these jobs would be anticipated to be fulfilled from the local work force. However, in the event that the 60 to 70 construction and infrastructure workers would migrate

temporarily to the area during the 15-month construction phase, there would be capacity throughout Camden County to house construction workers.

Public Services and Social Conditions

Public services in Camden County currently service a population of over 51,445 people. It would be anticipated that additional construction employment would be filled by the local work force and would not require additional public service personnel. However, in the event that the additional construction-related employment would be filled by personnel migrating to the area, there could be a potential increase in demand for emergency, medical, and other public services for the duration of approximately 15 months, which is the estimated length of construction phase. Under the assumption that all 60 to 70 construction and infrastructure workers would be migrating to the area temporarily for the duration of the construction, the additional temporary population would not be expected to strain the capacity or affect the quality of public services and social conditions in the ROI.

Environmental Justice

No disproportionately high and adverse impacts to minority and low-income populations are anticipated as a result of the construction of Spaceport Camden. The project would result in ground disturbance of less than 100 acres of land, located entirely within the boundaries and on the upland portion of the existing industrial area. The upland area is above water flows and does not include the portion of the property that is marshland. Standard construction practices would be implemented to minimize dust. During construction, there would be a temporary increase in noise. Construction noise could be audible at the closest noise-sensitive locations (approximately 2.5 miles due west from the western edge of the property), but construction noise would be temporary, lasting only the duration of the construction project, and would be limited to normal working hours. The proposed construction activities would not be expected to result in significant community noise impacts. In addition to noise, there could also be an increase in air emissions during construction but there would be no exceedance of the NAAQS, and Camden County would remain in attainment.

Environmental justice communities are present in the study area. However, construction activities associated with the Proposed Action would not cause disproportionately high and adverse human health or environmental effects on any minority or low-income populations, because no significant unmitigated impacts from construction would be anticipated to occur in surrounding communities.

Children's Environmental Health and Safety Risks

Similarly to environmental justice populations, there would be no significant unmitigated impacts anticipated from construction that would result in disproportionately high and adverse environmental health and safety risks to children anticipated as a result of the construction of Spaceport Camden.

4.12.1.2 Operation

As stated in Section 4.11, *Noise and Noise-Compatible Land Use*, noise levels during launches, landings, and static fire events would be quite high in areas immediately surrounding Spaceport Camden, but each event type would occur only up to 12 times per year. No land area outside of Spaceport Camden would be exposed to noise levels of 65 dBA DNL. Although individual noise events would temporarily alter the quiet setting that is a defining feature in surrounding areas (e.g., Cumberland Island), rocket noise events would be infrequent. Noise levels during launch, landing, and static fire events could interfere with the natural quiet and could negatively affect a visitor's experience. There would be a very low risk of damage to structures due to noise. However, the noise events would be infrequent and

would not be expected to result in significant impacts, and, therefore, no significant noise-related adverse impacts to socioeconomics, environmental justice, or special risks to children would be anticipated.

Socioeconomics

Employment and Income

Approximately 77 full-time personnel would be required to support operations. The new jobs would represent an increase of less than 1 percent of total employment. The full-time personnel and expenditures would represent a positive direct impact on the local economy and would generate additional indirect jobs and income, which would benefit the local economy. Given the current level of unemployment in the ROI (5.5 percent), it would be anticipated that the indirect jobs would be filled by the local labor force and there would be no in-migration as a result of indirect job growth.

Expenditures associated with daily operations of Spaceport Camden and additional expenditures and incoming temporary personnel during surge operations would result in benefits associated with increased tax revenue in the local community, including property tax, hotel occupancy tax, and gross receipts tax revenues. However, in the event that launches are continually delayed or cancelled, taxpayers could be required to vote for government funds to be available to support the spaceport operations.

Economic Activity

Restricted access or closures would involve securing both land and water areas in order to prevent access from unauthorized users. The size of the closures would vary for each operation. In general, restricted access or closures could have a potential impact on various economic activities, most notably public activities on Cumberland Island or recreational and commercial boating. As stated in Section 2.1.2.3, *Representative Launch*, notifications announcing the launch and identifying any closure area(s) could be made as much as a month in advance of the launch, although shorter notifications of two weeks or less are possible, depending upon launch-specific turnaround times or possible launch delays (see Section 2.1.2.5, *Pre-Launch Activities*). Advanced notifications would allow recreational and commercial users to plan activities accordingly to avoid the closure areas in most cases. However, visitors to Cumberland Island are allowed to make reservations up to six months in advance; thus, notice of closures a month or less in advance in recreational areas such as Brickhill Bluff on Cumberland Island could result in adverse impacts to those visitors with reservations to the area made several months in advance, the significance of the impact generally related to the individuals impacted and their specific circumstances. Other activities such as the Land and Legacies Tour, a five- to six-hour motorized tour to the north end of Cumberland Island, also allows advanced reservations as early as six months and could result in similar adverse impacts to visitors and to NPS revenues if notice of closures are less than a month. In the case of the Land and Legacies Tour, any cancellations made up to 14 days prior to the tour are refunded (NPS, 2016c). The 300 daily allowed visitors (see Section 1.1, *Background*) to Cumberland Island National Seashore would be impacted by Spaceport Camden launch and landing operations on the up to 12 days per year when these activities could occur. The primary area impacted would be the northern end of the island while the majority of the area to the south would remain open. The St. Marys ferry typically drops and picks up at Sea Camp, which is on the southern part of the island. There are currently two docks in operation, including the St. Marys dock and the Plum Orchard dock. The Dungeness dock sustained heavy storm damage and is closed for repairs until further notice (NPS, 2018b). None of the docks used (Sea Camp, Dungeness, and Plum Orchard) would be impacted by closure areas for any launches, as the docks are all south of the launch overflight area. Areas affected

1 would include Brickhill Bluff campground, Cumberland Wharf Ruins, High Point, the Settlement, and
2 First African Baptist Church. However, the 24 allowed campers per day at Brickhill Bluff, plus other
3 residents and potential persons at habitable structures on the north end of Cumberland Island (Squaw
4 Town and Plum Orchard) and Little Cumberland Island would be considered “authorized persons” (in
5 this document, “authorized persons” would refer to residents and home owners, NPS staff, and certain
6 park visitors with permits or reservations for camping spots) and could remain if they wished. The
7 County has discussed the option to offer anyone who is an “authorized person” who wants to depart for
8 the launch window a complimentary ride and/or appropriate temporary accommodations, including
9 “VIP” viewing passes for the launch.

10 While some recreational visitors might avoid the area during operations, there would be potential to
11 attract visitors to the area specifically to view a launch event. Tourism and the aerospace industry in
12 Camden County could potentially benefit from visitors viewing the launch and the expansion of the
13 aerospace industry and associated employment in the region.

14 There would be potential for compatibility issues with spaceport operations and Naval Submarine Base
15 Kings Bay. However, ongoing interagency coordination among local jurisdictions, the military, State and
16 regional agencies, and other agencies would help identify and address any potential compatibility issues.

17 As operations become functional, there would be potential for increased demand for public services and
18 additional responsibilities on existing NPS staff, other agencies, and private entities. Potential impacts
19 on funding during operations on agencies and private entities as a result of greater demand for public
20 services and agency responsibilities is discussed in more detail in *Public Services and Social Conditions*
21 below.

22 ***Population and Housing***

23 Population and housing during the operation of Spaceport Camden would not be anticipated to result in
24 significant population growth in the area or result in shifts in the population. Assuming that all
25 77 permanent full-time personnel migrate to the area and using an average Camden County household
26 size of owner-occupied units of 261 persons (USCB, 2015d), the maximum increase in population would
27 be approximately 201 people, or less than 1 percent of the ROI population of 51,445. If, under a
28 maximum-case scenario, all 77 permanent full-time personnel would migrate to the area and require
29 housing at the same time, then it would be anticipated that there would be available housing based on
30 the current vacancy rate of 2,728 housing units in Camden County.

31 Comments received during the public scoping process expressed concern regarding potential adverse
32 impacts to property values and quality of life from spaceport operations. There are many factors that
33 contribute to real property values, including market conditions, neighborhood characteristics, property
34 characteristics (e.g., age, size, amenities), interest rates, mortgage lending practices, unemployment,
35 and income. Due to the various factors that influence property values and the lack of any definitive
36 Federal standards or studies conducted for similar launch facilities, it would not be possible to quantify
37 the effect of the spaceport on property values. Property values could adversely be affected if potential
38 safety and evacuation issues are commonly shared concerns amongst real estate market participants,
39 thereby influencing their willingness to purchase homes in the area. However, property values near the
40 spaceport could increase if employment and income opportunities in the area are created, which would
41 stimulate demand for housing in the area.

Public Services and Social Conditions

During operations, there would be potential for increased demand for public services such as State and local police and emergency responders to set up additional security checkpoints to ensure controlled access to any closure area. Launch operations would occur approximately 12 times a year for a maximum closure duration of up to 12 hours. Camden County and/or the launch operator would coordinate with State and local law enforcement agencies to ensure the needs of the community and launch are met (see Appendix B, *Health and Safety*). This would include reviewing the accessibility of police and emergency responders on the remote areas of Cumberland Island in the case of an emergency. The NPS, the Camden County Sheriff's department, the USCG, Glynn County Sheriff's office, and the U.S. Navy, as well as private island dwellers with personal boats are all in the immediate area and could be included or relied upon to provide support in an emergency. As operations become functional, there would be potential for additional full-time law enforcement and fire protection personnel and support to protect facilities and Spaceport Camden assets during daily operations, which would likely require additional county funds and expenditures. These and other additional responsibilities and demands on local, State, and Federal agencies could result in a financial burden to the acting agency. Advanced planning, coordination, and securing funding sources would need to be addressed in order to meet the demands of public services required during operations.

There would be potential for an increase in the demand for public school services if full-time personnel, associated with operations, with school-aged dependents permanently migrate to the area. Dependents would be anticipated to be of varying ages and would attend one of the 13 schools throughout the Camden County School District.

Environmental Justice

Environmental justice communities are present in the study area. However, implementation of the Proposed Action would not cause disproportionately high and adverse human health or environmental effects on any minority or low-income populations, because no significant unmitigated impacts during operation would be anticipated to occur in surrounding communities as identified in other resource areas.

Children's Environmental Health and Safety Risks

The proposed site of Spaceport Camden is located in an industrial area approximately 9 miles from the closest school, 11 miles from the closest medical center, and 2.5 miles to the closest residential home. Implementation of the Proposed Action would not cause disproportionately high and adverse health and safety risks to children, because no significant unmitigated impacts during operation would be anticipated to occur in surrounding communities as identified in other resource areas.

4.12.2 Ocean-Landing Only Alternative

4.12.2.1 Construction

Under this alternative, construction activities would be similar to those described under the Proposed Action, with the exception of the landing zone. As a result, socioeconomic impacts, as well as environmental justice impacts and special risks to children, would be similar to those described under the Proposed Action.

4.12.2.2 Operation

With the exception of landings, all other operational activities would be the same as under the Proposed Action. There would be no noise levels that would exceed 65 dB DNL in the areas where the landing site would be located under the Proposed Action, and there would be no overland sonic booms associated with landings. This would result in less potential for noise-related adverse impacts to socioeconomics, environmental justice, or special risks to children than described under the Proposed Action. Potential impacts in other socioeconomic areas, environmental justice, and special risks to children would be similar to those described for the Proposed Action, with the exception discussed below.

Socioeconomics

Economic Activity

Potential impacts to economic activities under this alternative would be similar to those impacts described under the Proposed Action, except that the first-stage landings would occur on a barge only. Similar to the Proposed Action, a hazard area would be established surrounding the barge that would be confirmed free of nonparticipating vessels prior to the barge landings. The barge would be located approximately 200 to 300 miles off shore in the Atlantic Ocean. Recreational vessels would not be anticipated to be present in the area; however, it would be possible that commercial vessels could be present or traverse the area. Under this alternative, the number of closures in commercial waters could be more if all landings were to take place on the barge as compared to the Proposed Action, under which some landings would be made at the landing site at Spaceport Camden. However, as stated in Section 2.1.2.3, *Representative Launch*, notifications announcing the launch and identifying the closure area could be made as much as a month in advance of the launch, although shorter notifications of two weeks or less are possible, depending upon launch-specific turnaround times or possible launch delays. Advanced notifications would allow commercial users to plan activities accordingly to avoid the closure areas.

4.12.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. As a result, there would be no direct or indirect impacts to employment and income associated with construction activities, nor would there be direct or indirect changes to the population, employment, income, public services, and economic activity in the ROI associated with the operation of the Spaceport Camden.

Under this alternative, there would be no disproportionate impacts to minority or low-income populations and there would be no environmental health and safety risks to children associated with spaceport development and operation.

The baseline condition of socioeconomics, environmental justice, and special risks to children would continue to be influenced by ongoing activities within the ROI now and into the future.

4.13 Visual Effects

The analysis of visual resources depends upon the visual character of the surroundings, individual viewer's perceptions and experiences, the public value or role of the affected landscape (as assessed by an authorized management entity). It also depends on a variety of other contextual factors (such as angle of observation, distance, time of day, cloud cover, atmospheric humidity, etc.).

Visual changes may cause impacts to other resources that are addressed separately, as appropriate, in their respective sections of the EIS, including Section 4.2, *Biological Resources*; Section 4.4, *Coastal Resources*; Section 4.5, *Department of Transportation Act, Section 4(f)*; Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*; and Section 4.9, *Land Use* (i.e., wilderness resources). The visual resource analysis only briefly addresses the potential impact on these cross-cutting areas of concern.

Based on inspection of publicly available maps of state and national scenic byways, the proposed spaceport property is not visible from any state or National Scenic Byways or Trails within the designated National Trails System (NPS, 2010; Georgia DOT, 2015); therefore, these topics will not be explored further in the following sections. There are also no nearby astronomical observatories. However, the Satilla River is listed in the NRI by the NPS and visual impacts are considered in the analysis. Although not designated by Congress as a National Wild and Scenic River, the NPS requires protection of the river until its status is determined and consultation on projects that may affect outstanding natural and cultural values. Visual impacts on the river are further addressed in the analysis and in Section 4.5, *Department of Transportation Act, Section 4(f)*, and Section 4.14, *Water Resources*. Impacts to viewshed on Cumberland Island National Seashore are addressed in the analysis.

Methodology for Visual Resources

Methods developed by other land management agencies (such as the U.S. Forestry Service, BLM, and FHWA) use a systematic process to evaluate landscapes and to describe and estimate visual impacts of proposed projects and activities. These management agencies use visual quality rating to guide decisions and actions that may alter visual character or viewsheds within their land. The basic principle of the process is to assess the visual contrast (i.e., the visibility) created between a proposed project and the existing landscape (BLM, 1986). In the analysis, the degree of contrast is measured by comparing the project features with the major features in the existing landscape. The basic design elements of form, line, color and texture are used to make the comparison and to describe the visual contrast created by the project (BLM, 1986). Other key physical factors include distance of the changes from viewers, frequency of viewing (such as viewers on roadways commuting to work), unobstructed line of sight to the site from specific locations (visual access), and the value of the altered landscape or viewshed.

This assessment considers impacts to visual resources for both the construction and operational phases of the Proposed Action. The analysis follows these steps:

- Describes and locates the construction elements of the project (Section 2.1.1, *Construction – Activities and Facility Descriptions*)
- Establishes a general line of sight envelope to the project site in the surrounding area using terrain as the defining criteria (Section 3.13, *Visual Effects*)
- Identifies representative viewing locations based on line of site analysis, land use, and accessibility of viewing locations (such as highways, campgrounds, residential areas) (Section 3.13, *Visual Effects*)
- Describes the current visual character and quality of the site and views from the surrounding areas (Section 3.13, *Visual Effects*)
- Analyzes satellite imagery (Google Earth, 2017), photography, and geometric analysis, to interpret the extent of views to the Spaceport Camden site and how these are screened or blocked by terrain, vegetation, and structures

- 1 • Identifies the visual value of the site and affected views from the surrounding area (Section 4.13,
2 *Visual Effects*)
- 3 • Assesses the noticeability (degree of change) from the new construction at the selected
4 locations based on contrast with the existing visual context (considering size, forms, color,
5 texture of the new feature and the surrounding visual resources and/or visual character in the
6 study area, size of the viewing window to the proposed site) (Section 4.13, *Visual Effects*)
- 7 • Considers how applicable State and local regulations, policies, and zoning ordinances protect
8 against light pollution and visual changes (and whether the project changes align with these
9 management frameworks)
- 10 • Considers visual quality of the viewshed based on designated or locally recognized visual
11 resource values (as documented in applicable State and local regulations, policies, plans, and
12 zoning ordinances, and public values and input)
- 13 • Identifies affected viewers, their relative numbers, and the expectations they have about their
14 visual experience based on their activities and purposes
- 15 • Assesses the degree of impact of changes on the visual character of the viewshed and on
16 viewers based on the sensitivity of the viewshed considering its value (above) and ability of the
17 landscape to absorb change
- 18 • Determines the degree of impact (low, moderate, or high) based on the degree of change and
19 the value of the affected visual resource

20 Visual value considers the sensitivity of representative viewsheds based on the visual character of the
21 area, including the importance, uniqueness, and aesthetic value of the affected visual resources;
22 ecological and cultural sensitivity; regulatory directive and management plans (such as ordinances,
23 special land designations, and resource management goals); agency-designated visual resource values;
24 and agency and public input expressed during scoping and EIS comment periods.

25 The analysis concludes with an assessment of overall impact as high, moderate, or low (minimal) at the
26 representative observation points. Where possible, these points are used to extrapolate and describe
27 impacts at other similar settings. Analysis considers the extent to which the Proposed Action and
28 alternatives may affect visual character and viewsheds based on their importance, uniqueness, and
29 value; contrast with the existing visual character or resources; and block or obstruct views from other
30 locations. Input from agencies and the public during scoping is considered in estimating the degree of
31 impact on visual resources and from light emissions. Light pollution was the primary issue of concern
32 for the public. The NPS noted particularly the potential effect on dark skies in proximity to the
33 wilderness areas of the Cumberland Island National Seashore.

34 **Methodology for Light Emissions**

35 The evaluation considers the effect of light emissions from the project on activities in the affected area.
36 The analysis follows these steps:

- 37 • Describes and locates the sources of lighting used during construction and operations of the
38 spaceport including information on the direction, type, frequency/duration, and intensity of
39 fixtures at the site, to the extent known
- 40 • Identifies and locates light-sensitive activities and land uses near the site (such as airfields,
41 observatories, residential areas, special management areas)

- Identifies potential conflicts between light emissions from the project site on light sensitive human activities and uses (such as residential and recreational uses, sensitive protected areas). Impacts of light emissions on terrestrial, avian, and aquatic species are addressed in Section 4.2, *Biological Resources*. This assessment determines, to the extent possible, the degree to which the action would create annoyance or interfere with normal activities considering intensity of the light trespass, inherent safety criteria required for other activities; existing policies and management mechanisms for light emissions (such as local ordinances and special designations).
- Evaluates potential for light pollution in the form of light trespass, sky glow, and glare

The evaluation addresses the issue of “dark skies” and sky glow, focusing on current conditions of dark skies in the surrounding region. It identifies any specific dark sky initiatives, policies, and objectives of Federal, State and local agencies to manage and maintain dark skies in the region. The analysis concludes with an assessment of the level of light emissions impact of high, moderate, or low, based on the degree of change and sensitivity of area to nighttime light.

For adverse effects, the analysis identifies possible mitigation measures to decrease the impacts. These measures draw upon recommendation and guidelines from management agencies (including the NPS) and organizations such as the IDA and U.S. Green Building Council. Based on the factors above, FAA has identified minor to moderately adverse impacts associated with visual resources and light emissions under the Proposed Action and Ocean-Landing Only Alternative, as reported in the Sections 4.13.1, *Proposed Action*, and 4.13.2, *Ocean-Landing Only Alternative*.

4.13.1 Proposed Action

4.13.1.1 Construction

Visual Resources

This following analysis focuses on changes to the visual environment. The degree or significance of these changes depends on who or what is affected by the change. A description of the proposed construction for the Spaceport facilities and infrastructure is provided in Chapter 2, *Proposed Action and Alternatives*, with maps showing the location and descriptions of the extent of each component. Essentially the proposal includes development of four complexes within the proposed Spaceport property, three on vegetated areas (the Launch Control Center Complex Landing Zone, and Vertical Launch Facility), and one (for the Alternate Control Center and Visitor Center) on an existing developed site. The proposed water tower and four launch pad lightning towers at the Vertical Launch Facility, at 250 feet in height, are the tallest proposed features. In accordance with FAA Advisory Circular 70/7460-1L, Obstruction Marking and Lighting (FAA, 2016b), features above 200 feet are aviation hazards and for safety purposes, require permits, markings and continual lighting to mark their location. The tallest and largest building is the 65-foot tall Vehicle Integration Building at the Vertical Launch Facility site. This facility would not require obstruction markings.

The County’s UDC does not directly address the land use relationship between a Spaceport industrial use and adjacent lands that are mostly forested, undeveloped, or rural residential (Camden County, 2014). It does require certain land uses to provide adequate separation to maintain compatibility and visual cohesion. As the zoning enforcer and proponent, the County would have responsibility for ensuring adequate landscape buffering at the site as per the Camden County UDC, Article 4, *Buffers, Landscaping, and Tree Conservation*, and for avoiding conservation land and wetlands (Camden County

UDC Article 9, *Environmental Protection*). The Camden County UDC includes overlays to protect sensitive lands including the Satilla River corridor, land bordering rivers and creeks, and wetlands. These areas have special restrictions on construction to protect their natural and visual character. Following Camden County UDC ordinances (specifically Article 9, *Environmental Protection*), the project would avoid disturbing the shorelines of Satilla River delta waterways, and preserve its natural character and visual quality.

The primary focus of this evaluation is the impact on the views to the Spaceport property from surrounding areas because the very limited amount of onsite viewers that work on the property would not be negatively affected by visual changes at the site. It is assumed that proposed structures and infrastructure would express the functional requirements and purpose of the spaceport and would have an industrial appearance. To assess visual changes to surrounding views, the analysis uses several representative locations to describe the current and anticipated future views. Exhibit 3.13-3 shows the location of the 15 selected representative observation points for the analysis. These points are not comprehensive but can correlate to viewing conditions for nearby locations with similar vantage point or locations with similar sensitivity to viewshed. This evaluation considers the visual effects from activities during construction and the visual effects of the facilities following construction.

During construction, typically occurring in daylight hours, additional traffic would use local roads to the site. The activity of these vehicles, particularly larger trucks, would likely be visually noticeable to local residents who are not familiar with larger commercial vehicles. This impact (and associated noise and traffic effects) would last for about 15 months. Local drivers would likely notice the additional traffic volume, but that would not change visual environment.

The proposed spaceport property has a history of prior industrial activity and is zoned for industrial use. While parts of the site are natural and visually harmonious, the landscape qualities are not unique or distinctive (see Table 3.13-1). Notwithstanding, industrial equipment, stockpiling areas, and the erection of large-scale facilities would contrast strongly with the surrounding vegetation and the scale of most of the residential and small community buildings in the local area.

Development for the spaceport would fall under the regulatory review of Camden County, and current zoning restrictions would apply. Screening from existing vegetation would mostly obstruct offsite views to the construction activities at three of the four construction project areas, as described below.

- The Launch Control Center Complex site is close to the west boundary. The density of the existing forest along the west boundary fenceline is inconsistent. Users of the logging road along that fenceline may have limited visual access to that site. Some viewers may find these visual changes undesirable, detracting from the more natural vegetated landscape.
- The Landing Zone site is setback from the external boundary and not visible from any offsite locations. None of the construction activities would be visible offsite.
- Union Carbide Road leads directly to the current entry onto the spaceport site and the site for the Alternate Control Center. Construction and demolition activities at this complex would be highly visible but the viewing population is relatively small, consisting of site personnel, construction workers, and travelers on Union Carbide Road. This site is surrounded by the remnants of former industrial facilities. The construction activities would conform to the highly modified surrounding visual context.
- The tallest structures are planned for the Vertical Launch Facility. The forest surrounding this site would provide partial screening, but use of tall cranes for installation of the higher elements of the site (such as the water tower and launch pad lighting system, up to 250 feet in height)

would be visible above the tree canopies, particularly for persons using the adjacent waterways. The visibility of these construction activities may detract somewhat from the visual surroundings for some persons during the construction phase.

Upon completion of construction, impacts of new construction on views and viewsheds are summarized in Table 4.13-1 for 15 observation points. For each observation point, the table summarizes the visual quality of the view to the site, viewers, viewshed sensitivity, visual change from the new features, and overall impact. Twelve of the representative observation points have views to some part of the proposed site.

Using Google Earth satellite imagery, it was determined that most facilities on the site would not be visible, except for the tall water tower and launch pad lightning towers at the Vertical Launch Facility complex. The water tower on the proposed Vertical Launch Facility is used as the reference point in the analysis. Viewing distances are referred to as foreground (up to half-mile from new features,) middle-ground (from half mile to about 4 or 5 miles), and background or distant (beyond about 5 miles) vegetation would block views of proposed new buildings on the site. The lack of any substantial changes in elevation or terrain also reduces the potential for visual vantage points onto the site. Of the 15 representative observation points, 9 have at least partial views to the ground-level at the proposed site (see Exhibit 3.13-3).

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles) ¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
1. Brickhill Bluff	5.1	Viewshed quality: Views westward moderate to high, mostly natural but lacking distinctive landforms. Viewers: NPS personnel, some residents on LCI, and small number of park visitor recreationists. Viewshed sensitivity: High due to protective status of wilderness area. Viewshed changes: Tall constructed elements (water tower, lighting structures at VLF) visible above treeline in middle-ground to background distance, but subordinate to the surrounding viewshed. Overall impact: Moderate to high (due to sensitivity).	Launch visibility: Rocket launch flight path highly visible overhead for short duration about once per month by authorized users, including permitted campers, although most persons would be evacuated from this area during launches. Impact temporary and no lasting change to viewscape. Light emissions: Some sky glow from security and task lighting during construction and operational phase; noticeable but not glaring safety lighting on tall towers at VLF; minor but noticeable LED lighting glow from blue-rich LED fixtures at facility sites; lighting more noticeable when lights positioned to illuminate assembled rocket on launch pad and ground tasks at VLF for one or two nights (dusk to dawn) during monthly launch window. One night launch annually could have visible high-intensity LED launch pad lighting generating noticeable sky glow and potential glare spots. Sky glow effects more noticeable with low cloud cover. Less visible when foggy, high humidity.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles)¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
			Overall impact: Moderate to high due to sensitivity of dark sky values for CUIS and wilderness.
2. Bridge to Jekyll Island	8.8	Viewshed quality: Moderate to high due to panorama vantage point, but highly modified in fore and middle-ground, more natural character in distant views to north, west, and south, and views to ocean to east. Viewers: Relatively high volume of drivers and pedestrians crossing Jekyll Island bridge, including local residents and tourists. Viewshed sensitivity: Moderate due to local value for landscape and tourism. Viewshed changes: Higher constructed elements visible above treeline (water tower, lightning towers on launch pad) but visually subordinate to the overall viewshed. Block-like forms of taller structures on the site may be visible but subordinate to the surrounding viewshed. Overall impact: Minor due to distance and other features human-made features in viewshed.	Rocket launch flight path easily visible for short duration about once per month, particularly for annual night launch. Could distract drivers. Impact temporary and no lasting change to viewscape. Light emissions: Similar to observation point 1 but less noticeable due to foreground lighting and glow, Overall Impact: Moderate due to modified context, and concern for driver safety.
3. Crooked River State Park	7.7	Viewshed quality: From shoreline, moderate to high views to surrounding waterways, with mostly natural settings dominated by marsh and sky, with distant treeline canopies. Viewers: Park users, residents along shoreline. Moderate numbers. Viewshed sensitivity: Moderate due to mix of natural setting with rural residential. Viewshed changes: From a shoreline position, highest towers at launch pad may be visible but insubordinate in overall viewshed. Other new facilities on Spaceport Camden masked by vegetation. Overall impact: Minor impact due to distance and narrow view to Spaceport site.	Launch visibility: Rocket launch flight path easily visible for short duration about once per month. Impact temporary and no lasting change to viewscape. Light emissions: Glow from ambient LED lighting minimally noticeable due to distance and other interspersed light sources in viewshed. More noticeable during low cloud conditions. Safety lighting on tall towers noticeable from viewing points without foreground vegetative screening. Overall impact: Minor to moderate depending on viewer location and atmospheric conditions.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles)¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
4. Cumberland Wharf, CUIS	3.8	Viewshed quality: Similar to observation point 1. Historic context of ruins. Viewers: Similar to observation point 1. Viewshed sensitivity: High due to historic context and CUIS values. Viewshed changes: From a shoreline position, highest towers at launch pad easily visible with contrasting form to natural elements. Noticeable (due to lighting) but not dominant in middle-ground viewshed. Overall impact: Moderate to high due to viewshed sensitivity.	Launch visibility: Similar to observation point 1. Light emissions: Similar to observation point 1. Overall impact: Moderate to high due to sensitivity and dark sky values of CUIS.
5. Deep Water Access Dock	0.7	Viewshed quality: Low to moderate due to industrial use and existing modifications in foreground. Surrounding waterways are natural. Viewers: Dock users (including workers and sport fishing persons), nearby recreational boaters in waterways. Relatively low numbers. Viewshed sensitivity: Low due to existing modifications and uses at the observation point, low numbers of viewers. Viewshed changes: Similar to current views to west. Looking north from this location and nearby water channel, open views to foreground forest, and prominent view of tall structures at VLF and launch pad in middle-ground. Overall impact: Low to moderate due to existing modifications in immediate surroundings, low viewer numbers, and screening by foreground vegetation.	Launch visibility: Rocket launch flight path highly visible but area evacuated during launches. Impact temporary and no lasting change to viewscape. Light emissions: Sky glow from Spaceport sites minimal due to light dimming at night and masking by immediate lighting at the dock. LED lighting glare during pre-launch periods noticeable. Overall impact: Low to moderate due to low sensitivity but close proximity.
6. First African Baptist Church, CUIS	4.7	Viewshed quality: Moderate due to naturalness and surrounding historic structures, but limited views due to vegetative screening and local terrain. Viewers: Park users and personnel. Viewshed sensitivity: High due to CUIS and historic context values.	Launch visibility: Similar to observation point 1. Light emissions: Similar to observation point 1 but less noticeable due to limited view.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles)¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
		Viewshed changes: Most new facilities on the Spaceport Camden site and launch site not visible from this site due to vegetation and terrain. Tall water and lightning towers visible mostly due to safety lighting, but subordinate to viewscape of persons at this site. Overall impact: Low since low visibility.	Overall impact: Moderate due to high sensitivity but low visibility.
7. I-95 Overpass from 10 th Street	10.5	Viewshed quality: Low quality viewshed due to modification to landscape by roadway. Viewers: Relatively high number of drivers. Viewshed sensitivity: Low due to transportation corridor features and limited viewshed due to vegetation along roadway. Viewshed changes: Views to the Spaceport Camden site blocked by intervening terrain and trees. Highest towers at the VLF discernible but mostly unnoticeable to viewers or drivers Overall impact: Low due to lack of sensitivity and limited view to site.	Launch visibility: Launch vehicles temporarily visible for east bound travelers about once per month. May distract drivers causing safety concern. Light emissions: Spaceport security lights not directly visible from this location, but safety lighting on tall towers may be visible at night but not glaring due to distance. Sky glow from the site may be discernible depending on cloud conditions, but masked by other sources of glow such as suburban glow of Woodbine and Jekyll Island. Overall impact: Low due to surrounding context.
8. Ice House Museum, CUIS	13.4	Viewshed quality: Moderate due to modifications in viewshed eastward toward NSB Kings Bay and St. Marys. Viewers: park visitors and personnel. Popular area in CUIS. Viewshed sensitivity: Moderate to high, due to CUIS viewshed values. Viewshed changes: View similar to current conditions. The high tower features at the VLF site may be distinguishable above treeline on the distant horizon on clear days due to safety lighting, but minimal change in the overall viewshed quality. Overall impact: Low due to distance.	Launch visibility: Rocket launch flight path visible for short duration about once per month. Impact temporary and no lasting change to viewscape. Light emissions: Minor visible sky glow observable from this location at night when viewing the horizon in the direction of the proposed Spaceport site. LED blue-rich glow tends to disperse quickly. Glow intensity for isolated light sources from this distance is likely noticeable but low. Overall impact: Low to moderate due CUIS dark sky values.
9. Lodge at Cabin Bluff	3.5	Viewshed quality: Mostly pleasing natural surrounding views, altered by forestry and some anthropogenic features (roads, utility lines); moderate quality.	Launch visibility: Rocket launch flight path easily visible for short duration about once per month. Temporary visual intrusion may be of interest to some lodge visitors.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles) ¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
		Viewers: Lodge visitors and staff, boaters along waterways. Viewshed sensitivity: Moderate due to modified context of the foreground area, but sensitive due to importance of context for resort ambiance. Viewshed changes: Views similar to current views from the lodge, swimming pool and tennis courts. Tops of new water tower and lightning towers may be visible from fairways and in the nearby water channels, particularly with the safety lights at night. The Alternate Control Center and Visitor Center may be visible from some locations at the resort but not dominant given visual context has existing structures at the site for these new facilities. Overall impact: Low to moderate due to current context and narrow viewshed limited by foreground vegetation and structures.	Light emissions: Sky glow intermittently noticeable during launch windows when lighting at VLF is operating 24x7, and when cloud cover low. Masked by lighting at the observation point site which causes measurable sky glow (see Exhibit 3.13-4). LED blue-rich lights may cause minor glare to viewers at this distance. Overall impact: Low considering lighting at the observation point would mask the effect of the Spaceport lights.
10. NPS CUIS Visitor Center (VC), St. Marys	15.7	Viewshed quality: Mixture of small town urban landscape with views to natural waterways to south around VC. Mostly pleasing visual character. Viewers: High number of tourists and park visitors, park personnel, local residents in nearby areas. Viewshed sensitivity: Moderate sensitivity due to modified context. Does not include view to proposed Spaceport site. Viewshed changes: No view to the proposed Spaceport Camden property from the CUIS VC, therefore, no change. Overall impact: No visual impact from development on the Spaceport site.	Launch visibility: Launch events may be visible with unaided eye from this site once per month. Some visitors may find interest in launch events. Light emissions: Light emissions causing glare from Spaceport likely visible at this location. Sky glow masked by intervening lights from St. Marys. Overall impact: Minimal direct impact from launches and light emissions due to distance and intervening light sources. May provide beneficial impact for tourists interested in viewing and learning about launches.
11. Residence west of proposed Spaceport Camden	3.9	Viewshed quality: Moderate visual quality with natural and planted forest surroundings modified by small scale rural residential development, fences, structures, back county roads, with	Launch visibility: Rocket launch flight path highly visible for short duration about once per month. Augmented by accompanying noise. Only temporary change in visual context.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles) ¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
property		relatively dark sky context. Viewers: Small number of residents, Logging personnel. Viewshed sensitivity: Low to moderate due to residential use, and scale, Viewshed changes: Views to the Spaceport Camden property blocked by intervening forest, but partial views to tops of tallest structures at the VLF above treeline from some viewing locations without foreground vegetation. Small viewshed to impacting features. Overall impact: Minor to moderate due to limited viewshed, but residential sensitivity.	Light emissions: Sky glow from ambient lighting at Spaceport site, particularly during launch windows, dependent on weather and atmospheric conditions. Glare possible from launch pad lights depending on position of lights and shielding. Overall impact: Minor day-to-day operations, but moderate during launch windows due to proximity and intrusion on rural residential context.
12. River Oaks at Harrietts Bluff	6.6	Viewshed quality: Moderate visual quality; park and residential areas mixture of natural forest and small-scale rural enclaves, generally appealing but typical surrounding coastal and estuarine visual character; views over natural waterways from shoreline pleasing quality. Viewers: Residents, park visitors, recreationists, boaters in waterways. Viewshed sensitivity: Low to moderate due to overall natural qualities but context modified by shoreline homes and infrastructure. Viewshed north toward site limited window Viewshed changes: Similar to observation point 11. Spaceport features in background, subordinate to view. Overall impact: Minor to moderate due to residential sensitivity but limited background views.	Launch visibility: Rocket launch flight path easily visible for short duration about once per month. Short duration and temporary visual intrusion. Light emissions: Glow and glare from Spaceport lighting minor depending on atmospheric conditions, masked by local sky glow from surrounding context of NSB Kings Bay and minor ambient lighting from shoreline residences. Overall impact: Minor due to distance and limited view to Spaceport site.
13. Satilla River Marsh Island SNA	2.0	Viewshed quality: High due to natural, quiet surroundings, riparian habitat and wetlands and tidal marsh. Viewers: Boaters, recreationists, naturalists, bird watchers, low to moderate numbers. Viewshed sensitivity: Moderate to high due to the mix of rural development	Launch visibility: Launch operations highly visible, but observers not allowed in the closure area. Temporary visual intrusion. Light emissions: Light emissions from security and task lighting at VLF prominent at nighttime during launch windows (once per month), and annual

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles) ¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
		with the natural surroundings and sensitive ecology, NRI and local conservation status of Satilla River and the SNA. Viewshed changes: Tall elements at VLF easily visible from this location when looking toward the site, and along the Satilla River, St. Andrews Sound, Todd Creek, Floyd Basin and Floyd Creek. Lack of nearby tall foreground vegetation in most locations. Overall impact: High due to visual sensitivity.	night launch contribute to local sky glow and glare in some locations. Day-to-day lighting minor due to dimming at night. LED lights and sky glow may impact wildlife and estuarine species circadian rhythms and processes. Most river viewers not present at night when lighting most apparent. Overall impact: Lighting impacts moderate to high due to sensitivity of protected waterways.
14. Structure Little Cumberland Island	5.7	Viewshed quality: Moderate to high, views over ocean and surrounding natural dunes and coastal island habitat. Few human intrusions except for home sites. Viewers: Residents (seasonal and permanent). Viewshed sensitivity: Moderate due to sensitivity of residential use and coastal protection values of local population and CUIS. Viewshed changes: No visible changes as viewshed to the Spaceport Camden property blocked by intervening forest and terrain from east side of LCI and (and CUIS). Overall impact: Minimal due to lack of visibility from east side of outer islands.	Launch visibility: Rocket launch flight path highly visible for short duration about once per month, but residents evacuated during launch events. Light emissions: No direct visual access to view of spaceport site lighting, but minor sky glow may be visible to west during some atmospheric conditions, similar but less intense than glow from Jekyll Island and other intermittent pockets of rural development along the coast. Overall impact: Minimal impact due to orientation of viewshed from east coast of outer islands.
15. Residence on Dover Drive	5.1	Viewshed quality: Viewshed to site mostly natural, but surrounding context modified by small-scale rural residential development. Viewers: Rural residents, tourists, drivers. Viewshed sensitivity: Moderate to high due to residential-scale development along the protected Satilla River corridor. Viewshed changes: Views to south similar to current view but with tall structures on VLF visible but subordinate to overall view due to	Launch visibility: Rocket launch flight path easily visible for short duration about once per month, but temporary intrusion. Some residents evacuated so not affected. Light emissions: Similar to observation point 11, but more LED glare from lighting at VLF due to less obstructed views. Overall impact: Minor day-to-day operations, but moderate during launch windows due to proximity and intrusion on rural residential context.

Table 4.13-1. Summary of Visual Impacts from Spaceport Facilities at Representative Observation Points

ID No./Observation Point	Distance (miles) ¹	Future Day-time Viewshed (During and Post Construction)	Operations Phase- Launch Events and Light Emissions
		distance and vantage point. Overall impact: Moderate due to sensitivity of the Satilla River corridor, but more distant views from residences.	

Notes: CUIS = Cumberland Island National Seashore; LCI = Little Cumberland Island; LED = light-emitting diode; NPS = National Park Service; NRI = National River Inventory; SNA = State Natural Area; VC = Visitor Center; VLF = Vertical Launch Facility.

¹ Measured from observation point to proposed VLF water tower site.

Some views to the property from offsite locations are more sensitive to visual change than others. Sensitive viewing locations include the local waterways because the views tend to be less obstructed and users frequently value the natural surroundings. Residential areas are sensitive to industrial-scaled development, and to intense lighting levels. Views from parks and protected wilderness of the Cumberland Island National Seashore are also sensitive to visual changes that degrade the quality of viewsheds. An evaluation of impacts on wilderness values is provided in Section 4.9, *Land Use*.

The following paragraphs provide a more detailed description of the current and anticipated visual conditions and viewsheds from the selected observation points. This evaluation assumes viewers with average visual acuity and relatively clear conditions (unobscured by fog or mist). The impact of light emissions and rocket launches in the operational phase are included in Table 4.13-1. However, except for the Cumberland Island National Seashore Visitor Center (observation point 10), the discussion of launch and light emissions impacts is discussed separately, in Section 4.13.1.2, *Operation* (Visual Resources). The following discussion for the 15 observation points focuses on impacts to viewsheds resulting from physical development of the proposed spaceport facilities.

Brickhill Bluff is an accessible viewing location on the east shore of Cumberland Island with direct line-of-sight to the proposed Spaceport Camden. Foreground views are dominated by water and salt marsh low-lying landscape with a line of distant forest canopies bordering the marshland. This location is within the Cumberland Island National Seashore wilderness so the viewshed sensitivity is high. The NPS would consider the viewshed an important attribute for visitors who come to the island to enjoy the pristine wilderness experience. From this location and along the western shoreline of the island, the launch pad lightning towers and water tower would be visible, rising above the surrounding forest on the Spaceport Camden property. These features would contrast with the background sky, surrounding water, and horizontal bands of vegetation (similar to the view looking westward in photograph J). At a distance of about 5 miles, these upright elements would be moderately noticeable because they contrast with natural features and the sky. They also would have hazard markings and lighting to increase their visibility. Nonetheless, they would occupy a very small area in a viewer's cone of vision and viewing plane, low on the horizon. Although visible, they would not dominate the viewshed, and would mimic the forms of other tall towers in the viewshed, such as cellular towers, the closest of which is situated at Harrietts Bluff (CellReception, 2017). The overall impact on the viewshed is estimated as moderate due to the sensitivity of the wilderness viewshed.

1 *Bridge to Jekyll Island* is selected because it has a slightly elevated vantage point compared to most
2 locations in the surrounding area. From this position, travelers can see developed areas on either side
3 of the bridge on Jekyll Island and wide views to the southeast in the direction of the project site. The
4 Spaceport Camden land may be visible but not distinguishable from other surrounding forested areas
5 for most viewers. The viewshed is open to the south over the inland waterways and marshland west of
6 Cumberland Island. The tops of the higher constructed Spaceport Camden elements (the water and
7 lightning towers at the Vertical Launch Facility) may be visible, but subordinate to the overall viewshed,
8 due to vegetation masking and distance. Locations like this have a higher volume of viewers, including
9 tourists that expect attractive surroundings; therefore, the viewshed sensitivity is moderate. Overall,
10 the visual impact is low due to distance from the site and other human-made features in the foreground
11 viewshed.

12 *Crooked River State Park*. Views to the Spaceport Camden property are limited from this State Park and
13 shoreline residences in the vicinity due to intervening terrain, forests and developments. The view
14 northwards is over low-lying marshland and water, with moderate viewshed sensitivity due to the mix of
15 naturalness and rural residential features. The tops of the tallest new structures at the Vertical Launch
16 Facility may be visible but subordinate to the overall view. Vegetation, structures and terrain would
17 limit the size of the viewshed toward the site. The proposal would have minimal impact on the visual
18 surroundings from this location and other similar locations along the east shore of the mainland south of
19 the proposed Spaceport Camden property (see discussion below for River Oaks at Harrietts Bluff).

20 *Cumberland Wharf*, within the Cumberland Island National Seashore, is co-located near ruins and lies
21 just outside the wilderness boundary. The viewshed sensitivity from this site is high, but not as high as
22 from locations within the wilderness. The views from this site are similar to those described for Brickhill
23 Bluff, although the wharf is 35 feet high, providing a vantage point over some vegetation at the site and
24 the distant shore. Because this location is closer to the proposed Spaceport Camden site, the visibility of
25 the tall towers would be greater, although not dominant in the viewshed. Hazard lighting on the new
26 towers would make it more of a visual focal point, however. Isolated residences on the west shore of
27 Little Cumberland Island would experience similar views. Overall, the visual impact on the viewshed is
28 moderate to high due to viewshed sensitivity.

29 *Deep Water Access Dock* is on the edge of the proposed Spaceport Camden property along Floyd Creek.
30 The dock would continue to support industrial uses at the site with deliveries of materials and launch
31 vehicle components, but no physical changes are proposed. Looking west from the dock, former
32 facilities and powerlines are highly visible, surrounded by a backdrop of forest in foreground. To the
33 north, viewers see the edge of forest, mostly planted pines. The forest blocks views to the proposed
34 Vertical Launch Facility site, but after construction, the tall lightning towers and water tower at this
35 complex would be highly visible from the dock (see Exhibit 2.1-2 and Exhibit 2.1-9 for location) and
36 locations along Floyd Creek and the Intracoastal Waterway further east. The industrial features would
37 contrast with the environment preferred for recreation and area visitors on the waterways. Considering
38 the mixture of uses at this observation point, the visual intrusion of the new towers would conform to
39 current anthropogenic features, but the change to the viewshed would be highly visible and contrast
40 with the existing viewshed. Overall, the impact on views at the dock and nearby waterways are
41 estimated as low to moderate due to relatively low numbers of viewers, existing modifications, and
42 foreground screening vegetation.

43 *First African Baptist Church* on Cumberland Island is surrounded by mixed forest with variable density of
44 understory vegetation that blocks views of the Spaceport Camden site. Viewers at this location may be
45 able to see the new towers on the Vertical Launch Facility. Due to the historic context, the viewing

sensitivity at this site is high. Overall the visual impact at this site and other locations on Cumberland Island away from the shoreline is low because views of the spaceport site are blocked.

I-95 Overpass from 10th Street is a typical road in the surrounding area. Exhibit 3.13-1, photograph M shows how bordering forests and vegetation limit the area visible to travelers along most roadways. Vegetation close to the viewer obstructs more of the viewer's cone of vision than when vegetation is further from the viewer. There may be direct line-of-sight from some southbound-oriented locations along I-95 from which the tallest structures on the proposed site (lightning towers with hazard lights and water towers) could be visible if the viewer/driver looked to the east. The viewshed sensitivity is relatively low, as the roadway modifies the natural context. At this location, there are no views to the Spaceport Camden site. Consequently, the visual impact from this location and most roadways in the area is low.

Ice House Museum on Cumberland Island, and nearby ferry dock for visitors to Cumberland Island National Seashore, has wide open views to the north and northeast over the salt marshes and water channels of the inner coastal shorelines. The viewshed sensitivity from the Cumberland Island National Seashore is high since visitors expect to find natural surroundings that are dominated by nature and some historic features. The proposed Spaceport Camden site is situated in the distance but the forested edges of the site would not be distinguishable from the overall low-lying band of forest canopies surrounding the marshlands along the edges of the mainland. After construction, the tallest towers on the site may be discernable if a viewer knows where to look, but would have little impact on the viewshed. Overall, the visual impact of the spaceport development is estimated as low due to distance.

Lodge at Cabin Bluff is a resort situated on the edge of the Intracoastal Waterway, due south from the proposed Spaceport Camden and Vertical Launch Facility. From the main lodge area, trees block views looking north towards the proposed Spaceport Camden. From the open fairways on the golf course and out in the waterway, a viewer may see the forest edges on the Spaceport Camden site. The viewshed sensitivity is moderate to high in this natural or landscaped setting where visitors expect attractive surroundings. After construction, viewers would likely be able to see the upper part of the tall towers on the Vertical Launch Facility from some locations at the resort, but forest vegetation would block views of most of the facilities. The proposed Alternate Control Center at the entry to the Spaceport facilities may also be visible from some locations. This facility is designed with an industrial and technological appearance that displays the spaceport image. Overall, the viewshed impact is low to moderate due to current context and the narrow viewshed, limited by foreground and middle-ground vegetation and structures.

NPS Cumberland Island National Seashore Visitor Center has no visual line-of-sight to the proposed Spaceport Camden site. Due to distance, vegetation, and intervening development, views to the site are blocked. Visitors may catch glimpses of launch events if directed where to look. Motion of the launch vehicle may assist in locating the launch trajectory. Launches may not be visible from distant locations during dense fog or low cloud cover conditions. Launch events may be of interest to many visitors and not perceived negatively. For some tourists and park visitors, viewing launches may provide a beneficial educational benefit, unique to the southeastern coastal region.

Residence west of proposed Spaceport Camden site is relatively close to the proposed Spaceport Camden property and is representative of typical views from residential enclaves in the area. The viewing experience from this site is similar to the Cabin Bluff site. The viewshed is mostly natural vegetation intermixed with planted forests, with clearing for rural residential enclaves. Forested lands provides a visual buffer, but where trees are cleared, a viewer may have line-of sight to the forested edges of the Spaceport Camden site. This location is relatively close to the proposed Spaceport Camden and taller structures at the Vertical Launch Facility would likely be visible above the surrounding forest

1 and contrast with the forest and scale of rural residential structures. Views would likely be narrow and
2 intermittent due to the pattern of forest in the surroundings. Overall, minor to moderate visual impacts
3 are anticipated for this location and other local residents to the west and south of the spaceport site.

4 *River Oaks and State Park at Harrietts Bluff*, located to the south, would limit visual access to the
5 Spaceport Camden site. Most of the residences in this location have views to the south, rather than to
6 the north, due to masking by surrounding vegetation. The visual setting is pleasing with a mixture of
7 natural vegetation, waterways, and residences along the shoreline. The visual context at this location
8 reflects transition from rural to suburban, with cellular towers and small commercial enclaves. The
9 viewshed sensitivity is low to moderate due to the presence of anthropogenic features. Overall, the
10 visual impact at the location is minor to moderate due to limited background views of the site and
11 existing modifications to the landscape.

12 *Satilla River Island Marsh State Natural Area* is very close (about 2 miles) to the Vertical Launch Facility
13 site with low-lying marsh in the foreground, allowing relatively wide unobstructed views from the
14 shorelines of the island. This site represents conditions along the Satilla River delta and other smaller
15 waterways adjacent to the north boundary of the site. The context is visually sensitive to change due to
16 its naturalness and protected status as a State Natural Area, NRI-listed river, and conservation status in
17 the Camden County UDC. The foreground vegetation is relatively low, allowing high visual access to the
18 edges of the Vertical Launch Facility site from the viewers on the island, boat operators along the Satilla
19 River, Floyd Cut and Floyd Creek, and viewers along the shores of these waterways. Forest around the
20 Vertical Launch Facility site would screen most of the facilities, but the tall towers would rise visibly
21 above the tree canopy. These towers would contrast strongly with the natural setting. Overall, the
22 visual impact at this observation point and along the nearby waterways is high due to its sensitivity and
23 proximity.

24 *Structure on Little Cumberland Island (east shore)* has wide views over the ocean and foreground natural
25 setting of the island, but no line of sight to the proposed Spaceport Camden site. The proposed
26 spaceport facilities would have no impact on viewing locations on the east side of the island or Long
27 Point on Cumberland Island National Seashore.

28 *Residences on Dover Drive* north of the Satilla River, have unobstructed views across the Satilla River and
29 low-lying salt marsh and estuarine wetlands to the Spaceport Camden site. Due to lack of any
30 appreciable elevation along the shoreline, current views towards the site are limited, and forest hides
31 most of the industrial features of the site. This would be similar after construction of the Spaceport
32 facilities, except for the tall towers and lighting at the Vertical Launch Facility. These would be
33 prominent at locations with unobstructed views, particularly due to their markings and lights. This
34 situation would be typical for several viewing locations to the north of the Spaceport Camden site on
35 Piney Bluff, and along the Satilla River. Because the current context combines rural residential
36 development and the natural context of the protected Satilla River corridor, the viewshed sensitivity is
37 moderate to high. Overall, the visual impact is moderate due to the distance from the site and existing
38 modifications in the foreground residential enclaves.

39 As noted above, the Spaceport facilities would contrast strongly with the surrounding vegetation. Solid
40 block massing of the buildings and the tall linear forms of the water tower and lighting structures at the
41 Vertical Launch Facility would contrast with surrounding vegetation and would dominate the visual
42 setting at each of the four discrete functional areas within the spaceport property. Appropriate
43 peripheral landscape buffering as required by the County would limit the visibility of most facilities from
44 the land-side of the property. Many visitors to the site may experience the visual aspect of the
45 spaceport positively due to the scientific and educational context.

1 Although there is mostly adequate vegetation to screen most of the proposed new facilities, future
2 development around the spaceport may result in clearing of forests. It is recommended that the site
3 development plans for each complex within the spaceport property provide a solid border of tall trees
4 and suitable understory to ensure a visual barrier to offsite viewers and activities (see mitigations in
5 Section 6.13, *Visual Effects*). This would reduce incompatibility between existing and future land uses,
6 particularly residential areas. This would also conform to the intent of the County's Ordinance for
7 maintaining attractive vegetated separations between industrial and other sensitive uses. It would also
8 benefit site security by reducing visual access to the site.

9 Overall, daytime views to the site are blocked by intervening vegetation and in some cases, minor
10 undulations in the terrain. Several shoreline locations (without nearby vegetation blocking the view)
11 have visual connection to the edges of the site but not the facilities within the site due to peripheral
12 trees and forest. Exceptions are the tall water and lightning towers at the Vertical Launch Facility that
13 would be visible from many locations. These features would range from highly to minimally noticeable
14 depending on distance to the viewer and size of the viewer's unobstructed cone of vision. Views from
15 nearby residences and waterways nearest the Vertical Launch Facility site have the highest potential for
16 visual impact from changes to the visual character from these features. It should be noted that weather
17 and atmospheric conditions (cloud cover, humidity) have a marked effect on visibility in the coastal
18 southeast region. Views and visibility are frequently obscured by these physical conditions.

19 **Light Emissions**

20 During construction, the majority of activity would occur during the day. Some construction may occur
21 at night, particularly during the shorter daylight hours in the winter. However, this would be an
22 infrequent and temporary occurrence and not typical of normal construction activities. Infrequent tasks
23 undertaken at night would require illumination. LED lighting for these tasks may be noticeable,
24 particularly if there is low cloud cover reflecting the light from the work site, causing localized sky glow.
25 More discussion of light emissions impacts follows in Section 4.13.1.2, *Operation*. For most of the
26 construction sites on the proposed Spaceport Camden site, vegetation would screen any light or direct
27 glare from neighboring properties. To ensure this, a Light Management Plan (developed by the
28 construction contractor) should specify lighting types and appropriate directional controls, lighting
29 types, and dimming mechanisms to minimize unnecessary light and light trespass outside of the
30 Spaceport Camden property. This is included as a mitigation measure in Section 6.13, *Visual Effects*. The
31 NPS, FAA, and Camden County should approve this lighting plan. Overall, only minimal light emissions
32 impacts on human activities and uses are anticipated during the construction phase.

33 **4.13.1.2 Operation**

34 **Visual Resources**

35 As described for the construction phase of the Proposed Action, offsite viewers would have limited
36 views into the functional areas due to intervening forest and vegetation. Day-to-day activities at the
37 ground level would be mostly unviewable except for the Visitor Center and the Alternate Control Center
38 at the entry to the proposed spaceport. In accordance with County ordinances, the spaceport site
39 development would incorporate suitable buffering landscaping where the existing vegetation is not
40 adequate to screen the facilities from offsite areas (see Section 4.13.1.1, *Construction*).

41 Site personnel would continue to augment traffic on local roads. While added traffic may annoy some
42 local residents, it would not modify the visual surroundings.

Launch and recovery operations would be visible in the surrounding areas due to the high altitude of the airborne components, above the elevation of any vegetative screening in most situations. Table 4.13-1 summarizes the visibility and visual impact of launch events at the 15 representative observation points. Due to their altitude, sound, and motion, launches would be visible from most local areas if the viewer is facing toward the trajectory pathway. The trajectories to the east would result in only a short window during which a launch vehicle is visible. These operations are temporary and sporadic and would not change existing landscapes; therefore they would not cause permanent visual impacts. The occurrence of a launch is inconsistent with wilderness values for naturalness and lack of any imprint of humans. However, launches would not cause any lasting imprint or permanent impairment to the Cumberland Island National Seashore (observation points 1, 4, 6, and 8). The associated issues for wildlife, coastal zone lands, historical resources on Cumberland Island National Seashore, and park visitors addressed in the appropriate resource sections of the EIS. As with viewsheds, weather conditions (low cloud cover, fog, high humidity) could partially or totally obscure the visibility of a rocket trajectory soon after takeoff.

The launches would be highly visible from most residences in the vicinity (observation points 3, 11, 1214, and 15) of the Vertical Launch Facility, particularly on Piney Bluff (observation point 15) and Jekyll Island (observation point 2). As described above, these would occur sporadically, and not impair the landscape. Recovery operations would be similar to a small aircraft landing. These operations would be infrequent and cause no change to views in the area. The temporary visibility of the rocket launch contrasts with the normal aspect of the sky and is identified as an impact. Some viewers would find this impact adverse to naturalness in this sensitive coastal area. Other viewers would find the events visually spectacular on an occasional basis and perceive them positively.

Of more concern is the potential for a launch event to startle or distract someone from a particular activity, such as driving on local roadways or working on a crane. Startle effects from witnessing a launch without prior expectations are usually a response to noise, but may have a visual component as well. Appropriate signage (with warning lights) along local routes and I-95, notices in local media, and published schedules of launch events can provide warning to drivers, local residents and visitors in the area to minimize startle effects and distraction.

For some persons and visitors to the area, launches could generate positive responses. Tourists and Cumberland Island National Seashore visitors may have an interest in viewing these intermittent events. Providing designated observation points to view launches could bring educational and scientific opportunities to the public. This can have associated economic benefits as well.

Retrieval of the first stage of the launch vehicle to the Landing Zone at the spaceport would occur soon after the launch and be of short duration. Viewers could view the aerial component in the air as it approaches the Landing Zone at the spaceport. It would have the same visual prominence as a small aircraft. Alternatively, the component may be delivered back to the site on a barge to the existing deep water dock. Since the dock would not undergo any modification, the visual impact of this facility would not change compared to the current situation. Since boat traffic and people would be evacuated from these waterways during the launch and recovery operations, the retrieval operations would be essentially unnoticeable.

Light Emissions

Light emissions can cause glare and sky glow. Glare from unshielded or misdirected light sources, whether direct or reflected, is rated as blinding (as the sun), disabling, or discomforting. Sky glow, caused by reflected light from illuminated surfaces or upward directed light, is reflected back to the

1 earth. Sky glow is seldom described as uncomfortable, but can cause indirect effects that are
2 bothersome, and potentially unhealthy.

3 As described in Chapter 2, *Proposed Action and Alternatives*, the four complexes would have area
4 lighting (for parking areas and pathways) and security/perimeter lighting. All external lighting would be
5 LED lighting. For typical non-launch weekday operations, external lighting would go into dim mode after
6 9 p.m., and security lights would only illuminate when triggered by a security alert after 9 p.m. The site
7 operator would consider using smart lighting measures to the extent practical and safe for spaceport
8 operations. For this evaluation, it is assumed that for launch operations, external lighting may be active
9 from dusk until dawn due to the potential for three-shift operations at all four facilities. This could
10 happen for one or two nights each month. During launches, area floodlights may be used at all four
11 complexes, but dimmable when appropriate. During a launch event, lighting at the launch pad is a
12 matter of safety and security, so safety rather than conservation would govern their use. As mentioned
13 in Section 2.1.1.6, *Infrastructure*, although dimmable, floodlighting at the launch pad would not meet
14 new IDA guidelines for blue-rich LED white lighting (IDA, 2016). In addition to functional lighting, the tall
15 water tower and lightning towers over 200 feet in height would have markings and lighting to identify
16 them as aerial obstructions. These lights would operate at all times. Additional parameters for site
17 lighting are described in the Biological Assessment provided in Appendix A, *Public Involvement/Agency*
18 *Coordination and Consultation*. A Lighting Management Plan will detail spaceport lighting (e.g., type
19 [wavelengths, etc.] and location of lights via a plan drawing of exterior lighting), timing and positioning
20 considerations for exterior lighting, measures to minimize light glow (shielding mechanisms, directed
21 lighting, etc.), and processes and procedures for lighting installation and management. These measures,
22 identified during consultation with USFWS, would minimize glare and sky glow, reducing impacts on
23 human and animal receptors (i.e., marine, terrestrial, and avian species.)

24 *Sky Glow*. As previously described, sky glow results from illuminated surfaces reflecting up into the
25 atmosphere. This means that all the area lighting is a potential light source for sky glow. Dimmable
26 fixtures and shut offs mechanisms would help to minimize the light intensity and duration of light
27 emanating upwards on normal (non-launch) nights. However, night radiance is generally measured as
28 an average over a period of time, so that lights during launch windows would contribute to the
29 Spaceport Camden sky glow footprint. Currently, the site has very low nighttime radiance. Nearby
30 locations within the rural setting are already producing radiance footprints (see Exhibit 3.14-4) within a
31 couple of miles of the site (see Section 3.13.3, *Existing Conditions*, and Exhibit 3.13-4). It is likely that the
32 Spaceport Camden would produce visible and measureable radiance during the operational phase to the
33 degree that it would measure above low on a nighttime radiance map that averages radiance data from
34 satellite imagery over time, such as the one in Exhibit 3.13-4.

35 For offsite viewers, sky glow from the site or other urban areas may appear as isolated brighter areas on
36 the horizon or in the sky canopy, with darker areas in between. This change would also likely appear as
37 a new measureable low intensity spot location on night radiance maps, surrounded by existing darker
38 areas. The amount of luminescence from the proposed site would likely be visible but not as bright as
39 from some of the larger urbanized areas along the seashore. From any viewing location, sky glow is
40 augmented under certain weather conditions such as low cloud cover, because light is reflected by cloud
41 and water particles in the atmosphere, and consequently is more visible than dispersed light that does
42 not reflect off a surface (in this case comprised of water particles). In the past, the proposed site
43 contributed to local sky glow from onsite manufacturing facilities and activities, as addressed in Section
44 5.3.13, *Visual Effects*; however, the current context at the site is relatively dark, so that new light
45 sources would appear as a noticeable change in current nighttime radiance level from the site. This

1 would range from minor to moderate depending on the distance of the viewer and humidity and cloud
2 conditions.

3 Sky glow is likely less annoying to nearby residents than glare, but would contribute to the eroding dark
4 skies in the region. The impact on dark skies would range from low to moderate in the local area,
5 depending on factors such as frequency of launch events, distance of the viewer, type of light fixture,
6 atmospheric haze or cloud cover. Sky glow effects would be greatest during infrequent nighttime
7 launches, and augmented by cloudy conditions. Many local residents value the quiet and dark
8 surroundings that still exist in the rural coastal areas of Georgia. Also, dark sky is a value promoted by
9 the NPS management policies. The depletion of darkness in the night sky is at odds with wilderness
10 values and the NPS responsibility to keep the imprint of man to a minimum. Because of the distance of
11 the launch site to Cumberland Island National Seashore, and the low frequency of night launch activities,
12 effects on dark skies would likely not rise to a level of substantial impairment. The color of LED lighting
13 has varying effects on sky glow and glare. High-color lights in the white and blue spectrum brighten the
14 night sky more than lights in the amber/yellow range. To minimize effects on human health and wildlife,
15 the IDA recommends using LEDs with a color spectrum below 3000 Kelvins (IDA, 2017a; 2015).

16 Overall, sky glow could cause moderate impacts to the sensitive dark sky character of sensitive and
17 protected coastal areas, and moderate to low impacts for the rest of the surrounding region. Effects of
18 light emissions on terrestrial, aquatic, and avian wildlife is addressed in Section 4.2, *Biological Resources*.

19 *Glare.* The area lighting at the four facility enclaves at the proposed spaceport may be on (without
20 dimming) from dusk to dawn for about one to two nights per month as part of pre-launch activities (for
21 an estimated 12 to 24 nights per year). Most of the site's outdoor lighting would not be directly visible
22 offsite due to surrounding barriers of vegetation that is higher than the near-ground level fixtures,
23 structures, and distance. However, residents in nearby locations may be annoyed by the glare of the
24 Vertical Launch Facility high wattage LED lighting and hazard lights on the lightning towers. The
25 spaceport would use FAA-compliant lighting fixtures for tall structures that would meet safety
26 specifications to minimize hazards to airborne navigation systems. Direct glare is incompatible with
27 some activities such as driving and aviation, depending on the intensity and precise location of the
28 viewer. The impact of glare could range from disabling to discomfort for the affected person. Glare can
29 be more disabling for older viewers (or drivers) since retinal light scattering increases with age making it
30 more difficult to discern objects. Light trespass in the form of direct glare on surrounding properties
31 could cause annoyance, particularly if it interfered with daily activities such as sleeping and use of
32 outdoor areas. Direct glare would be visible from the Cumberland Island National Seashore wilderness,
33 but at much lower intensity due to the distance from the light source and atmospheric absorption and
34 scattering of light. High intensity LED lighting, especially at the launch pad, would only operate during
35 launch windows, sometimes for up to a few days, but likely not more than a couple of nights each
36 month.

37 A report published by the IDA on the effects of blue-rich white outdoor lighting describes how glare
38 from LED lighting can produce feelings on a spectrum of discomfort. Individual responses may range
39 from mild, where a viewer may blink or avert their gaze, up to disability from blinding glare that reduces
40 visual performance (IDA, 2010a). Commonly noticed by most persons in the new blue-light headlights,
41 sources of intense light in the 350 to 450 nanometers range can be uncomfortable and cause physical
42 impacts on the lens of the eye, that cause it to fluoresce, resulting in a veiling luminance within the eye,
43 reducing visual acuity (IDA, 2010b). In this case, it is expected that the viewer would also avert their eyes
44 or fixate on the glare source. This response can be more exaggerated in aging eyes, and, therefore, older
45 drivers and viewers are more adversely affected. This impact on vision is a safety concern for drivers.
46 This ocular effect would also inhibit a person's ability to observe their surroundings and viewsheds.

1 Viewers at some locations in close proximity to the Vertical Launch Facility (up to 2 or 3 miles) where
2 there is no intervening vegetation could experience these effects from a direct source of glare from the
3 spaceport site (if unshielded). While residents can avert their eyes from the glare source, drivers or
4 navigators may be at risk if blinded by high wattage white LED lighting. Nonetheless, this impact could
5 adversely affect some residents in the area. Visual barriers (screens or vegetation) close to the affected
6 locations could provide the most effective method for managing direct glare. Since the impact is very
7 site and context-specific, it is difficult to identify the exact locations where the impacts may occur. In
8 addition, use of IDA-approved LED fixtures with the “Fixture Seal of Approval” and color temperature no
9 higher than 3000 Kelvins is a recommended mitigation measure (see Section 6.13, *Visual Effects*).

10 Both exterior and indoor lighting can create glare that attracts birds, causing collision with glass surfaces
11 of buildings. Conditions for bird collisions are highest during bird migration season in spring and fall,
12 and more pronounced for tall buildings. Lighting for onsite buildings and infrastructure will comply with
13 the Lighting Management Plan. Bird collision impacts are addressed in more detail in Section 4.2,
14 *Biological Resources*.

15 In addition to the measures proposed to minimize light emissions in Section 2.1.1.6, *Infrastructure*, and
16 the Biological Assessment provided in Appendix A, *Public Involvement/Agency Coordination and*
17 *Consultation*, additional mitigation measures are proposed in Section 6.13, *Visual Effects*, including the
18 preparation of a Light Management Plan by the site contractor that covers all the construction and
19 operational activities, light fixtures and luminaires, and lighting controls at the site. This plan should
20 undergo approval by relevant agencies, (e.g., NPS, FAA, USFWS, and Camden County) and use of Fixture
21 Seal of Approval approved fixtures that meet the IDA standards for outdoor LED lighting (IDA, 2015). The
22 proponent could also commit to a commissioning process to initially and periodically review all lighting
23 equipment to ensure it is functioning according to specifications, and monitor actual performance. This
24 should occur on a regular basis. During this process, the site manager can incorporate adjustments into
25 the plan using input from data collected onsite, and input other agencies and the public. The U.S. Green
26 Building Council LEED® program has developed methods and integrative process for the commissioning
27 of facilities.

28 Glare can also reflect off new buildings such as the Launch Control Center Complex (Exhibit 2.1-6) and
29 Alternate Control Center facility (Exhibit 2.1-7) that are depicted with large glazed exterior window
30 walls. The former building is mostly screened by forest vegetation, but the latter is planned for a more
31 open site. At certain times of day, these surfaces may reflect light. Depending on the orientation of
32 these facilities, some viewing locations offsite may experience glare from these structures at certain
33 times of day. To reduce this glare, non-reflective coatings, slight angling of the exterior panels and use
34 of shading systems with tracking devices can minimize glare and also help control bird strike.

35 Overall, glare from nighttime lighting could have high localized effects for viewing locations with
36 unobstructed views to site, particularly in the foreground and middle-ground distance. These are most
37 critical where they could impair task safety such as driving and boat/vessel operators along the
38 Intracoastal Waterway. Similarly, glare reflected off large glazed panels on buildings could cause glare at
39 certain times of day for specific viewing locations. Mitigation measures to address these impacts are
40 described above and in Section 6.13, *Visual Effects*.

41 **4.13.1.3 Impact Summary**

42 Overall, adverse visual impacts, ranging from low to high, may result from the visible changes from
43 construction of new facilities and light emissions at the proposed Spaceport Camden. The completed
44 facilities would mostly be screened and not visible from most offsite locations except at the Main Gate

1 and Visitor Center, where the facility displays its function to the public. The tallest tower elements of
2 the construction situated at the Vertical Launch Facility would rise above surrounding forest and
3 vegetation. These elements would be visible from several locations and from open waterways. These
4 structures would contrast with a back drop of surrounding forest or sky. Depending on the distance of
5 the viewer and atmospheric and weather conditions, these features would generally be visually
6 subordinate to the larger viewshed except from near and middle-distance locations. Notably, these
7 elements would be visible but not dominant in the viewshed from the western shoreline of the
8 wilderness areas on the Cumberland Island National Seashore. Because these towers would have hazard
9 lighting and markings, they could be annoying to some residents in proximity to the site and to persons
10 at locations where naturalness and dark skies are anticipated (such as local and Cumberland Island
11 National Seashore camping areas).

12 Lighting at the launch pad during the pre-launch and launch event would be noticeable at nighttime for
13 about one or possibly two nights each month on average. Depending on the direction of task lights
14 around outdoor work areas, light could be intrusive at nearby locations and could cause glare depending
15 on the exact position of the viewer. Glare can conflict with activities such as driving and aviation, and
16 residential outdoor activities. Further from the light sources, the intensity would diminish. Nighttime
17 area lighting 12 to 24 nights per year would contribute to local sky glow caused by reflected light into
18 the atmosphere. Intermittent effects of site nighttime lighting during launch windows on sky glow may
19 have temporary, moderate impacts on wilderness values for Cumberland Island National Seashore but
20 would not cause substantial or irreparable impairment to the wilderness due to distance and temporary
21 duration of nighttime lighting during launch windows. For day-to-day operations at the spaceport,
22 measures such as dimming and shut off would lessen the amount of light emissions from the site, and,
23 therefore, would contribute minimally to sky glow. Overall, the Spaceport Camden site would likely
24 create a measureable, small and isolated new spot location on night radiance maps in a currently dark
25 area (see Exhibit 3.13-4).

26 Through use of best practices for outdoor lighting described in Section 2.1.1.6, *Infrastructure* (such as
27 auto-shut offs and dimmers on area lighting and shielded and directed lighting), normal day-to-day light
28 emissions would not trespass outside the site. Light reflected off illuminated pavements and upward
29 from outdoor work areas may contribute to localized sky glow, particularly during times of low cloud or
30 high humidity. Due to the sensitivity of the viewshed and efforts of NPS to preserve dark skies for
31 protected lands (such as Cumberland Island National Seashore), proposed mitigation measures are
32 recommended in Section 6.13, *Visual Effects*, to further control the impacts of sky glow and glare.

33 **4.13.2 Ocean-Landing Only Alternative**

34 The visual impacts of this alternative would be similar to the Proposed Action, described in Section
35 4.13.1.1, *Construction*, and Section 4.13.1.2, *Operation*, above. Under this alternative, there would be
36 no Landing Zone or aerial recovery operations. For this alternative, the first stage of the rocket would
37 land in the ocean or, alternatively, get retrieved by a barge about 200 to 300 miles off shore. At this
38 distance, land-based viewers would be unable to see the ocean-landing operations. Should these
39 recovery operations attract recreational boaters into the vicinity of the barge to view the landing events,
40 the Safety Review Process and an Operations Safety Plan would address measures for controlling boats
41 in launch/landing mission hazard areas.

42 Use of a barge to bring the first stage back to the spaceport dock would be similar to delivery of
43 components and materials under the Proposed Action. Aerial and barge recovery operations considered
44 for the Proposed Action would not cause any visual impacts or effects on views. Therefore, the exclusion
45 of aerial recovery operations under this alternative would not change the findings of the analysis.

Overall, visual and light emissions impacts are minor to moderately adverse, similar to the Proposed Action, as stated in the Impact Summaries for Sections 4.13.1, *Proposed Action*, and 4.13.2, *Ocean-Landing Only Alternative*.

4.13.3 No Action Alternative

Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of Spaceport Camden and no spaceport facilities would be constructed. The property use would not change and the proposed construction and operations would not take place. Visual resources and light emissions would continue to be affected by ongoing baseline and future activities at or near the site, but no impacts resulting from spaceport development or operation would occur.

4.14 Water Resources

This section describes the potential impacts of the Proposed Action and alternatives on water resources (wetlands, floodplains, groundwater, surface water, and wild and scenic rivers) and identifies any associated permitting requirements for the Proposed Action and alternatives.

The impact analysis for water resources includes potential direct and indirect impacts. Direct impacts are impacts which are caused by the action and occur at the same time and place. Indirect impacts are later in time or farther removed in distance, but are still reasonably foreseeable.

Direct impacts were quantitatively evaluated when the amount of waters resources lost or used could be reasonably calculated. Quantitative analysis of direct impacts to wetlands, floodplains, and surface waters was conducted where permanent infrastructure would be built or where temporary construction related activities would occur. Impacts were identified by calculating the amount of surface water features that would be affected by these ground-disturbing activities under the Proposed Action and Alternative. Losses were calculated by overlying the proposed spaceport facility boundaries with field delineated wetland boundaries and surface water maps. Floodplain encroachment was evaluated by overlaying the facility boundaries with the 100 and 500-year preliminary FEMA Flood Insurance Rate Map boundaries. Groundwater drawdown impacts were assessed by comparing the authorized use rates of groundwater extraction wells on the property boundaries with the anticipated usage rate for the proposed spaceport facilities and operations. Indirect impacts were qualitatively assessed based on factors such as alterations of hydrology, sedimentation, new impervious surfaces, and petro-chemical spills.

4.14.1 Proposed Action

4.14.1.1 Construction

Wetlands

Up to 0.78 acre of the 3.61 acres of the wetland delineated in the vicinity of proposed construction areas, may be directly impacted as a result of the placement of fill material during construction and roadway improvements; this assumes that all optional/alternate roadways and sites are constructed as initially envisioned (Table 4.14-1; Exhibit 3.14-2).

The evaluation of wetland impacts was conducted using the full extent of potential impacts and alternate routes. Therefore, these wetland impacts are a conservative estimate based on a preliminary facility design. In some cases, such as the impacts to Wetland 10, the alternate route is not likely to be included in the final design. The footprint for actual impacts may be smaller, and the overall wetland

1 impacts may be less than 0.78 acre. The actual total extent of wetland impact will be determined during
2 final permitting and design. A Section 404 permit will be required from USACE prior to any work in the
3 jurisdictional wetland areas. Compensatory mitigation would be required for any unavoidable wetland
4 impacts (see Chapter 6, *Mitigation*).

Table 4.14-1. Delineated Wetlands

Wetland Area	Wetland Type	Total Acres in Field Survey Area	Estimated Impacted Wetlands (acres) (Proposed Action)	Preliminary Jurisdictional Determination ^a	WRAP Score
3A	PFO	0.184	0.043 (Regular Road)	Jurisdictional	0.72
3B	PFO	0.141	0.041 (Regular Road)	Jurisdictional	0.72
3C	PFO	0.477	0.081 (Regular Road)	Jurisdictional	0.72
3D	PFO	0.172	0	Jurisdictional	0.72
3E	PFO	0.366	0.134 (Regular Road)	Jurisdictional	0.72
6	PUB	0.002	0.002 (Vertical Launch Facility)	Jurisdictional	0.48
7	PEM	0.196	0.073 (Heavier Road)	Jurisdictional	0.65
9	PEM	0.121	0.015 (Heavier Road [Alternate Route])	Jurisdictional	0.65
10	PFO	0.644	0.267 (Heavier Road [Alternate Route])	Jurisdictional	0.63
11	PSS/PEM	0.082	0.012 (Heavier Road)	Jurisdictional	0.67
12A	PFO	0.048	0	Jurisdictional	0.63
12B	PFO	0.079	0	Jurisdictional	0.63
14	PEM	0.189	0.021 (Regular Road)	Jurisdictional	0.65
15	PEM	0.057	0.002 (Regular Road)	Jurisdictional	0.65
16	PFO/PSS/PEM	0.276	0.026 (Regular Road)	Jurisdictional	0.72
17	PFO/PSS/PEM	0.210	0.061 (Regular Road)	Jurisdictional	0.72
18	PFO/PSS	0.092	0	Jurisdictional	0.70
19A	PSS/PFO	0.078	0	Jurisdictional	0.70
19B	PSS/PFO	0.161	0	Jurisdictional	0.70
20	PFO	0.015	0	Jurisdictional	0.63
21	PEM	0.017	0.004 (Regular Road)	Jurisdictional	0.47
Total		3.61	0.78 acre		

Notes: CFR = Code of Federal Regulations; PEM = Palustrine Emergent, PFO = Palustrine Forested, PSS = Palustrine Scrub Shrub, PUB = Palustrine Unconsolidated Bottom; USACE = U.S. Army Corps of Engineers; USEPA = U.S. Environmental Protection Agency; WRAP = Wetland Rapid Assessment Procedure.

^a Jurisdictional refers to wetlands and surface waters that are considered *Waters of the United States*, as defined by Clean Water Act regulations (USACE at 33 CFR §328.3 and USEPA at 40 CFR §230.3). All wetland observed during the field surveys were determined to be jurisdictional by USACE (see Appendix H, *Wetland Delineation*).

5 A WRAP conducted during the wetland delineation documented the functional condition of the
6 wetlands (Table 4.14-1). The index score is shown in the “WRAP Score” column of Table 4.14-1 as a
7 number from 0 to 1. A higher WRAP index number represents higher functionality, whereas a lower
8 number represents poor functionality. Wetlands potentially filled during construction have WRAP
9 scores ranging from 0.48 to 0.72. Higher functioning wetlands included Wetlands 3, 16, and 17 which
10 were either forested wetlands (PFO) or partially forested (PFO/PSS/PEM) wetlands while the lowering
11 functioning wetland was a small pond (PUB).

12 Most of the impacted wetlands within the proposed construction areas would be partially filled. For the
13 area of wetland that is permanently filled, water quality, hydrology, and habitat functions would be

1 completely lost. The functions of the remaining wetland could be affected through the potential
2 alteration and degradation of wetland vegetation, which could affect wildlife use of the wetland area.
3 The remaining wetland area would also have a smaller storage capacity for overland runoff, resulting in
4 reduced water quality and hydrology functions. As shown in Table 4.14-1, the wetland acreage impacted
5 is a small percentage of the total wetland acreage within the proposed Spaceport Camden and is not
6 anticipated to result in a substantial loss of overall wetland functions.

7 Additional indirect impacts could occur to wetlands that are located immediately adjacent to
8 construction activities. These impacts could include sedimentation and slight alteration of hydrology.
9 Sedimentation and alteration in hydrology could affect vegetation by smothering plants and by changing
10 plant species composition if the wetland hydrology regime becomes wetter or drier; this would result
11 in a corresponding loss or alteration of wildlife habitat. Impacts are anticipated to be minor as the
12 hydrology of wetlands adjacent to proposed roadways has already been historically modified by those
13 roadways. Sedimentation would occur only in the areas bordering proposed construction projects and
14 implementation of erosion and sedimentation practices would minimize these impacts.

15 Construction equipment would be refueled at the construction site in designated construction staging
16 areas. These areas would not be located in wetlands, and it is unlikely that fuel spills would occur in a
17 wetland. All spills would be managed in accordance with spill plan and response requirements as
18 outlined in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*. Should a spill occur
19 in a wetland, then impacts would be dependent upon the amount of material spills and the effect of
20 cleanup efforts. Impacts could include loss or alteration of vegetation, which would impact the wildlife
21 habitat function of the wetland.

22 Indirect disturbance of wetlands could result in an increase in invasive plant species. Increases in
23 invasive plants could impair wetland functions by outcompeting existing native plants, which can result
24 in altered vegetation structure and reduction in plant species richness, and overall reduction in wildlife
25 habitat value.

26 **Floodplains**

27 The Vertical Launch Facility, Alternate Control Center and Visitor Center, and proposed roads would be
28 constructed in the 100 and 500-year flood zone (Exhibit 3.14-1). The Main Gate area of the Proposed
29 Action is also within the 500-year flood zone. Approximately 82 acres of proposed facilities would be
30 constructed within flood zones (19 acres in the 100-year flood zone, and 63.1 acres in the 500-year flood
31 zone). This represents 0.9 percent of the approximately 9,470 acres of flood zones within the ROI.

32 The Vertical Launch Facility is a critical facility under Camden County's definition in the County's UDC as
33 the facility would store and use flammable and volatile chemicals. Construction in the floodplain would
34 require an exemption to the County's UDC, which states that critical facilities shall not be constructed in
35 a flood plain. County development codes in this case are stricter than Federal guidelines, which under
36 EO 11988, Floodplain Management, states that agencies funding and/or permitting critical facilities are
37 required to avoid the 0.2 percent (500-year) floodplain or protect the facilities to the 0.2 percent chance
38 flood level. The storage of flammable and volatile chemicals at the Vertical Launch Facility would be
39 above the 0.2 percent base flood elevation.

40 Camden County is a participant in the National Flood Insurance Program and complies with the
41 standards of FEMA's National Flood Insurance Program regulations including the National Flood
42 Insurance Program criteria found in 44 CFR §60.3. The final design of the proposed facilities would
43 comply with Camden County floodplain regulations for construction in a floodplain and would require a
44 floodplain permit.

Construction in the floodplain would require the following general standards:

- Construction should be anchored to prevent flotation, collapse, or later movement of the structure.
- Construction should occur with materials and utility equipment resistant to flood damage.
- Construction should use methods and practices that minimize flood damage.
- Buildings should be elevated above the base flood elevation and buildings designs certified by a professional engineer as in compliance with the County standards.
- All heating and air conditioning equipment and components (including ductwork), all electrical, ventilation, plumbing, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
- New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.
- New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharges from the system into flood water.
- Onsite waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding.

Additional standards required for development in the floodplain can be found in the Camden County UDC, Article 11, Division 4 Flood Damage Prevention.

FAA determines significant floodplain encroachment by evaluating three possible flood related impacts, as described in DOT Order 5650.2. These impacts are (1) a considerable probability of loss of human life; (2) likely future damage associated with the encroachment that could be substantial in cost or extent, including interruption of service on or loss of a vital transportation facility; and (3) a notable adverse impact on “natural and beneficial floodplain values”. If significant floodplain encroachment occurs, then FAA is required to prepare a written finding of no practicable alternatives and confirmation that the action is applicable to all relevant standards.

The construction of the proposed Spaceport Camden within the 100- and 500-year flood zones would not pose a considerable probability of loss of human life. The proposed facilities are not designed as a human dwelling. The design of the facility would not prohibit people from leaving the area should a flood event occur. Road improvements in floodplains would most likely occur on the existing roads and would use existing culvert systems to minimize changes in floodplain hydrology.

Likely future damage associated with encroachment is not anticipated to be substantial or result in the loss of vital transportation facility because the proposed facilities would be constructed to be above base flood elevations and any facilities closures due to a 100-year or greater flood event would be temporary. Hazardous materials stored at the site would be stored in areas above the 500-year flood elevations to minimize potential impacts.

The Proposed Action is not anticipated to have a notable adverse impact on “natural and beneficial floodplain values.” Some minor benefits resulting from the filtering capacity of the floodplain and to wildlife habitat would be lost due to the proposed construction. These impacts are not considered significant as the habitat lost is not unique or rare and represents only a small percentage of similar habitat located within the floodplain. Similarly, the portion of the floodplain removed from performing a filtering function is a small percentage of the overall Satilla River floodplain and stormwater facilities

constructed as part of the planned facilities would restore some of this capacity. A small loss of flood storage capacity would also occur.

The Proposed Action would not result in significant floodplain encroachment as defined in DOT Order 5650.2. Alternatives to the Proposed Action were considered and it was determined that there are no practicable alternatives to the proposed location (see Section 2.4, *Alternatives Considered but not Carried Forward*). In accordance with DOT Order 5650.2, public notification of this potential floodplain encroachment was conducted as part of the scoping process and public release of this EIS.

Surface Water Resources

Approximately 1,043 linear feet of jurisdictional ephemeral streams could be impacted as a result of the Proposed Action (Exhibit 3.14-2). Table 4.14-2 summarizes the impacts to these resources by project facilities.

Table 4.14-2. Surface Water Impacts by Project Facilities

Ephemeral Stream	Disturbance	Acres in the Field Survey Area	Potentially Impacted Linear Feet	Acres
1	Landing Zone	0.152	660	0.1524
2A	Heavier Road	0.009	107	0.0069
2B	Heavier Road	0.003	53.962	0
3A	Heavier Road	0.007	109.492	0.0002
3B	Heavier Road (Alternate Route)	0.015	112.571	0.0062
	Total	0.159	1,043	0.166

Note: ^a Jurisdictional refers to wetlands and surface waters that are considered *Waters of the United States*, as defined by Clean Water Act regulations (U.S. Army Corps of Engineers [USACE] at 33 Code of Federal Regulations [CFR] §328.3 and U.S. Environmental Protection Agency at 40 CFR §230.3). Jurisdictional status is pending final USACE determination of these features.

As with wetland impacts, a conservative estimate was made, based on the preliminary facility design. To provide the conservative estimate, the entire facility area was used as the extent of potential impacts and alternate routes were considered in the stream impact total. In some cases, such as the impacts caused by the “heavier road (alternate route)” the alternate route is not likely to be included in the final design. The footprint for actual impacts is therefore anticipated to be smaller, and the overall surface water impacts may be less than those described. The actual total extent of stream impacts will be determined during final permitting and design. A Section 404 permit will be required from USACE prior to any work in jurisdictional surface waters. All of the surface waters shown in Table 4.14-2 are considered jurisdictional waters. Compensatory mitigation would be required for any unavoidable impacts to jurisdictional waterways (see Chapter 6, *Mitigation*). No direct impacts are anticipated to Floyd Creek in the vicinity of the deep water dock. No in-water dock improvements or modifications are planned at this time. Use of this dock or any work on the dock, including maintenance, must be coordinated with the Georgia Coastal Resources Division and USACE to obtain applicable permits/permissions (O.C.G.A. 12-5-280, *Coastal Marshlands Protection Act*, and O.C.G.A. 50-16-61, *Administrative Procedures Act/Revocable License Program*), to include a USACE Section 404 and Section 10 permit, and Coastal Marshlands Protection Committee permit.

Potential indirect impacts from proposed construction activities could result in additional sediment loads being transported to surface waters in the vicinity of proposed construction. Increased sedimentation would result in a short-term reduction in water quality through an increase in turbidity which may reduce sunlight to aquatic vegetation. Excessive sedimentation has the potential to cover

1 aquatic vegetation and reduce aquatic habitat by clogging waterways. During construction, an SWPPP
2 and sediment and erosion control plan would be prepared in compliance with Georgia NPDES
3 requirements and Georgia's Erosion and Sedimentation Act of 1975. The SWPPP and sediment and
4 erosion control plan would implement the use of management practices to prevent erosion and
5 sedimentation. Implementation of these management practices would minimize indirect impacts and no
6 significant adverse impacts to surface waters would be anticipated.

7 Construction equipment would be refueled at the construction site in designated construction staging
8 areas. These areas would not be located near surface water features, and it is unlikely that fuel spills
9 would occur in a surface water feature. All spills would be managed in accordance with spill plan and
10 response requirements as outlined in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution*
11 *Prevention*. Should a spill occur, then impacts would be dependent upon the amount of material spills,
12 distance from water resource, and the effect of cleanup efforts. Impacts could include degraded water
13 quality, which would impact the aquatic habitat and the loss of aquatic species due to exposure to
14 pollutants. Impacts would be short-term in nature.

15 Significant indirect loss of hydrologic function of streams is not anticipated from the project. For road
16 improvements that would occur on existing roads, the existing culverts would be extended as necessary.
17 Placement of a new culvert has the potential to restrict flow upstream of the culvert and increase the
18 width and depth of the stream downstream of the culvert. Therefore, construction of new roads, if
19 necessary, would include sufficient culverts to minimize impacts to floodplain hydrology.

20 **Groundwater Resources**

21 Potential impacts to groundwater are assessed if the Proposed Action could result in exceedances of
22 groundwater quality standards or contamination of the public drinking water supply. As described in
23 Section 3.14, *Water Resources*, groundwater in the ROI occurs in three main aquifers, two of which are
24 major sources of potable water.

25 Due to the depth of the Brunswick and Floridan aquifers potentially used for potable water in the ROI
26 (greater than 300 feet) and the confined nature of these aquifers, it is highly unlikely that proposed
27 construction activities would impact these aquifers. Two existing drinking water wells are located on
28 the site and withdraw water from the Floridan aquifer. No construction activities would occur in the
29 vicinity of these wells. Proposed construction activities would not occur in any areas in or near
30 waterbodies that have a direct, known relationship with groundwater recharge. As described in Section
31 3.14, *Water Resources*, groundwater recharge for the Brunswick and Floridan aquifers in the ROI occurs
32 outside of the ROI to the north and west. No impact to groundwater within these aquifers is anticipated
33 from construction-related activities.

34 Potential impacts to groundwater in the surficial aquifer from construction include contamination from
35 spills or leaks associated with construction vehicles and machinery. Fuels and other petroleum products
36 would be stored and transferred onsite during construction activities. As discussed in Section 4.7,
37 *Hazardous Materials, Solid Waste, and Pollution Prevention*, spill prevention plans would be in place to
38 minimize the potential for spills and to quickly clean up any spills that would occur.

39 As noted in Sections 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, and 3.14, *Water*
40 *Resources*, a number of contamination sites and potentially contaminated sites occur within the ROI.
41 Section 4.14, *Water Resources*, describes the construction-related impacts in these sites and the risk
42 minimization procedures (i.e., surveys) required to reduce impacts at these sites. Section 4.14 also
43 describes how these sites would be managed under the Georgia Brownfields Program. In this case, the
44 new owner (Camden County) would be responsible for soil and groundwater investigations and cleanup
45 of soil and source material to Georgia risk reduction standards.

Wild and Scenic Rivers

The closest Wild and Scenic River to the ROI is the Wekiva River in central Florida. Therefore no further analysis of wild and scenic rivers was conducted. The NRI lists the Satilla River as a river with potential outstanding resource values. No construction related impacts to the Satilla River are anticipated that would adversely impact this river system. The river is located more than 1 mile from proposed construction activities and the potential for the offsite migration of sediments would be low.

4.14.1.2 Operation

Wetlands

Operations of the proposed spaceport have the potential to impact wetlands through potential increases in stormwater discharges from new impervious surfaces and the potential for those discharges to carry pollutants. Increases in pollutants and stormwater discharges could potentially impact wetland function through the loss or alteration of vegetation and degraded wetland water quality. Stormwater retention has been built into the proposed spaceport facilities which will minimize changes in stormwater runoff. As discussed in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, spill prevention and hazardous waste management plans will be implemented to minimize the accidental release of pollutants that could then enter stormwater runoff.

Potential adverse impacts to wetlands associated with launch failures are considered unlikely. Should an accident occur, either on the launch pad, during ascent, or during recovery then it is possible that rocket propellant and payload fuel containers could fail and leak hazardous chemicals into wetland areas. These chemical could be released as direct spills or as burning byproducts. Direct spills and fire could result in the loss or alteration of vegetation and a corresponding loss of wetland habitat function. Chemicals that reach wetlands could also degrade wetland water quality. The degree and the scope of the impact and associated cleanup effort would be dependent on the type of chemical, weather conditions, the conditions of the accident, and type of wetlands impacted.

Floodplains

Operations of the proposed spaceport are anticipated to have minor indirect impacts on floodplains. Potential impacts could result from additional stormwater runoff from impervious surfaces at the spaceport facility locations. Stormwater retention has been built into the proposed spaceport facilities which will minimize changes in stormwater runoff.

Surface Waters

Operations of the proposed spaceport have the potential to indirectly impact surface waters through potential increases in stormwater discharges from new impervious surfaces and the potential for those discharges to carry pollutants. Increases in discharge could result in increased erosion, and increased pollutants could impair or degrade surface waters. Stormwater retention has been built into the proposed spaceport facilities which will minimize changes in stormwater runoff. As discussed in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, spill prevention plans will be implemented to minimize the accidental release of pollutants that could then enter stormwater runoff. The proposed Spaceport Camden will require an industrial stormwater permit in compliance with Section 402 of the CWA. This permit will include the creation of an SWPPP to control surface water runoff related to the operations of the spaceport.

Surface waters in the vicinity of the Vertical Launch Facility have the potential to be affected by the condensation of the vapor cloud resulting from the deluge water system. The vapor cloud resulting from

the use of liquid oxygen and RP-1 propellants would consist of water only and would not contain hazardous materials (U.S. Air Force, 2011). Deluge water that is not released in the vapor cloud would be captured in the retention basin at the Vertical Launch Facility. This water would be sampled and analyzed to determine if the water can be discharged under Georgia water quality standards. Should potential contaminants be present, then the water would be disposed of at an approved, offsite, industrial waste facility.

After launch the first stage of the rocket system could land at Spaceport Camden, on a barge in the Atlantic Ocean, or drop into the Atlantic Ocean. First stages that are dropped into the Atlantic Ocean may spill residual quantities of RP-1 and liquid oxygen. Larger quantities of RP-1 may form a film on the surface of the water which under the right conditions could inhibit oxygen from entering the water. The film would dissipate within hours (FAA, 1999). Liquid oxygen could have a localized impact on water temperature but it would be anticipated to rapidly volatilize into oxygen gas. The small volume of these chemicals in a large open water environment would be anticipated to have minimal impacts (FAA, 1999).

Potential adverse impacts to surface waters associated with launch failures are considered unlikely. Should an accident occur, either on the launch pad, during ascent, or during recovery then it is possible that rocket propellant and payload fuel containers could fail and leak hazardous chemicals into surface water resources. These chemical could be released as direct spills or as burning byproducts. Direct spills and fire could result in degradation of water quality through chemical contamination, thereby resulting in the potential for loss of vegetation, loss of wildlife, and a corresponding loss of the wildlife habitat. Some spills could be cleaned up, but the degree and the scope of the impact and cleanup effort would be dependent on the type of chemical, weather conditions, the conditions of the accident, and type of water resource impacted. Any launch/landing vehicle debris landing in tidally-influenced marsh or State waters out to 3 miles must be recovered when feasible and may require authorization from the Georgia Coastal Resources Division (O.C.G.A. 12-5-230, *Shore Protection Act*, and/or O.C.G.A. 12-5-280, *Coastal Marshlands Protection Act*, and/or O.C.G.A. 50-16-61, *Administrative Procedures Act/Revocable License Program*).

Groundwater

The operation of the proposed Spaceport Camden is anticipated to annually withdraw 16.3 million gallons of water. This is based on a nominal water usage of 11,500 gallons per day with peak usage of approximately 405,000 gallons per day (peak usage would be dominated by the activation of the water deluge system, which could use up to 250,000 gallons per launch). This represents less than 0.7 percent of the current annual groundwater withdrawals in Camden County (U.S. Geological Survey, 2010). The site is currently authorized to withdraw 1.7 million gallons of water daily from two existing groundwater wells.

Other potential impacts to groundwater during operations include contamination from spills or leaks of hazardous materials stored at the site. The impacts of these spills would be limited to the groundwater in the upper part of the surficial aquifer. Should a severe enough spill occur, then the groundwater in the vicinity of the spill could become contaminated, degrading the water quality in the vicinity of the spill. The confined nature and depths of the aquifers in the vicinity of the ROI limits the potential for spills to migrate into the lower portions of the surficial aquifer and to the Brunswick and Floridan aquifers. As discussed in Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, spill prevention plans and hazardous waste management plans would be in place to minimize the potential for spills and to quickly clean up any spills that would occur. Proposed storage of hazardous materials would not occur in any areas in or near waterbodies that have a direct, known relationship with aquifer recharge nor would storage of these materials occur in the vicinity of existing groundwater drinking wells.

As noted in Sections 3.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, and 3.14, *Water Resources*, a number of contamination sites and potentially contaminated sites occur within the ROI. Section 4.7, *Hazardous Materials, Solid Waste, and Pollution Prevention*, describes how these sites would be managed under the Georgia Brownfields Program. In this case, the new owner (Camden County) would be responsible for soil and groundwater investigations and cleanup of soil and source material to Georgia risk reduction standards. The depth and confined nature of the Brunswick and Floridan aquifer in the ROI make it unlikely that any contaminants in the soils would migrate to these aquifers.

An analysis of the potential effects of ground vibration on the landfill site located 1.65 miles from the launch site concluded that launches would result in peak ground accelerations (i.e., the maximum amount of ground shaking) equivalent to a minor earthquake (magnitude 3.9) and is approximately equivalent to vibrations produced by a passing truck (TetraTech, 2017). Vibrations at this level would not be anticipated to contribute to the migration of contaminants in the soil.

No significant adverse impacts to groundwater are anticipated from activities related to the operations of Spaceport Camden.

Wild and Scenic Rivers

The Satilla River is listed on the NRI. As described in the surface water section no significant adverse impacts to surface waters in terms of water quality are anticipated from construction activities and the normal operations of the spaceport. This would include adverse impacts to the Satilla River. Operational impacts to the Satilla River would primarily be related to noise and the possible impacts to recreational use of the river. As discussed in detail in Section 4.11, *Noise and Noise-Compatible Land Use*, individual noise events would temporarily alter the quiet setting that is a defining feature in surrounding areas (e.g., Satilla and Cumberland Island). Because the sound environment in noise-sensitive locations near Spaceport Camden would be unchanged during the vast majority of the year, current land uses (e.g., recreation, residences, commercial, etc.) would remain compatible.

4.14.2 Ocean-Landing Only Alternative

The landing zone laydown area and associated infrastructure would not be required under this alternative. Construction related wetland impacts would potentially be less (0.49 acre) than those described previously as no heavier road alternate route would need to be constructed from the landing zone area. Similarly surface water impacts would be less than those described previously as no impacts would occur to the surface water areas within the landing zone or along the heavier roads from the landing zone area. This would reduce the linear feet of stream impact by approximately 791 feet and the amount of floodplain impacted by approximately 0.11 acre. Other construction related impacts to floodplain and groundwater would be the same as those described previously under the Proposed Action. There would be no impacts to wild and scenic rivers.

Operational impacts to wetlands, floodplains, and surface waters would be the same in type as those described in the Proposed Action but would be reduced in scale. There would be less impervious surfaces and less stormwater runoff decreasing potential indirect impacts associated with stormwater runoff. Groundwater withdrawal rates would effectively be the same as those described under the Proposed Action and impacts to groundwater would be the same as those previously described. There would be no impacts to wild and scenic rivers.

1 **4.14.3 No Action Alternative**

2 Under the No Action Alternative, FAA would not issue a Launch Site Operator License for operation of
3 Spaceport Camden and no spaceport facilities would be constructed. The property use would not
4 change and the proposed construction and operations would not take place. No impacts are anticipated
5 to wetland, surface water resources, or floodplains as the property would remain in its current state.
6 Less groundwater would be withdrawn through the existing wells under the No Action Alternative.

5 CUMULATIVE IMPACTS

The CEQ regulations define a cumulative impact 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” (see 40 CFR §1508.7). Cumulative impacts can be viewed as the total combined impacts on the environment of a proposed action or alternative(s) and other known or reasonably foreseeable actions.

The depth of a cumulative impacts analysis is commensurate with the potential for significant impacts. Cumulative effects may occur when there is a relationship between a proposed action or alternative and other actions expected to occur in a similar location or during a similar time period. This relationship may or may not be obvious. The effects may then be incremental (increasing) in nature and result in cumulative impacts. Actions overlapping with or in proximity to a proposed action or alternatives can reasonably be expected to have more potential for cumulative effects on “shared resources” than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

5.1 Region of Influence

The ROI for the cumulative impacts analysis is the same ROI defined for the Proposed Action’s direct and indirect impact analysis for operations. Thus, the ROI is different for each resource category. Analysis is conducted by first identifying past, present, and reasonably foreseeable actions as related to the ROI for the particular resource. Cumulative impacts are then identified if the combination of proposed activities and past, present, and reasonably foreseeable actions interact with the resource to the degree that incremental or additive effects occur.

5.2 Past, Present, and Reasonably Foreseeable Future Actions

Past, present, and reasonably foreseeable future actions are considered in determining whether there are potential cumulative impacts. Actions can be initiated by any entity (i.e., other Federal agencies, State, tribal, or local governments, or private entities). In this EIS, FAA has made an effort to identify actions on or near the action areas associated with the Proposed Action that are under consideration and in the planning stage at this time. These actions are included in the cumulative analysis sections to the extent that details regarding such actions exist and the actions have a potential to interact with the Proposed Action and associated “shared” resources. Although the level of detail available for those future actions varies, this approach provides the decision maker with the most current information to evaluate the consequences of the alternatives. The EIS addresses cumulative impacts in order to assess the incremental contribution of the alternatives to impacts on affected resources from all factors.

Past actions are actions that occurred within or near the Proposed Action ROI in the past and may warrant consideration in determining the environmental impacts of an action. While not a comprehensive list of all past projects that have occurred within the region, FAA has identified the following past actions as representative and relevant to cumulative impact analysis within the context of this EIS, which include but are not limited to the projects described in following subsections.

Past Industrial Use of the Project Site

As discussed in Section 3.7.3, *Hazardous Materials, Solid Waste, and Pollution Prevention, Existing Conditions*, of this EIS, the proposed project site was previously used for industrial activity, including ship-building in the 1800s, production and testing of solid rocket motors in the early 1960s, the

1 manufacture of military hardware and supplies, including mortar ammunition, illuminating ordnance
2 devices (trip flares), tear gas, and assorted chemicals in the late 1960s–early 1970s, and Temik pesticide
3 manufacturing from the mid-1970s to 2012. Until 2015 the site contained industrial facilities associated
4 with the Temik manufacturing facility (see Appendix F, *Cultural Resources*, for detailed information
5 regarding historical context of the site). The proposed Vertical Launch Facility overlaps two historical
6 contamination sites, the MRA-2, also known as SWMU 9, and the Empty Drums Area. The proposed
7 Landing Zone overlaps two historical contamination sites, Loop Road Site and SWMU 6. The Proposed
8 Action also includes improvements to several existing roads. These roads traverse the following
9 historical contamination sites: MRA-1 (SWMU 8), MRA-2 (SWMU 9), Loop Road Site, and SWMU 6.

10 **Camden County Kings Bay Joint Land Use Study (2014)**

11 The Camden County Kings Bay Joint Land Use Study provides an overview and discussions about past
12 and present growth trends in the area and provides recommendations to ensure compatible land use
13 between the county and the military. The study established smart-growth land use and development
14 procedures for vacant and redevelopment sites near Kings Bay, identified existing and future non-
15 compatible uses and recommended mitigation measures for Naval Submarine Base Kings Bay, Camden
16 County, St. Marys, Kingsland, Woodbine and other appropriate agencies, and developed enhanced
17 communication and access management plans involving various highway and waterway linkages
18 between the community and the Naval Submarine Base Kings Bay.

19 **Closure of St. Mary's Airport**

20 In September 2017, the St. Marys airport was closed by FAA due to safety and security issues associated
21 with Naval Submarine Base Kings Bay. The public use airport, located approximately 2 miles north of the
22 central business district of St. Marys and 1 mile south of the naval base, covered an area of
23 approximately 286 acres and served an average of 10 aircraft operations per day. The City maintained
24 ownership of the land after the airport closed. A new replacement airport is expected somewhere in the
25 region; however, no specific plans have been developed at this time.

26 ***Present and Reasonably Foreseeable Actions*** are any other actions that are or have a reasonable
27 expectation of occurring within or near the Proposed Action ROI in the same general time frame as the
28 proposal or in the near future. Reasonably foreseeable future actions are actions that may affect
29 projected impacts of a proposal and are not remote or speculative. An action may be reasonably
30 foreseeable even in the absence of a specific proposal. However, future actions not grounded in
31 planning documents, projected development trends, or regional or local plans are typically considered
32 remote and speculative, and thus not analyzed. In addition, future actions may be considered
33 improbable or remote even though they have been mentioned in planning documents (e.g., general
34 statements about future growth opportunities and unrefined lists of potential projects). While not a
35 comprehensive list of all ongoing and potential future projects that are occurring or may occur within
36 the region, FAA has identified the following present and reasonably foreseeable future actions as
37 representative and relevant to cumulative impact analysis within the context of this EIS; these projects
38 include but are not limited to:

39 **Naval Submarine Base Kings Bay**

40 Naval Submarine Base Kings Bay is a significant economic contributor to the local economy. Naval
41 Submarine Base Kings Bay is a base of the U.S. Navy located adjacent to St. Marys. The base is the east
42 coast home port of the Ohio Class Submarine. Activities conducted at Naval Submarine Base Kings Bay
43 are anticipated to continue and expand into the future.

Residential Growth on Cumberland Island

The Camden County Planning Commission granted a hardship variance on December 7, 2016, which approved an 87-acre tract on Cumberland Island to be divided into a 10-lot subdivision. The private owner of the tract intends to build the lots for family members. The property is located adjacent to the Sea Camp Ranger Station and campground. The public had 30 days to appeal the decision. An appeal was submitted by conservationist groups on January 5, 2017.

Rezoning of St. Marys for Potential Barge Port

The St. Marys City Council approved rezoning of a former Durango-Georgia Paper Company site for the possible development as a logistics and industrial center and barge port. The barge port would be anticipated to result in employment gains from construction and operation of the port but also human health and environmental impacts from increased noise, air pollutants, and traffic amongst other environmental impacts.

Cumberland Island Fire Management Plan 2015

The Cumberland Island National Seashore Fire Management Plan “serves as a detailed and comprehensive program of action to implement fire management policy principles and goals, consistent with the unit’s resource management objectives” (NPS, 2015). The 2015 Cumberland Island National Seashore Fire Management Plan provides an update to the 2004 Fire Management Plan and includes more active fire management strategies including prescribed burning, wildfire managed for resource objectives and targeted herbicide use and also no longer bases management actions on the Hazardous Fuels Categorical Exclusion (NPS, 2015).

Ongoing Public/Commercial Use within the Operational ROI

Public and commercial use within the operational ROI includes use of the Intracoastal Waterway for recreational (boating, fishing, etc.) and commercial (tugboats, barges, etc.) activities, and use of Cumberland Island for recreational (camping, beach driving, etc.) activities. Commercial activities occur with the Greyfield Inn, which is a private business and is independent of the NPS. Other various activities within the operational ROI include recreational use of water bodies and state and local parks, industrial and commercial activities such as paper mills and various enterprises, as well as ongoing development in the area associated with economic and population growth. Future growth around the proposed Spaceport Camden site may occur should the proposal move forward. However, there is no information at this time available to provide any specific analysis.

Amateur Rocket Launches

The proposed spaceport site has recently been used for amateur rocket launches, in particular from private spaceflight startup Vector, which launched a 40-foot full-scale prototype of its Vector-R rocket in August 2017; the Vector-R is designed to carry very small payloads weighing up to 145 pounds into lower Earth orbit (this particular launch did not reach orbit). The launch did not require construction of any supporting infrastructure. A NOTMAR was issued by the Port of Charleston to advise mariners to exercise caution when transiting the vicinity of the Satilla River and Fancy Bluff Creek. FAA defines amateur rockets as unmanned rockets that (1) are propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less; and (2) cannot reach an altitude greater than 150 kilometers (93.2 statute miles) above the Earth’s surface.

Amateur launches do not require FAA licensing but do require authorizations/waivers per Chapter 31 Section 2 of FAA order 7400.2. Chapter 31 Section 2 part 3 of FAA order 7400.2 outlines the process by which the FAA Office of Commercial Space Transportation manages amateur rocket launches. The Office

of Commercial Space Transportation supports the waiver/authorization process by providing Air Traffic with the results of safety analyses and recommendations pertaining to proposed amateur rocket activities. FAA Order 1050.1F categorically excludes amateur rocket launch authorizations from the Environmental Assessment or EIS NEPA processes. Whether or not the Spaceport Camden is ultimately approved, amateur rocket launches may continue in the future provided that procedures outlined in Chapter 31 Section 2 of FAA order 7400.2 are followed.

Future Roadway Improvements

There are a number of large-scale roadway improvement/construction projects either currently underway or scheduled to begin in the near future throughout southeastern Georgia and northeastern Florida are listed below because of their potential to consume large amounts of energy or natural resources (asphalt and concrete) (Florida DOT, 2016; Georgia DOT, 2016):

- Interstate-85 Express Lanes Extension – addition of 10 miles of newly constructed toll lanes north of the existing I-85 Express lanes at Old Peachtree Road to Hamilton Mill Road in Gwinnett County
- Interstate-75 South Metro Express Lanes – addition of two reversible express lanes along I-75 south of Atlanta at State Road 155/McDonough Road to SR 138/Stockbridge Highway
- State Route 26/US 80 Projects – Relieve congestion, improve traffic conditions, and encourage transportation safety on the US 80 bridges and roadway between Tybee Island and the mainland. Renovate the Lazaretto Creek Bridge because of structural deficiencies
- State Route 400 Widening – Widen State Route 400 in Forsyth County from McFarland Parkway interchange to State Route 369/Browns Bridge Road
- State Route 200 Widening – Widen State Route 200 from Rubin Davis Lane to O’Neill Scott Road
- Interstate-285 and State Route 400 Improvements – Aid in reducing traffic congestion and improve safety in the area surrounding the I-285/SR 400 interchange in metro Atlanta
- Rome-Cartersville Development Corridor – Provide a direct connection between U.S. 411, at its interchange with U.S. 41 west of Cartersville, and I-75
- Interstate-16/Interstate-75 Interchange Project (Pleasant Hill Mitigation) – Reconstruction project to improve the safety of the corridor by widening and reconstructing I-75 from Hardeman Avenue to Pierce Avenue and I-16 from I-75 to Walnut Creek within the City of Macon

5.3 Cumulative Impact Analysis

5.3.1 Air Quality

Air quality changes over time with increasing/decreasing populations, industry, and other activities that result in air emissions. From a cumulative perspective, past activities do not impact current or future air quality, while present ongoing activities are captured in current air emission numbers represented in the baseline shown in Section 3.1.3, *Air Quality, Existing Conditions*. Depending on the timing of future improvement projects occurring in the surrounding community, incremental increases in air emissions would result from construction activities. However, impacts and emissions associated with proposed spaceport construction and operational activities would be minor and, when taken in context with future activities, emissions from several, simultaneous projects are not likely to result in temporary or

1 long-term combined emissions that would negatively affect county attainment status or otherwise
2 adversely affect regional air quality. Emissions associated with construction activities are short-term and
3 temporary. Operational activities would be approximately 12 per year, with these emissions being
4 temporary and associated with individual launches but occurring on an annual basis throughout the life
5 of the launch operator license. However, these emissions are unlikely to result in any cumulative
6 adverse impacts when considered with other activities within the region.

7 **5.3.2 Biological Resources**

8 As discussed in Section 4.2, *Biological Resources*, there would be some adverse impacts (e.g., permanent
9 loss of habitat from the facility and infrastructure footprints). The construction ROI was previously
10 disturbed from past industrial and development activities, with industrial activities ceasing in 2012, and
11 buildings having been removed as recently as 2015. Discontinuation of past industrial activities and
12 removal of buildings may have contributed to habitat and species growth at the site over the past
13 several years; however, currently the land area is mostly semi-improved with pockets of unimproved
14 land area, with bush hogging and other maintenance activities regularly occurring on the semi-improved
15 areas of the construction ROI. These gains may be offset in some manner by development and operation
16 of the spaceport, as regular industrial activity returns to the site.

17 Military development and recreational uses within the operational ROI would affect wildlife by
18 disturbing individual animals. Also, population growth, development, and continued military
19 requirements could lead to additional habitat loss or fragmentation. The Navy conducts various
20 operations at Kings Bay that generate noise, which can affect terrestrial and marine species. The
21 Proposed Action would add to this type of effect on biological resources associated with disturbance
22 from the presence of human activity and noise. Measures would reduce but not eliminate the potential
23 for cumulative impacts to biological resources. For these reasons, there would be cumulative impacts on
24 biological resources from additional human activity and noise associated with the Proposed Action when
25 combined with other present and reasonably foreseeable future actions within the operational ROI.
26 Significant cumulative impacts on biological resources are not expected.

27 **5.3.3 Climate**

28 Very minute emissions of GHGs would result from the Proposed Action (see Section 4.3, *Climate*);
29 emissions of this magnitude are not likely to have any impact on global climate change, sea level rise, or
30 any potential impacts of climate change. When considered with other projects in the area that
31 contribute to GHGs, the Proposed Action would be insignificant and is not expected to result in any
32 significant cumulative climate impacts. However, sea level rise and other climatological changes such as
33 increase in extreme weather events, may impact the Proposed Action in the coming years.

34 **5.3.4 Coastal Resources**

35 As discussed in Section 4.4, *Coastal Resources*, the Proposed Action would affect coastal resources by
36 increasing the amount of impermeable surface, adding new structures, generating noise, and increasing
37 lighting. Coastal resources in the operational ROI are currently affected by military, development, and
38 recreational uses. Population growth and continued military requirements would affect coastal
39 resources. Thus, the Proposed Action would result in cumulative impacts on coastal resources when the
40 impacts from the action overlap with impacts from other activities. This is expected to occur during
41 launch-related operations and the actual launches and landings. Therefore, cumulative impacts on
42 coastal resources would be temporary. No significant impacts on coastal resources are expected.

5.3.5 Department of Transportation Act, Section 4(f)

Cumulative impacts to Section 4(f) properties assessed in Chapters 3, *Affected Environment*, and 4, *Environmental Consequences*, may result from past, present, or reasonably foreseeable projects within the vicinity of the proposed spaceport. In general, ongoing economic development and continued activity, both recreational and commercial, in the area associated with the present and reasonably foreseeable actions described earlier in Section 5.2, *Past, Present, and Reasonably Foreseeable Future Actions*, could have an impact on identified Section 4(f) properties. For example, residential growth on Cumberland Island and continued development in the area have the potential for impacts on visual resources (see Section 5.3.13, *Visual Effects*, below), which in turn could affect Cumberland Island National Seashore (a Section 4(f) property). The same may be said for other present or reasonably foreseeable infrastructure or economic development projects, depending on the scope of the project and its vicinity to identified Section 4(f) properties. Ongoing public and commercial use of areas within the ROI also contribute to noise and visual effects to Section 4(f) properties, the extent of which is relative to scope and proximity of use.

As presented in the impact analysis in Section 4.5, *Department of Transportation Act, Section 4(f)*, FAA has made a preliminary determination that construction and operational activities associated with the Proposed Action would not result in a physical use or constructive use of any Section 4(f) properties in the ROI. Although the Proposed Action operations would result in noise and visual impacts, as well as periodic brief closures of some Section 4(f) properties, the Proposed Action would not result in substantial impairment of any Section 4(f) property. As a result, FAA does not anticipate that the Proposed Action would incrementally contribute to cumulative impacts that would result in substantial impairment of any Section 4(f) property, and any potential cumulative impacts on Section 4(f) properties associated with the Proposed Action would not be significant.

5.3.6 Farmlands

No impacts to farmlands have been identified; therefore the Proposed Action is not expected to contribute to any incremental impacts (beneficial or adverse) to farmlands associated with other activities within the region.

5.3.7 Hazardous Materials, Solid Waste, and Pollution Prevention

Under the Proposed Action there would be an increase in the quantity of hazardous and non-hazardous waste generated in the region. However, with the implementation of appropriate handling and management procedures for hazardous materials, hazardous wastes and solid wastes generated during the construction and operation of the facility, there would be no significant onsite impacts. Off-site impacts from disposal of spaceport-generated hazardous and non-hazardous waste would be negligible to minimal under the Proposed Action due to the small quantities of waste in comparison to waste disposal capacity available in the region. When past, present, and reasonably foreseeable projects are analyzed in conjunction with the Proposed Action, no significant adverse cumulative impacts are identified.

5.3.8 Historical, Architectural, Archaeological, and Cultural Resources

Overall, adverse effects resulting in impacts to historic properties related to the Proposed Action are likely to add to the cumulative impacts of other actions within the ROI and the region. Within the APE for direct impacts, adverse effects to the archaeological historic properties would be added to the overall loss of dateable sites from continued regional development. Mitigation actions as required by

Section 106 of the NHPA (which requires the proponent resolve the adverse effect through avoidance, minimization, or mitigation [36 CFR §800.6(b)]) provide some relief, but the nature of archaeological sites means that even with data collection, adverse effect to a site cannot be reversed. For architectural resources in the APE for direct effects, there would be no cumulative effect. Although the Anchor House ruins continue to deteriorate, as do the Charles Rinaldo Floyd Burial Site and the Floyd Family Cemetery, no other actions would further reduce these resources' contribution to the complement of this site type. Within the APE for audible and visual effects, although vegetation and other structures would block the view of structures at the spaceport from the High Point-Half Moon Bluff Historic District and the Main Road, visual and temporary noise intrusions (65- to 250-foot-tall structures and launch vehicles) would result in a cumulative effect on the viewshed and other aspects of the setting of historic properties in the Cumberland Island National Seashore. Visual and temporary noise intrusions are less likely to add to a cumulative effect to historic properties on Dover Bluff and Cabin Bluff due to the more modern setting of these areas.

5.3.9 Land Use

Because the property proposed for Spaceport Camden has historically been used for industrial purposes there would be no change in land use. The proposed spaceport would also not have any adverse land use impacts on the nearby communities of Woodbine, Kingsland, and St. Marys, Crooked River State Park, Naval Submarine Base Kings Bay, Jekyll Island, or Fort Clinch State Park on Amelia Island. No other past, present, or future actions have been identified that would have similar impacts as the Proposed Action to recreational activities at Cabin Bluff, portions of Cumberland Island National Seashore, Intracoastal Waterway users, and residents of Little Cumberland Island. Therefore, while there may be impacts to these areas as identified within Section 4.9, *Land Use*, the Proposed Action would not incrementally contribute to any cumulative impacts.

Cumberland Island Wilderness

All past and present actions with potential to impact wilderness qualities of Cumberland Island Wilderness are considered in the baseline description included in Section 3.9.3, *Land Use, Existing Conditions*. Untrammeled, undeveloped, and solitude and primitive or unconfined recreation qualities already experience some degree of degradation based on activities that currently occur within and around Cumberland Island Wilderness. As described in Section 4.9.1, *Land Use, Proposed Action*, untrammeled and undeveloped qualities of proposed Spaceport Camden activities would not be impacted; therefore, cumulative impacts to these qualities would not occur. However, proposed Spaceport Camden construction and operations would introduce stressors that would impact the natural and solitude and primitive or unconfined recreation qualities of wilderness, specifically noise and light emissions. Increased military operations at Naval Submarine Base Kings Bay, rezoning of St. Marys for a potential barge port, continuation of ongoing public/commercial uses, and amateur rocket launches would also contribute noise to the surrounding soundscape, resulting in similar impacts to the solitude and primitive or unconfined recreation quality as those described for the Proposed Action (Section 4.9.1, *Land Use, Proposed Action*). Impacts from anthropogenic noise sources outside wilderness would be short-term and minor. While visitors' perceptions of solitude may be temporarily degraded, cumulative impacts to solitude and primitive or unconfined recreation would not be significant. On the other hand, the *Cumberland Island 2015 Fire Management Plan* includes management considerations for Cumberland Island Wilderness. Some management actions may result in short-term impacts to the untrammeled quality; however, only the minimum necessary fire management actions would occur within wilderness that would protect and restore natural processes in wilderness. As a result, implementation of the Fire Management Plan is expected to enhance overall

wilderness character on the island in the long-term. Since the analysis in this EIS assumes that all wilderness qualities of Cumberland Island are weighted equally, short-term and minor to moderate impacts to two wilderness qualities from the Proposed Action and reasonable foreseeable future actions would not result in adverse cumulative impacts to the overall wilderness character of Cumberland Island.

5.3.10 Natural Resources and Energy Supply

Cumulative impacts to energy use and supply of natural resources could occur if projects near the proposed project area consume energy and/or natural resources.

In addition, there are many ongoing and future construction and renovation projects, both private and public, associated with private and economic development throughout the ROI. While the implementation of these projects would require use of natural resources and result in “cumulative consumption,” the Proposed Action is not expected to contribute in any substantive manner to adverse cumulative impacts to energy use and supply of natural resources. Resource providers are located throughout the state and beyond, and energy consumption associated with these projects would be expected to be short-term while development occurs. New facilities constructed over time would be more energy efficient, and energy providers plan for increased energy requirements over time.

5.3.11 Noise and Noise-Compatible Land Use

Impacts associated with noise resulting from construction and operational activities within the region would be as those identified in Section 4.11, *Noise and Noise-Compatible Land Use*. Construction and operational noise may result in incremental noise impacts depending on the timing of construction and operational activities in conjunction with other proposed future projects. Construction noise would be temporary, and given the current land use of the site, distance to sensitive noise receptors, and distance of the site from other proposed future projects construction noise would not be expected to result in any long-term adverse cumulative impacts. Operational noise would also be temporary, with noise associated with launches and testing occurring only during these activities. There may be short-term incremental noise increases during these operational activities if there are other noise generating activities within the ROI at the same time, such as those identified previously in this chapter. However, noise levels would return to baseline upon completion of the operational activity. As a result, any cumulative noise impacts would be short-term and temporary.

5.3.12 Socioeconomics, Environmental Justice, and Children’s Environmental Health and Safety Risks

Past and present actions include changes in industry and employment opportunities over time, resulting in population and economic trends. As described earlier, the site of the Proposed Action was previously used to support an industrial industry and a maximum of 500 employees during its peak in 1989 (more detailed information on historic context of the site is provided in Appendix F, *Cultural Resources*). Resources in the area were able to accommodate fluctuations in the industry and population and would be anticipated to be able to accommodate necessary resources for Spaceport Camden. Continued growth and development in the area would contribute to the local population and economy of Camden County. Construction employment provides temporary employment and income benefits for the duration of the activity but continued development maintains the level of construction related employment. Population growth and continued military requirements could lead to encroachment issues and compatibility issues amongst recreational and commercial users, and the military. Continued

1 cooperation from the State and local government, Federal agencies, and the public through Joint Land
2 Use Study programs, management plans and communication would minimize conflicts.

3 Reasonably foreseeable future actions include growing number of employment opportunities and
4 associated population and economic activity. Potential increases in residential growth on Cumberland
5 Island could result in more conflicts with Spaceport operations and residents. Opportunities such as the
6 barge port would continue to increase the population and potential employment and economic growth
7 in the area but also create additional environmental impacts and conflicts to natural resources and
8 recreational and commercial users, and place additional demands on public and financial services and
9 social conditions in the area. Any additional demands for emergency or fire services on the mainland
10 associated with spaceport operations combined with past, present, and future actions could create
11 longer emergency response times to areas on Cumberland Island. In addition to continued cooperation
12 among agencies and the public, advanced planning and notifications would further minimize conflicts.

13 **5.3.13 Visual Effects**

14 **Visual Resources**

15 In the foreseeable future, no other large-scale projects are anticipated for Camden County in the vicinity
16 of the spaceport site. It is likely that over time the area will experience residential developments on a
17 small scale in the rural areas and expanding out from nearby communities such as Woodbine and St.
18 Marys, and the bluffs, north of Satilla Creek. Other infrastructure may include road improvements and
19 additional cellular towers.

20 The proposed site was previously used for industrial uses by the Bayer Corporation prior to 2012.
21 During this phase of industrial use, the site had several industrial-scaled facilities, which have since been
22 demolished. Visually, most of these were not noticeable in the surrounding area due to vegetation
23 screening, with the exception of the 300-foot tall Temik manufacturing facility and a water treatment
24 plant. These taller structures were visible and prominent from some offsite viewing locations. Prior to
25 2012, these facilities were deconstructed and removed, and restoration structures, utility infrastructure,
26 roads, and concrete pads remain. The activities at the site during this era also produced light emissions
27 that in the past were noticeable sources of sky glow and glare.

28 The spaceport project would redevelop a previously used industrial site. This is a sound practice under
29 U.S. Green Building Council LEED® evaluative criteria, as it would minimize the expansion of the local
30 industrial footprint into new areas. Camden County would have permit authority for the spaceport and
31 other future development in the surrounding area under its UDC. Local ordinances would apply to the
32 construction and operations at the new spaceport and include standards for buffering industrial sites
33 from adjacent areas and avoiding specific sensitive areas. Following the intent of this code, future
34 development near the spaceport will also undergo site specific review and approval. This process can
35 address new situations as they arise, with amendments to the code as necessary, and inclusion of
36 appropriate measures to maintain visual compatibility near the spaceport site.

37 **Light Emissions**

38 The larger region (reaching about 25 miles around the site), includes radiance from urbanized areas,
39 including St. Simons and Brunswick to the north, Woodbine to the west, and Naval Submarine Base
40 Kings Bay, St. Marys, Fernandina Beach, and Yulee to the south. About 40 miles south, the suburbs of
41 Jacksonville generate urban radiance. The spaceport project would introduce light emissions into an
42 area that is dark and part of a valued viewshed for the Cumberland Island National Seashore.

1 The analysis of the proposal in Section 4.13.1, *Visual Effects, Proposed Action*, found that operation of
2 the spaceport may add to local sky glow and glare from the lighting infrastructure proposed for the site.
3 This current context of the site is relatively dark and unilluminated, although during its past use, the
4 industrial sites were illuminated. Current night radiance mapping shows the proposed spaceport site as
5 dark (see Exhibit 3.13-4), with isolated areas of night radiance in the surrounding region. Although the
6 spaceport may appear as a new local pocket of low-intensity night radiance, it would remain isolated.
7 However, this begins a trend for the eventual infill and overlap of pockets of night radiance as more
8 development occurs in the region. This effect is a long-term process. Efforts to shift industry use of
9 blue-rich white LED lighting to lighting with a warmer color spectrum is beginning and could interrupt
10 this trend (see mitigations in Section 6.13, *Visual Effects*).

11 Overall, considering, past, present, and reasonable future development expectations for the local area
12 and region, the visual changes of the new spaceport are within the historic footprint of anthropogenic
13 change. Nonetheless, the visibility of the proposed structures and associated lighting is not congruous
14 with the goals for sensitive viewsheds of the Cumberland Island National Seashore and the NPS goals for
15 maintaining a dark sky environment.

16 To minimize the erosion of the dark sky resource, a cooperative effort is recommended.

17 **5.3.14 Water Resources**

18 The cumulative impacts on water resources should take into account all surface-altering actions that
19 have occurred or are likely to occur within or adjacent to the ROI. The most frequent effect of surface
20 disturbance in this region is accelerated erosion and sediment deposition which may affect water
21 resources by contributing sediment, introducing contaminants, or increased flooding. Past industrial and
22 development activities at the site have influenced the current condition of water resources at the site.

23 The primary cumulative impacts on surface water and wetlands from reasonably foreseeable present or
24 future actions would result from any increase in the acreage of earthmoving activities and accelerated
25 erosion from infrastructure improvement projects that have the potential to increase sediment delivery
26 and surface water runoff downstream, or introduction of chemical contaminants into surface
27 waterbodies and wetlands. None of the projects listed in Section 5.2, *Past, Present, and Reasonably*
28 *Foreseeable Future Actions*, have the potential to interact with water resources in such a manner.

29 The primary cumulative impacts on groundwater from reasonably foreseeable present or future actions
30 would result from an increase to groundwater usage that would exceed the sustainable yield of the
31 groundwater source or contaminate the water supply. None of the projects listed in Section 5.2, *Past,*
32 *Present, and Reasonably Foreseeable Future Actions*, have the potential to interact with groundwater
33 resources in such a manner.

34 No significant adverse impacts are anticipated to water resources as a result of implementing
35 construction activities or operations at the proposed Spaceport Camden. Development activities require
36 permitting for both wetland and soil disturbance; the intent of these permitting requirements is to
37 ensure impacts to water resources are minimized or avoided to the extent practicable. A safety buffer
38 would surround the developed Spaceport Camden. No additional construction would occur in this
39 buffer area, further reducing the potential for erosion and sedimentation from future developments. As
40 a result, cumulative impacts resulting from implementation of the Proposed Action in conjunction with
41 past, present, and reasonably foreseeable future actions on water resources in the ROI are not expected
42 to be significant given permitting requirements.

6 MITIGATION

This chapter describes mitigation measures that may be implemented to avoid or minimize identified adverse impacts in Chapter 4, *Environmental Consequences*, associated with the Proposed Action. Some of these mitigation measures may be associated with permitting requirements (and in some cases exact mitigations would be outlined during the permitting process), while others may be associated with consultation with the USFWS and Georgia SHPO or recommended as part of impact analysis.

Mitigation measures to be implemented would be identified in the Record of Decision and incorporated into a Mitigation Plan that would indicate implementation and monitoring requirements, timelines for implementation, and roles and responsibilities with regards to mitigation measure implementation and monitoring.

6.1 Air Quality

While no significant adverse impacts to air quality have been identified, and no mitigation measures associated with operational activities for air quality are necessary, there are some mitigation measures that can be implemented to further minimize impacts from activities associated with construction, such as:

- Implementing dust abatement techniques (e.g., water application) on unpaved or vegetated surfaces to minimize airborne dust during construction
- Revegetating disturbed areas as soon as possible after disturbance, which could include interim revegetation along road beds, once heavy construction is completed
- Covering construction materials and stockpiled soils if they are a source of fugitive dust

Most of these mitigation measures are also tied to minimization of erosion and sedimentation and would likely be included in any NPDES permitting requirements.

6.2 Biological Resources

Through consultation with the USFWS and NMFS, an extensive list of conservation measures designed to avoid, minimize, and mitigate potential effects to biological resources was developed. These measures are identified in the ESA consultation documents in Appendix A, *Public Involvement/Agency Coordination and Consultation*. The conservation measures would be implemented through coordinated efforts of FAA, Camden County, and future spaceport users. Spaceport Camden would designate an employee or contractor as the Natural Resources Specialist who would be responsible for overseeing compliance with these conservation measures. The Natural Resources Specialist would be a biologist or have similar ecology or natural resources training. FAA would require compliance with these conservation measures as part of maintaining an active Launch Site Operator License.

The measures below are examples of those provided in the USFWS consultation provided in Appendix A, *Public Involvement/Agency Coordination and Consultation*, that would serve to avoid, minimize, and compensate for potential effects to biological resources due to the proposed construction and operation of Spaceport Camden:

6.2.1 Construction

1. Conduct pre-construction sensitive species and associated habitat surveys.

2. Develop a Protected Species and Habitat Management Plan to address sensitive species protection and habitat management at the Spaceport.
3. Develop a Lighting Management Plan in coordination with the USFWS and GDNR:
 - a. Minimize to the extent possible visibility of facility glow, sky glow, or direct light to wildlife.
 - b. Provide clear guidance to project and/or facility managers.
 - c. Consult with the IDA or another similar professional organization when developing the lighting design and management plan for Spaceport Camden.
4. Develop a Wildland Fire Management and Burn Plan in coordination with the USFWS and GDNR at least six months prior to Spaceport Camden development.
5. Follow National Bald Eagle Management Guidelines (USFWS, 2007a):
 - a. A bald eagle nesting survey would be required prior to construction; if an active nest (i.e., nest with eggs or chicks) occurs within the construction ROI, then the nest would be protected until the chicks have fledged.
 - b. State and Federal permits for eagle take (disturbance) are required in order to avoid liability under the Bald and Golden Eagle Protection Act; Camden County is responsible for determining if a Bald and Golden Eagle Protection Act permit is necessary.
 - i. Construction would follow the guidelines for the Georgia Power Avian Protection Plan developed in coordination with the APLIC and USFWS (2005) to minimize impacts from power lines, unless structural or human safety would be compromised.
 - ii. The perimeter of all areas to be disturbed during construction or maintenance activities would be clearly demarcated using flagging or temporary construction fence (i.e., silt fence), and no disturbance outside that perimeter would be authorized, particularly in tidal flats. All access routes into and out of the proposed disturbance area would be flagged, and no construction travel outside those boundaries would be authorized. When available, areas already disturbed by past activities or those that would be used later in the construction period would be used for staging, parking, and equipment storage.
 - iii. Camden County would maintain clear shoulders on road edges to allow drivers to more easily see wildlife along the road edge and reduce incidents of vehicle/wildlife collisions.

6.2.2 Operations

1. Implement the Lighting Management Plan as part of standard operational activities.
2. Establish a prescribed fire program in the Wildland Fire Management and Burn Plan that details the frequency, timing, and location of prescribed burns to reduce potential wildfires.
3. Develop the proposed closure area in consultation with FAA, USFWS, GDNR, and NPS to ensure the Cumberland Island National Seashore and the Satilla River, Andrews Sound, and Cumberland River areas are properly secured, with minimal impact to USFWS, GDNR, and NPS activities and operations related to habitat and wildlife management.
4. Prior to static fire tests, launches, and landings, warning sirens may be employed to deter birds and minimize the probability of bird strikes. The launch team would also look for birds on the radar prior to liftoff, assuming primary radar is in use.

6.3 Climate

GHG emission reduction is not mandated and may not be possible in all situations. However, changes to more fuel efficient equipment, delay reductions, use of renewable fuels, and operational changes could serve to minimize GHG emissions.

With regard to impacts of climate change on the Proposed Action, ensuring critical facilities and storage areas are above flood level and that facilities are constructed to withstand severe storm activity would minimize any such adverse impacts.

6.4 Coastal Resources

No specific mitigation measures for coastal resources other than those identified for other resources throughout this chapter have been identified at this time. Any additional mitigation measures resulting from GDNR coastal consistency review will be included in the Final EIS.

6.5 Department of Transportation Act, Section 4(f)

No specific mitigation measures for Section 4(f) resources other than those identified for other resources throughout this chapter have been identified at this time. Section 4(f) compliance does not require that mitigation measures be developed unless the Proposed Action would result in a use of a Section 4(f) property. In such a case, and unless a feasible and prudent alternative can be identified that avoids the use of Section 4(f) properties altogether, Section 4(f) requires that the alternative with the least overall harm be selected after taking into consideration all possible planning to minimize harm and mitigate impacts. Because FAA has made the preliminary determination that the Proposed Action would not result in the use of a Section 4(f) property, no additional minimization or mitigation measures are required.

6.6 Farmlands

In the absence of any identified impacts to farmlands, no mitigation measures have been identified.

6.7 Hazardous Materials, Solid Waste, and Pollution Prevention

Containment areas surrounding the fuel storage tanks and any fueling facilities must be designed to ensure adequate containment or catchment of fuel so that tidal resources would not be impacted by a fuel spill (O.C.G.A. 12-8-60, *Hazardous Waste Management Act*).

Potential measures to mitigate impacts related to hazardous materials, solid waste, and pollution may include the following:

- Mitigation, monitoring, treatment and/or cleanup requirements applicable to prior or ongoing cleanup activities, as required through the Georgia Brownfields program
- Performing comprehensive surveys prior to construction to identify MEC-related hazards
- Educating workers on the potential for MECs, including how to recognize MECs and what procedures to apply in case MECs are encountered
- Employing signage and escorts to ensure that site visitors are not accidentally exposed to MECs

- Educating workers on the potential for contamination (stained/discolored soil, odors, sheen on groundwater, etc.) to be encountered during construction, including what procedures to apply in case contamination is encountered
- Developing a hazardous materials response plan and/or a SPCC plan to identify those precautions, training requirements, and response measures that would be taken to prevent and contain releases of hazardous materials
- Coordinating sweeps after each event, as part of security patrols by Spaceport Camden personnel during launches and landings, to recover materials that have been discharged from rockets
- Obtaining a hazardous waste generator operating permit from the Georgia Environmental Protection Division
- Employing source reduction strategies such as recovering, recycling, or composting waste materials
- Finding markets for recovered, recycled, or composted products, or other wastes that are usable for producing energy or other activities
- Recycling construction debris associated with the action
- Developing and incorporating an Environmental Management System
- Incorporating recommendations provided by Federal, State, tribal, or local agencies responsible for managing any known contaminated sites

6.8 Historical, Architectural, Archaeological, and Cultural Resources

Resolution of adverse effects to historic properties requires the avoidance, minimization, or mitigation of the adverse effects (36 CFR §800.6(b)). Where avoidance is not feasible, mitigation measures would be formalized in a Section 106 agreement document between FAA, the Georgia SHPO, and other parties as appropriate.

For historic properties, mitigations of adverse effects may take place at the location of the adverse effect, or at another location if all signatories to the Section 106 agreement document concur. Some or all of the following measures may be appropriate mitigations:

- Historic American Building Survey or equivalent documentation (for structures)
- Monitoring for damage from the proposed spaceport facility with any necessary repairs addressed according to the Secretary of Interior's Standards for the Treatment of Historic Properties (36 CFR Part 68)
- Interpretive display(s) at the proposed spaceport Visitor Center, or other appropriate location
- Ample notice of impending launches/landings and wet dress rehearsals and static firings to the NPS staff at Cumberland Island National Seashore
- Continued consultation with the SHPO and NPS to determine additional appropriate mitigation measures
- Preparation of new or updates to existing resource management plans for affected resources

- Phase II NRHP eligibility testing if construction will occur and sites cannot be avoided. If the sites are determined to be eligible for listing on the NRHP, then possibly require Phase III archaeological data recovery if the sites cannot be avoided by the proposed construction
- Data recovery excavations at an archaeological historic property, based on a research design, resulting in a technical study that documents the scientific data obtained

As discussed previously in Section 4.8, *Historical, Architectural, Archaeological, and Cultural Resources*, NHPA Section 106 consultation with the Georgia SHPO is currently ongoing (see Appendix A, *Public Involvement/Agency Coordination and Consultation*). Any additional mitigation measures for any potential adverse effect to cultural resources identified through agency consultation will be included in the Final EIS.

6.9 Land Use

Closures would be required as described in Section 4.9.1.2, *Land Use, Proposed Action, Operation*. The Georgia Coastal Resources Division recommends avoiding or minimizing launch operations that require closure areas on weekends, holidays, and during organized fishing tournaments in the vicinity, as well as posting closure dates/times at all public access points within 10 miles of proposed closure areas, including public boat ramps, 30 days in advance (O.C.G.A. 12-5-320, *Coastal Management Act*). Additionally, the Georgia Coastal Resources Division requests notification in writing of all launch operations that require public notification so that they may assist in alerting the affected public of upcoming closures. While there are no specific mitigation measures associated with land use, other mitigation measures identified under the resource sections within this chapter would apply to closures.

Cumberland Island Wilderness

Various measures have been developed for other resource areas that will serve to preserve Cumberland Island Wilderness character:

- As indicated in Section 6.2, *Biological Resources*, and Section 6.13, *Visual Effects*, a Light Management Plan will be developed and implemented to minimize light emissions and potentially reduce adverse impacts to the natural quality and visitors' perceptions of solitude.
- As indicated in Section 6.12, *Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks*, advanced public notice would be provided to inform wilderness visitors of upcoming closures and launch activities to minimize disruptions in visitors' wilderness experience.

6.10 Natural Resources and Energy Supply

Energy conservation measures could be incorporated into facility and infrastructure designs and operating standards for Spaceport Camden. Such measures could include the following:

- Following principles of environmental design and sustainability (including pollution prevention, waste minimization, and resource conservation) in project or program planning
- Incorporating into project design measures to provide more efficient cooling, heating and lighting
- Utilizing energy from renewable sources to the extent possible (i.e., solar paneling)

6.11 Noise and Noise-Compatible Land Use

Minimizing nighttime launch trajectories and trajectories over populated areas are measures that could be implemented to minimize and/or avoid noise annoyance impacts.

6.12 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

Recommended measures to minimize impacts include the following:

- Do not schedule launches/landings during special events, holidays, or other days of cultural significance.
- Do not schedule launches/landings with the 115-degree trajectory range during managed hunts on Cumberland Island. The hazard area range for the 115-degree trajectory encompasses a large portion (up to 50 percent) (NPS, 2018a) of the authorized hunting area and the Brickhill Bluff campsite, which is used during the six managed hunts held annually on Cumberland Island.
- Provide advanced public notice to minimize the impacts on commercial fishermen for waterway closures.
- Coordinate with the management of Cumberland Island and its campsites to minimize disruption to their operation.
- Coordinate, review, and update (as necessary) emergency response plans.
- Emergency response times could vary depending on tide conditions, availability of qualified personnel, and location of emergencies. To minimize potential emergency management situations on the Cumberland Island and Little Cumberland Island, emergency response resources and personnel should be readily available on the island and nearby to minimize response times.
- Secure funding sources for additional demand on public services and additional responsibilities of local, State, and Federal agencies.

6.13 Visual Effects

Recommended measures to minimize visual impacts and light emissions include the following:

- For protected species management, develop an Artificial Lighting Management Plan for Construction and Post-Construction (Operational) Phases for the proposed Spaceport. The plan should specifically address the use of LED lighting and promote the use of amber/yellow spectrum LED lighting (below 3000 Kelvins) as per 2014 IDA standards for blue-rich white lighting, when this does not conflict with mission-essential safety and performance. Other measures to consider in the development of the Light Management Plan include the following:
 - At a minimum, the construction contractor shall minimize project-related light and glare to the maximum extent feasible, given safety considerations. Color-corrected halide lights will be used. Portable lights will be operated at the lowest allowable wattage and height and will be raised to a height no greater than 20 feet. All lights will be screened and directed downward toward work activities and away from the night sky and nearby residents to the

1 maximum extent possible. The number of nighttime lights used will be minimized to the
2 greatest extent possible.

- 3 – Designs of structures associated with the entire project shall evaluate similar, local
4 structures with historic value or that are well-designed and use these features as design
5 precedent to develop designs that complement the natural landscape, are aesthetically
6 pleasing, and minimize the effects of visual intrusion of project facilities on the landscape.
7 Where no local design precedent exists, the designer shall research structure designs
8 outside the local area. At a minimum, new structures shall be painted with a shade that is
9 visually cohesive with the general surrounding area. Colors will be chosen from the U.S.
10 Department of the Interior BLM Standard Environmental Colors Chart CC-001: June 2008.
11 The building designer shall employ the use of color panels evaluated from key observation
12 points during common lighting conditions (front versus backlighting) to aid in the
13 appropriate color selection. Panels will be a minimum of 3 by 2 feet in dimension and will be
14 evaluated from various distances, but within 1,000 feet, to ensure the best possible color
15 selection. Color selection will be made for the coloring of the most prevalent season, and
16 the intent is to match the panels to this surrounding coloring and pick a color that best fits.
17 If the color selection is between two or three colors on the Standard Environmental Colors
18 Chart, then it is suggested that one of the darker shades be selected. Choosing a shade that
19 is darker will allow the surface to recede and blend within the visual landscape whereas a
20 lighter color advances or is more apparent within the visual landscape. Therefore, coloring
21 shall be slightly darker unless aesthetic design treatments indicate another color selection is
22 appropriate with the intent to specifically improve aesthetics. Refer to
23 [http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management](http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/technical_information.html)
24 [practices/technical_information.html](http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/technical_information.html) for more information on this technique and other best
25 management practices and techniques for visual screening. All paints used for the color
26 panels and structures shall be color matched directly from the physical color chart, rather
27 than from any digital or color-reproduced versions of the color chart. Paints shall be of a
28 dull, flat, or satin finish only. Appropriate paint type shall be selected for the finished
29 structures to ensure long-term durability of the painted surfaces. The appropriate operating
30 agency or organization shall maintain the paint color over time. Concrete or shotcrete
31 structures that are highly visible to the public shall implement aesthetic design features such
32 as mimicking natural material (e.g., stone or rock surfacing) and integral color, in the same
33 theme, to reduce visibility and to better blend with the landscape. Tall vertical structures
34 shall be of a material or color that helps surfaces to blend better with the surroundings.
35 They shall be constructed with low-sheen and non-reflective surface materials to reduce
36 potential for glare, and the use of glossy paints or surfaces should be avoided.
- 37 – All artificial outdoor lighting will be limited to safety and security requirements, designed
38 using Illuminating Engineering Society's design guidelines, and in compliance with IDA-
39 approved fixtures. All lighting is designed to have minimum impact on the surrounding
40 environment and will use downcast, cut-off type fixtures that are shielded and direct the
41 light only towards objects requiring illumination. The lowest allowable wattage will be used
42 for all lighted areas and the amount of nighttime lights needed to light an area will be
43 minimized to the degree possible. Light fixtures will have non-glare finishes that will not
44 cause reflective daytime glare. Lighting will be designed for energy efficiency and have
45 daylight sensors or be timed with an on/off program. Lights will provide good color
46 rendering with natural light qualities with the minimum intensity feasible for security,
47 safety, and personnel access. Lighting, including light color rendering and fixture types, will

be designed to be aesthetically pleasing. LED lighting will avoid the use of BRWL lighting and use a correlated color temperature that is no higher than 3000 Kelvin, consistent with the IDA's Fixture Seal of Approval program (IDA, 2010a; 2010b; 2015).

- Minimize potential for glare reflected off glazing on the new facilities through use of non-reflective coatings, orientation of the glazing, or use of sun tracking shading devices.

- Develop Site Revegetation and Landscaping Plans for each complex and the overall site that responds to the specific context of facilities and provides an appropriate landscaped buffer with trees and understory vegetation to fully screen views from offsite locations to the extent possible, particularly from the east and Cumberland Island. In developing this plan, the site contractor should coordinate with local residents, businesses, and highway department planners during the spaceport's post-construction commissioning phase to identify glare hotspots and devise appropriate site-specific visual screening or warning systems.

- The Site Revegetation and Landscaping Plan would address establishing new vegetation on areas that are disturbed and cleared during construction (such as stockpiling areas and vehicle maneuvering areas) and augmenting the overall appearance of the Spaceport property, as per the following guidelines:

- One hundred percent of the species composition of open space areas will reflect species that are native and indigenous to the project region. The species list should include trees, shrubs, and an herbaceous understory of varying heights, as well as both evergreen and deciduous types. Plant variety will increase the effectiveness of revegetated areas by providing multiple layers, seasonality, diverse habitat, and reduced susceptibility to disease.
- Under no circumstances will any invasive plant species be used at any location.
- The construction contractors shall use native grass and wildflower seed in erosion control measures where such a measure would improve aesthetics. Wildflowers will provide seasonal interest to areas where trees and shrubs are removed or grading has occurred. Species shall be chosen that are native and indigenous to the area and for their appropriateness to the surrounding habitat. For example, upland grass and wildflower species shall be chosen for drier, upland areas and wetter grass species shall be chosen for wetland areas. If not appropriate to the surrounding habitat, wildflowers should not be included in the seed mix. Under no circumstances shall invasive plant species be used in any erosion control measures.
- Vegetation will be planted within two years following project completion.
- Design of the landscaping plan shall try to maximize the use of planting zones that do not need irrigation, such as seeding with a native grassland and wildflower meadow mix, and incorporate aesthetic features, such as a cobbling swales or shallow detention areas, that reduce or eliminate the need for an irrigation system.
- If an irrigation system is required, an irrigation and maintenance program will be implemented during the plant establishment period and carried on, as needed, to ensure plant survival.
- If an irrigation system is required, areas that are irrigated will use a smart watering system that evaluates the existing site conditions and plant material against weather conditions to avoid overwatering of such areas. To avoid undue water flows, the irrigation system will be

managed in such a manner that any broken spray heads, pipes, or other components are fixed within 1 to 2 days, or the zone or system will be shut down until it can be repaired.

- To the extent possible, use existing utility corridors on the site for new utility infrastructure.
- Review dark sky effects with the NPS periodically and consider using reasonable new measures to minimize light emissions that would not impair safety of launches.
- Use a commissioning process to rigorously check lighting equipment, monitor performance and make adjustments to onsite lighting in response to specific issues.
- Develop road signage with signaling on key roadways that alerts drivers during live launch windows.
- Develop designated launch observation points in the local area for the public, and use as an opportunity for education and outreach.
- Support efforts to aid impacted local residents or businesses to install site-specific screening or landscaping to shield any direct glare caused by Spaceport lighting. This may include reimbursing cost of materials for qualifying projects.

6.14 Water Resources

Wetlands

Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill materials into waters of the United States, including wetlands. USACE issues permits for projects that will disturb waters of the United States. Permit applicants must show that steps have been taken to avoid impacts, that impacts have been minimized to the extent feasible, and provide compensation for any remaining unavoidable impacts. All three of these requirements are considered mitigation measures.

The Section 404 permit process is part of a regulated permit review process. An individual permit is required for potentially significant impacts. Individual permits are reviewed by USACE, which evaluates applications under a public interest review, as well as the environmental criteria set forth in the CWA Section 404(b)(1) Guidelines.

For most discharges that will have only minimal adverse effects, a general permit may be suitable. General permits are issued on a nationwide, regional, or State basis for particular categories of activities. The general permit process eliminates individual review and allows certain activities to proceed with little or no delay, provided that the general or specific conditions for the general permit are met. For example, minor road activities, utility line backfill, and bedding are activities that can be considered for a general permit. States also have a role in Section 404 decisions, through State program general permits and water quality certification. In Georgia, Section 401 water quality certifications occur jointly with the Section 404 permit application.

During the initial design phase of the Spaceport Camden, every effort was made to avoid siting facilities in waters of the United States. This effort will continue into the final design phase of the project. It is anticipated that some impacts to waters of the United States will be unavoidable and the project will require a Section 404 permit and compensatory mitigation.

In 2008, USEPA and USACE jointly promulgated regulations revising and clarifying requirements regarding compensatory mitigation. Compensatory mitigation means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and preservation of waters of the United

States for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved (USEPA, 2017f).

There are three mechanisms for providing compensatory mitigation (listed in order of preference as established by USEPA and USACE regulations): mitigation banks, in-lieu fee programs, and permittee-responsible mitigation (USEPA, 2017f).

Mitigation bank means a site where waters of the United States are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by USACE permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor (USEPA, 2017f).

In-lieu fee program means a program involving the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for USACE permits. In-lieu fee programs are similar to mitigation banks with slightly different rules governing the operation on use of mitigation banks (USEPA, 2017f).

Permittee-responsible mitigation means restoration, establishment, enhancement, and/or preservation activity undertaken by the permittee (or an authorized agent or contractor) to provide compensatory mitigation for which the permittee retains full responsibility (USEPA, 2017f). Mitigation measure requirements will be coordinated with USACE as part of the ongoing Section 404 permit process.

Floodplains

Impacts to floodplains would be mitigated by complying with the floodplain portion of the county UDC. All final designs will be approved by a professional engineer familiar with county requirements. These measures would include but may not be limited to the following:

- Minimizing fill requirements in the floodplain
- Construction controls to minimize erosion and sedimentation
- Facility design in compliance with County ordinances that require adequate flow circulation and preserve free, natural drainage

Surface Waters

Compensatory mitigation requirements described for wetlands would also apply for jurisdictional surface waters that are directly impacted by construction activities. Mitigation measure requirements will be coordinated with USACE as part of the ongoing Section 404 permit process.

Grading and excavation activities associated with construction have the potential to increase runoff, erosion, and sedimentation. Any potential impacts to surface water and groundwater would be prevented or minimized by implementing permit-related erosion best management practices during and after construction. Separate Georgia NPDES Construction Stormwater General Permit and land disturbance activity permits from Camden County would be required. Permit conditions would specify best management practices and mitigative measures required to prevent fugitive soil, sediment, and other potential contaminants from entering water bodies and wetlands. Such conditions could include minimization of earth-moving activities during wet weather/conditions, covering soil stockpiles, installation of silt fencing and sediment traps, and revegetation of disturbed areas with native plants as soon as possible to contain and prevent any offsite migration of sediment or eroded soils from the project areas.

- 1 The site drainage plan for the spaceport should provide effective engineering controls and adequate
- 2 naturally vegetated buffers around unused wetlands to prevent any soil, sediment, or other potential
- 3 contaminants resulting from stormwater runoff from impervious surfaces (e.g., roads and roofs) from
- 4 entering these sensitive natural resources. Following construction, disturbed areas not covered with
- 5 impervious surfaces would be reestablished with appropriate vegetation and native seed mixtures and
- 6 managed to minimize future erosion potential.

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7 UNAVOIDABLE ADVERSE IMPACTS, IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES, AND SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

As required by 40 CFR §1502.16 of the CEQ regulations, FAA must identify any irreversible or irretrievable commitments of resources, which would be involved in the Proposed Action or reasonable alternative(s), should they be implemented. An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed. Examples include permanent conversion of wetlands and loss of cultural resources, soils, wildlife, agricultural production, or socioeconomic conditions. Irreversible is a term that describes the loss of future options. It applies primarily to the impacts of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over long periods of time. Irretrievable is a term that applies to the loss of production, harvest, or use of natural resources. For example, if farm land is used for a non-agricultural event, some or all of the agricultural production from an area of farm land is lost irretrievably while the area is temporarily used for another purpose. The production lost is irretrievable, but the action is not irreversible.

Implementing the Proposed Action or Ocean-Landing Only Alternative would require a commitment of natural, physical, human, and fiscal resources. In all of these categories, irreversible and irretrievable commitments of resources would occur, with these commitments similar in nature across both alternatives. While the land area under consideration is currently designated as an industrial site, with a closed landfill operating under a RCRA post-closure care permit and MECs areas on the Union Carbide Corporation property, land required for new construction would be irreversibly committed during the functional life of the facilities. In some cases land uses would change from unimproved/semi-improved to improved but for the most part designation as an industrial site would remain. Although it is possible for land to revert to its former state if the facilities were abandoned and destroyed, the likelihood of such an occurrence for established facilities would be low.

Considerable amounts of fossil fuels and construction materials such as steel, cement, aggregate, and bituminous material would be expended under the action alternatives. However, these physical resources should generally be in sufficient supply during the proposed project that their commitment would not have an adverse effect on the resources' local, regional, or national continued or future availability.

Some biological resources would be irreversibly and irretrievably lost with construction of the proposed project, and some areas of wildlife habitat would be lost. However, based on the amount of actual construction footprint compared to the amount of buffer area and remaining open areas at and surrounding the launch site, the loss would be minimal. Significant or sensitive habitat areas would be avoided to the extent practicable, and impacts to sensitive species would be mitigated as discussed in the EIS and ESA Section 7 consultation.

In terms of human resources, labor would be used in preparation, fabrication, and construction related to the project. Labor is generally not considered to be a resource in short supply, and commitment to the project would not have an adverse effect on the continued availability of these resources. Project construction would require a substantial expenditure of funds. It is anticipated that businesses, employees, and residents of the local area would benefit from improved economics resulting from implementation of the Proposed Action or Ocean-Landing Only Alternative.

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5 Kings Bay, GA 31547	48 Eric Somerville
6 U.S. Department of the Navy	49 Regulatory Specialist
7 C. R. Destafney	50 61 Forsyth Street, SW
8 Regional Environmental Director	51 Atlanta, GA 30303
9 PO Box 30A / NAS JAX Building 903	52 <u>U.S. Fish and Wildlife Service</u>
10 Jacksonville, FL 32212	53 U.S. Fish and Wildlife Service
11 U.S. Department of the Navy	54 Coastal Georgia Sub Office
12 Omarr Tobias	55 Robert Brooks
13 NAVFAC SE PWD Kings Bay, GA Naval	56 4890 Wildlife Drive, NE
14 Submarine Base	57 Townsend, GA 31331
15 Kings Bay, GA 31547	58 U.S. Fish and Wildlife Service
16 <u>U.S. Department of the Interior</u>	59 Georgia Ecological Services
17 U.S. Department of the Interior	60 Gail Martinez
18 75 Spring Street, Room 1048	61 4980 Wildlife Drive, NE
19 Atlanta, GA 30303	62 Townsend, GA 31331
20 U.S. Department of the Interior	63 U.S. Fish and Wildlife Service
21 Joyce Stanley	64 ESA - Section 7
22 Regional Environmental Protection Specialist	65 Bill Wikoff
23 75 Spring Street, Rm 1048	66 4980 Wildlife Drive, NE
24 Atlanta, GA 30303	67 Townsend, GA 31331
25 U.S. Department of Veterans Affairs	68 <u>United States Coast Guard</u>
26 Secretary of Veterans Affairs	69 Commander, Coast Guard Maritime Force
27 810 Vermont Avenue NW	70 Protection Unit, Kings Bay
28 Washington, DC 20420	71 Kevin Jones
29 <u>U.S. Environmental Protection Agency</u>	72 1063 USS Tennessee Avenue
30 U.S. Environmental Protection Agency	73 Kings Bay Base, GA 31547
31 Larry O. Gissentanna	74 United States Coast Guard
32 Regional Administrator, Region 4	75 Adam White
33 61 Forsyth Street, SW	76 100 W. Oglethorpe Ave. Ste 1017
34 Atlanta, GA 30303	77 Savannah, GA 31401
35 U.S. Environmental Protection Agency	78 <u>United States Marine Corps</u>
36 Gwen Keys-Fleming	79 William A. Drawdy
37 Regional Administrator, Region 4	80 Natural Resources and Environmental Affairs
38 Sam Nunn Atlanta Federal Center	81 Officer
39 61 Forsyth Street, SW	82 Marine Corps Air Station, Beaufort, SC
40 Atlanta, GA 30303	83 Mary Ryan
41 U.S. Environmental Protection Agency	84 Air Quality/NEPA Program Manager
42 Region 4	85 Marine Corps Air Station
43 Heather McTeer-Toney	86 Beaufort, SC 29904-5001

1 *Libraries, Educational Institutions*

2 Brunswick-Glynn County

3 St. Simons Public Library
4 Librarian
5 530 Beachview Drive #A
6 St. Simons Island, GA 31522

7 Librarian
8 208 Gloucester Street
9 Brunswick, GA 31520

10 Camden County, Georgia

11 Camden County School District
12 PO Box 1329
13 Kingsland, GA 31548

14 College of Coastal Georgia
15 1 College Drive
16 Brunswick, GA 31520

17 Augusta University
18 Stacey Bennetts
19 2500 Walton Way
20 Augusta, GA 309021

21 The University of Georgia, SBDC
22 David Lewis
23 Area Director
24 501 Gloucester Street, Suite 200
25 Brunswick, GA 31521

26 Augusta University
27 Jessica M. Reichmth
28 1120 15th Street
29 Augusta, GA 30904

30 Three Rivers Regional Library System

31 St. Marys Public Library
32 Librarian
33 100 Herb Bauer Drive
34 St. Marys, GA 31558

35 Camden Public Library
36 Librarian
37 1410 Highway 40 East
38 Kingsland, GA 31548

39 *Local Government*

40 Columbus, Georgia

41 Columbus Fire and Emergency Medical Services
42 R. Riley
43 Land
44 Deputy Director
45 Emerg Mgmt/Homeland Sec Division
46 Columbus, GA 31901

47 Brunswick, Georgia

48 Georgia Ports Authority
49 Mayors Point Terminal
50 Port of Brunswick, PO Box 1758
51 Brunswick, GA 31521

52 Naomi Atkinson
53 City Clerk
54 601 Gloucester Street
55 Brunswick, GA 31520

56 Johnny Cason
57 Commissioner
58 601 Gloucester Street
59 Brunswick, GA 31520

60 James D. Drumm
61 City Manager
62 601 Gloucester Street
63 Brunswick, GA 31520

64 Arne Glaeser
65 City Planner, Planning and Zoning
66 601 Gloucester Street
67 Brunswick, GA 31520

68 Felicia Harris
69 Mayor Pro Tem
70 601 Gloucester Street
71 Brunswick, GA 31520

72 Cornell Harvey
73 Mayor
74 601 Gloucester Street
75 Brunswick, GA 31520

76 Julie T. Martin
77 Commissioner
78 601 Gloucester Street
79 Brunswick, GA 31520

Spaceport Camden

1	Shauntae Walker	41	Jim Gant
2	Comm Dev Bk Grant Manager	42	Council Member Post 3
3	601 Gloucester Street	43	808 Devon Drive
4	Brunswick, GA 31520	44	St. Marys, GA 31558
5	Vincent Williams	45	John J. Holman
6	Commissioner	46	City Manager
7	601 Gloucester Street	47	418 Osborne Street
8	Brunswick, GA 31520	48	St. Marys, GA 31558
9	<u>Kingsland, Georgia</u>	49	John F. Morrissey
10	Downtown Development	50	Mayor
11	Patricia C. Jared	51	418 Osborne Street
12	PO Box 250	52	St. Marys, GA 31558
13	Kingsland, GA 31548	53	Robert L. Nutter
14	Planning and Zoning	54	Council Member Post 1
15	Ken Kessler	55	521 Moeckel Place
16	Director	56	St. Marys, GA 31558
17	PO Box 250	57	Elaine Powierski
18	Kingsland, GA 31548	58	Council Member Post 2
19	City Clerk	59	571 Cardinal Circle East
20	Linda M. O'Shaughnessy	60	St. Marys, GA 31558
21	PO Box 250	61	Allen Rassi Jr.
22	Kingsland, GA 31548	62	Council Member Post 5
23	Mayor	63	210 Overlook Lane
24	Kenneth E. Smith	64	St. Marys, GA 31558
25	PO Box 837	65	David Reilly
26	Kingsland, GA 31548	66	Council Member Post 4
27	Terry R. Smith	67	1062 Greenwillow Drive
28	Fire Chief	68	St. Marys, GA 31558
29	595 E. King Ave.	69	Peggy Trader
30	Kingsland, GA 31548	70	Chair, Historic Preservation Commission
31	City Manager	71	418 Obsborne Street
32	Lee H. Spell	72	St. Marys, GA 31558
33	PO Box 250	73	Linda P. Williams
34	Kingsland, GA 31548	74	Council Member Post 6
35	<u>St. Marys, Georgia</u>	75	703 Bealey Street
36	Community Development	76	St. Marys, GA 31558
37	Jeffrey S. Adams	77	<u>Woodbine, Georgia</u>
38	Director	78	Rob Baird
39	418 Osborne Street	79	Councilor
40	St. Marys, GA 31558	80	310 Bedell Avenue
		81	Woodbine, GA 31569

1 M. Lynn Courson
2 City Clerk
3 310 Bedell Ave, PO Box 26
4 Woodbine, GA 31569

5 Donald Harrelson
6 Councilor
7 310 Bedell Ave
8 Woodbine, GA 31569

9 C. C. Higginbotham, Jr.
10 Councilor
11 310 Bedell Ave, PO Box 26
12 Woodbine, GA 31569

13 Louise Mitchell
14 Mayor Pro-tem
15 310 Bedell Ave, PO Box 26
16 Woodbine, GA 31569

17 Steve Parrott
18 Mayor
19 310 Bedell Ave, PO Box 26
20 Woodbine, GA 31569

21 Ken Walker
22 City Administrator
23 310 Bedell Ave, PO Box 26
24 Woodbine, GA 31569

25 **Media**

26 St. Marys Magazine
27 Barbara Ryan
28 511 Osborne Street
29 St. Marys, GA 31558

30 Tribune & Georgian
31 Jill Helton
32 Publisher
33 PO Box 6960/206 Osborne Street
34 St. Marys, GA 31558

35 WABE
36 Molly Samuel
37 Reporter
38 740 Bismark Rd. NE
39 Atlanta, GA 30324

40 **Non-Governmental Organizations**

41 Camden Partnership
42 Sheila McNeil
43 President
44 531 North Lee Street
45 Kingsland, GA 31548

46 Camden Round Table (CRT)
47 Dave Southern
48 President
49 277 Osprey Circle
50 St. Marys, GA 31558

51 Coastal Georgia Greenway
52 Gray's Reef National Marine Sanctuary
53 Becky Shortland
54 Resource Protection Coordinator
55 10 Ocean Science Circle
56 Savannah, GA 31411

57 Georgia Conservancy
58 Altamaha Riverkeeper
59 Joni House
60 President
61 PO Box 4122
62 Macon, GA 31208

63 Georgia Conservancy
64 Charles McMillan
65 428 Bull Street
66 Savannah, GA 31401

67 Little Cumberland Island
68 Russell L. Regnery
69 4090 Livesey Road
70 Tucker, GA 30084

71 National Parks Conservation Association
72 Emily A. Jones
73 Sr. Program Manager, Southeast Region
74 4707 Skyline Dr.
75 Knoxville, TN 37914

76 One Hundred Miles
77 Megan Desrosiers
78 PO Box 2056
79 Brunswick, GA 31520

1 One Hundred Miles
2 Kelly Patton
3 Program Associate
4 PO Box 2056
5 Brunswick, GA 31520

6 Satilla Riverkeeper
7 Ashby Nix Worley
8 PO Box 697
9 Woodbine, GA 31569

10 Southern Environmental Law Center
11 Helen Barnes
12 Associate Attorney
13 Ten 10th Street NW, Suite 1050
14 Atlanta, GA 30309

15 Southern Environmental Law Center
16 Gil Rogers
17 Ten 10th St.
18 Atlanta, GA 30309

19 St. Simons Island
20 Administrative Offices
21 1505 Richmond Street
22 Brunswick, GA 31520

23 St. Simons Island
24 Phil Fortune
25 2700 Marquis One Tower
26 Atlanta, GA 30303

27 The Georgia Conservancy
28 Robert Ramsay
29 President
30 817 West Peachtree Street, Suite 200
31 Atlanta, GA 30308

32 The Jekyll Island Authority
33 A. Richard Royal
34 Chairman, Board of Directors
35 100 James Road
36 Jekyll Island, GA 31527

37 Wild Cumberland
38 C. Ruckdeschel
39 PO Box 7080
40 St. Marys, GA 31558

41 ***State Agencies***

42 *Coastal Regional Commission of Georgia*
43 Coastal Regional Commission of Georgia
44 Allen Burns
45 Executive Director
46 1181 Coastal Drive SW
47 Darien, GA 31305

48 Coastal Regional Commission of Georgia
49 Colleta Harper
50 1181 Coastal Drive SW
51 Darien, GA 31305

52 *Georgia Department of Community Affairs*
53 Georgia Department of Community Affairs
54 60 Executive Park South, NE
55 Atlanta, GA 30329

56 Georgia Department of Community Affairs
57 Deatre Denion
58 60 Executive Park South, NE
59 Atlanta, GA 30329

60 Georgia Department of Community Affairs
61 Saralyn Stafford
62 Division Director
63 60 Executive Park South, NE
64 Atlanta, GA 30329

65 Georgia Department of Community Affairs
66 Adriane Wood
67 60 Executive Park South, NE
68 Atlanta, GA 30329

69 *Georgia Department of Natural Resources*
70 Georgia Department of Natural Resources
71 254 Washington Street SW, Ground Level
72 Atlanta, GA 30334

73 Georgia Department of Natural Resources
74 Non-Game Conservation
75 2070 US Hwy 278, SE
76 Social Circle, GA 30025

77 Georgia Department of Natural Resources
78 Historic Preservation Division
79 2610 Georgia Highway 155, SW
80 Stockbridge, GA 30281

1 Georgia Department of Natural Resources	42 Georgia Department of Natural Resources
2 David Crass	43 Mark Williams
3 Director, Historic Preservation Division	44 Commissioner, Office of the Commissioner
4 254 Washington Street SW	45 2 Martin Luther King Jr. Drive SE, Suite 1252
5 Atlanta, GA 30334	46 Atlanta, GA 30334
6 Georgia Department of Natural Resources	47 Georgia Department of Natural Resources
7 Dan Forster	48 Georgia State Parks
8 Director, Wildlife Resources Division	49 Bobby Wilson
9 2070 US Hwy 278, SE	50 One Conservation Way
10 Social Circle, GA 30025	51 Brunswick, GA 30152
11 Georgia Department of Natural Resources	52 Georgia Department of Natural Resources
12 Eddie Henderson	53 Spud Woodward
13 Director, Law Enforcement Division	54 Director, Coastal Resources Division
14 2070 US Hwy 278, SE	55 One Conservation Way
15 Social Circle, GA 30025	56 Brunswick, GA 31520
16 Georgia Department of Natural Resources	57 Georgia Department of Natural Resources, CRD
17 Duncan N. Johnson, Jr.	58 Karl Burgess
18 Chairman, Board of Directors	59 1 Conservation Way
19 2 Martin Luther King Jr Drive, Suite 1252	60 Brunswick, GA 31520
20 Atlanta, GA 30334	61 Georgia Department of Natural Resources, CRD
21 Georgia Department of Natural Resources	62 Bradley Smith
22 Becky Kelley	63 400 Commerce Center Drive
23 Director, Parks, Recreation and Historic Sites	64 Brunswick, GA 31523-8251
24 Division	65 <u>Georgia Department of Transportation</u>
25 2600 Hwy 155 SW, Suite C	66 Georgia Department of Transportation
26 Stockbridge, GA 30281	67 Engineering Division
27 Georgia Department of Natural Resources	68 600 West Peachtree NW, 25th Floor
28 Kelie Moore	69 Atlanta, GA 30308
29 Federal Consistency Coordinator	70 Georgia Department of Transportation
30 One Conservation Way	71 Hiral Patel
31 Brunswick, GA 31520	72 Director of Engineering, Engineering Division
32 Georgia Department of Natural Resources	73 600 West Peachtree NW, 25th FL
33 Tom Shillock	74 Atlanta, GA 30308
34 Floodplain Manager	75 <u>Georgia Emergency Management Agency</u>
35 200 Piedmont Ave SW, Suite 418	76 Georgia Emergency Management Agency
36 Atlanta, GA 30334	77 Jim Butterworth
37 Georgia Department of Natural Resources	78 Director
38 Judson H. Turner	79 935 E Confederate Avenue, SE
39 Director, Environmental Protection Division	80 Atlanta, GA 30316
40 2 Martin Luther King Jr Dr, Suite 1456	
41 Atlanta, GA 30334	

1 Georgia Forestry Commission

2 Georgia Forestry Commission
3 Robert Farris
4 Director
5 5645 Riggins Mill Road
6 Dry Branch, GA 31020

7 Space Florida

8 Space Florida
9 Dale Katchain
10 505 Odyssey Way
11 Exploration Park, FL 32953

12 Special Interest

13 Crooked River State Park
14 Joe Bradford
15 6222 Charlie Smith Sr. Highway
16 St. Marys, GA 31558

17 Historic Preservation Division
18 Georgia Council on American Indian Concerns
19 254 Washington Street SW, Ground Level
20 Atlanta, GA 30334

21 Crooked River State Park
22 Park Manager
23 6222 Charlie Smith Sr Highway
24 St. Marys, GA 31558

25 Gullah/Geechee Nation Headquarters
26 Post Office Box 1109
27 St. Helena Island SC 29920

28 State Historic Preservation Office

29 State Historic Preservation Office
30 Georgia Department of Natural Resources
31 Jennifer Dixon
32 Environmental Review and Preservation
33 Planning Program Manager
34 Historic Preservation Division

35 **State Government**

36 Florida

37 Florida Transportation Commission
38 Matthew D. Ubben
39 Executive Director
40 605 Suwannee Street, Mail Station 9
41 Tallahassee, FL 32399

42 Georgia

43 Georgia House of Representatives
44 Alex Atwood
45 300 Main Street, Suite 201
46 St. Simons Island, GA 31522

47 Georgia House of Representatives
48 John Corbett
49 607-E Cloverdell Legislative Office Building
50 Atlanta, GA 30334

51 Georgia House of Representatives
52 Mike Dudgeon
53 608-C Coverdell Legislative Office Building
54 Atlanta, GA 30334

55 Georgia House of Representatives
56 Jeff Jones
57 411-F Coverdell Legislative Office Building
58 Atlanta, GA 30334

59 Georgia House of Representatives
60 Brad Raffensperger
61 10335 Belladrum
62 Johns Creek, GA 30022

63 Georgia House of Representatives
64 Paulette Rakestraw
65 501-H Coverdell Legislative Office Building
66 Atlanta, GA 30334

67 Georgia House of Representatives
68 Jason Shaw
69 508-A Coverdell Legislative Office Building
70 Atlanta, GA 30334

71 Georgia House of Representatives
72 Jason Spencer
73 28 Yachtsman Court
74 Woodbine, GA 31569

75 Georgia House of Representatives
76 Bruce Williamson
77 PO Box 430
78 Monroe, GA 30655

79 Georgia State Senate
80 William T. Ligon, Jr.
81 421-C State Capitol
82 Atlanta, GA 30334

1 Governor's Office	41 Eastern Band of Cherokee Indians
2 Office of the Lieutenant Governor	42 Patrick Lambert
3 Casey Cagle	43 Principal Chief
4 Lieutenant Governor	44 PO Box 455
5 204 State Capitol	45 Cherokee, NC 28719
6 Atlanta, GA 30334	46 Eastern Band of Cherokee Indians
7 Governor's Office	47 Russell Townsend
8 Governor Nathan Deal	48 Tribal Historic Preservation Officer
9 206 Washington Street, 111 State Capitol	49 Qualla Boundary Reservation
10 Atlanta, GA 30334	50 Cherokee, NC 28719
11 <i>Tribal</i>	51 <u><i>Georgia Tribe of Eastern Cherokee</i></u>
12 <u><i>Cherokee Nation of Oklahoma</i></u>	52 Georgia Tribe of Eastern Cherokee
13 Cherokee Nation of Oklahoma	53 Georgia Tribe of Eastern
14 Bill John Baker	54 Cherokee
15 Principal Chief and THPO	55 PO Box 1915
16 PO Box 984	56 Cumming, GA 30028
17 Tahlequah, OK 74465	57 <u><i>Lower Muskogee Creek Tribe</i></u>
18 <u><i>Chickasaw Nation</i></u>	58 Lower Muskogee Creek Tribe
19 Chickasaw Nation	59 Marian S. McCormick
20 Virginia Nail	60 Principal Chief
21 Tribal Historic Preservation Officer	61 106 Tall Pine Drive
22 PO Box 1548	62 Whigham, GA 39897
23 Ada, OK 74821	63 <u><i>Miccosukee Tribe of Indians</i></u>
24 <u><i>Choctaw Nation of Oklahoma</i></u>	64 Miccosukee Tribe of Indians
25 Choctaw Nation of Oklahoma	65 Colley Billie
26 Gary Batton	66 Chairperson
27 Chief	67 PO Box 440021
28 PO Box 1210	68 Miami, FL 33144
29 Durant, OK 74701-1210	69 <u><i>Muscogee (Creek) Nation of Oklahoma</i></u>
30 Choctaw Nation of Oklahoma	70 Muscogee (Creek) Nation of Oklahoma
31 Ian Thompson	71 Rae Lynn Butler
32 Tribal Historic Preservation Officer	72 Tribal Historic Preservation Officer
33 PO Drawer 1210	73 PO Box 580
34 Durant, OK 74702-1210	74 Okmulgee, OK 74447
35 <u><i>Eastern Band of Cherokee Indians</i></u>	75 Muscogee (Creek) Nation of Oklahoma
36 Eastern Band of Cherokee Indians	76 Johnnie Jacobs
37 Mitchell Hicks	77 Tribal Historic Preservation Officer Manager
38 Principal Chief	78 PO Box 580
39 Qualla Boundary, PO Box 455	79 Okmulgee, OK 74447
40 Cherokee, NC 28719	

1 Muscogee (Creek) Nation of Oklahoma	44 Seminole Tribe of Florida
2 Emman Spain	45 James E. Billie
3 Tribal Historic Preservation Officer	46 Chairman
4 PO Box 580	47 6300 Stirling Road
5 Okmulgee, OK 74447	48 Hollywood, FL 33024
6 Muscogee (Creek) Nation of Oklahoma	49 <u><i>The Chickasaw Nation</i></u>
7 George Tiger	50 The Chickasaw Nation
8 Principal Chief	51 Bill Anoatubby
9 PO Box 580	52 Governor
10 Okmulgee, OK 74447	53 PO Box 1548
11 <u><i>Poarch Band of Creek Indians, Alabama</i></u>	54 Ada, OK 74821
12 Poarch Band of Creek Indians, Alabama	55 <u><i>Thlopthlocco Tribal Town</i></u>
13 Stephanie Bryan	56 Thlopthlocco Tribal Town
14 Chairperson	57 Charles Coleman
15 5811 Jack Springs Road	58 Tribal Historic Preservation Officer
16 Atmore, AL 36502	59 PO Box 188
17 Poarch Band of Creek Indians, Alabama	60 Okemah, OK 74859
18 Robert Thrower	61 Thlopthlocco Tribal Town
19 Tribal Historic Preservation Officer	62 George Scott
20 5811 Jack Springs Road	63 Town King
21 Atmore, AL 36502	64 P.O. Box 188
22 <u><i>Seminole Nation of Oklahoma</i></u>	65 Okemah, OK 74859
23 Seminole Nation of Oklahoma	66 <u><i>United Creeks of Georgia</i></u>
24 Alan D. Emarthle	67 United Creeks of Georgia
25 Tribal Historic Preservation Officer	68 565 Warwick Street
26 PO Box 1768	69 Atlanta, GA 30316
27 Seminole, OK 74868	70 <u><i>United Keetoowah Band of Cherokee Indians,</i></u>
28 Seminole Nation of Oklahoma	71 <u><i>Oklahoma</i></u>
29 Leonard M. Harjo	72 United Keetoowah Band of Cherokee Indians,
30 Principal Chief	73 Oklahoma
31 PO Box 1498	74 Lisa LaRue-Baker
32 Wewoka, OK 74884	75 Tribal Historic Preservation Officer
33 Seminole Nation of Oklahoma	76 PO Box 746
34 Natalie (Deere) Harjo	77 Tahlequah, OK 74465
35 Tribal Historic Preservation Officer	78 United Keetoowah Band of Cherokee Indians,
36 PO Box 1498	79 Oklahoma
37 Wewoka, OK 74868	80 George Wickliffe
38 <u><i>Seminole Tribe of Florida</i></u>	81 Chief
39 Seminole Tribe of Florida	82 PO Box 746
40 Paul N. Backhouse	83 Tahlequah, OK 74465
41 Tribal Historic Preservation Officer	
42 30290 Josie Billie Highway	
43 Clewiston, FL 33440	

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