FINAL

ENVIRONMENTAL ASSESSMENT FOR EXPLORATION PARK- PHASE 1

for

Space Florida

and

Kennedy Space Center

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DYNAMAC® CORPORATION

FINAL ENVIRONMENTAL ASSESSMENT FOR EXPLORATION PARK- PHASE 1

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ABBREVIATIONS AND ACRONYMS

ac	acres
BMP	Best Management Practice
C	Celsius
Cal Tech	California Institute of Technology
CO	carbon monoxide
CatEx	Categorically Excluded
CCAFS	Cape Canaveral Air Force Station
CDSC	Communications Distributions and Switching Center
cm	centimeters
CNS	Canaveral National Seashore
CO	carbon monoxide
dBA	decibels, A-weighted
DoD	Department of Defense
E	Endangered
EA	Environmental Assessment
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EO	Executive Order
EPA	Environmental Protection Agency
F	Fahrenheit
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FHWA	Federal Highway Administration
FPL	Florida Power and Light
ft	foot/feet
gal	gallons
GPD	gallons per day
ha	hectares
HAP	hazardous air pollutant
HC	hydrocarbons
ISS	International Space Station
ISU	International Space University
in	inch
IRL	Indian River Lagoon
km	kilometers
KSC	Kennedy Space Center
kV	kilovolt
l	liters
LC	Launch Complex
LPD	liters per day
m	meters
mi	miles
MINWR	Merritt Island National Wildlife Refuge
MIT	Massachusetts Institute of Technology
MOU	memorandum of understanding

NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration
NO_2	nitrogen dioxide
NPS	National Park Service
NSR	new source review
O_3	ozone
OSHA	Occupational Safety and Health Administration
PAMS	Permanent Air Monitoring System
Pb	lead
PM-10	10-micron particulates
PSD	prevention of significant deterioration
SHPO	State Historic Preservation Office
SLF	Shuttle Landing Facility
SO_2	sulfur dioxide
SR	State Road
SSTO	single stage to orbit
STP	Sewage Treatment Plant
SWMU	Solid Waste Management Unit
T	Threatened
UMAM	Unified Mitigation Assessment Method
US	United States
USAF	United States Air Force
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAB	Vertical Assembly Building

EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321-4370d) and according to the Procedures of Implementation of NEPA for the National Aeronautics and Space Administration (NASA) [Title 14, Code of Federal Regulations, part 1216 subparts 1216.1 and 1216.3].

Purpose and Need

The Space Shuttle Program is scheduled to end in 2010, and NASA operations are expected to greatly decrease thereafter. The John F. Kennedy Space Center (KSC) and Space Florida (SPFL) have been exploring the expansion of facilities that would provide opportunities for increased participation by the commercial sector in supporting the nation's Vision for Space Exploration. Phase 1 of Exploration Park (Phase 1) will require construction of new facilities. The purpose of this EA is to document the potential environmental impacts from those changes and the activities associated with development of Phase 1.

Proposed Action and No Action Alternatives

The Proposed Action alternative and No Action Alternative were analyzed. Under the Proposed Action alternative, new facilities would be constructed on a site at the John F. Kennedy Space Center, Florida. The Phase 1 Park site would support four main focus areas: education, technology and innovation development, industrial application and space industry support services.

The No Action alternative states that development of Phase 1 and the associated construction would not occur.

Affected Environment and Consequences

KSC encompasses nearly 56,451 hectares (ha) [139,490 acres (ac)] on the east coast of central Florida. Approximately 3,035 ha (7,500 ac) of KSC are actively used to support space mission operations, with the remaining lands being managed by the U.S. Fish and Wildlife Service as wildlife habitat. Resources identified that could be impacted by the Proposed Action alternative include facilities and infrastructure (transportation, waste water, electricity and natural gas, communications, potable/fire water, and stormwater), air quality, land cover, wildlife, threatened and endangered species, cultural resources, geology and soils, noise, surface and groundwater quality, socioeconomics, and land use. Four classifications of environmental impacts were pre-determined, and the resources were evaluated in terms of these classifications: none (no impacts expected); minimal (impacts would not be expected, or are too small to cause any discernable degradation to the environment); minor (impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation); or major (impacts could individually or cumulatively be substantial).

Impacts from construction under the Proposed Action alternative were classified as minor in the categories of facilities and infrastructure, land cover, geology and soils, noise, surface water quality, socioeconomics, and land use. Construction would be expected to minimally impact transportation,

air, wildlife, threatened and endangered species, and groundwater quality; as these effects would be localized and temporary. Mitigation requirements for the loss of impacted vegetation would be planned during the permitting process. Cultural resources would not be impacted by the construction of the proposed Exploration Park Phase 1.

During its operational period, the Phase 1 project was expected to have a major impact on only one resource category, socioeconomics. Impacts from operations under the Proposed Action would be minor for facilities and infrastructure, land cover, and wildlife. Minimal impacts to air quality, threatened and endangered species, and surface and ground water quality would be expected from the operation of the proposed Phase 1 Park. Operations at the proposed Phase 1 site would not have any impact to geology and soils or noise.

Under the No Action alternative, socioeconomics and land use would be the only resources potentially affected. Construction of the Phase 1 business park would have a minimal impact on socioeconomics. Without the development and operation of the proposed Phase 1 Park, approximately 1,200 employment opportunities would not be created on KSC. Given the projected reduction in the total KSC workforce due to the end of the Space Shuttle Program, the loss of the potential new jobs associated with the Proposed Action would be considered a major impact. In terms of land use, the lack of utilization of the proposed site would have a minimal impact.

The Proposed Action alternative would not be anticipated to produce any consequences related to Environmental Justice as all activities are located away from population centers. The development of Phase 1 business park would not be expected to affect the surrounding communities any differently than the current programs at KSC.

1.0 INTRODUCTION, PURPOSE, AND NEED

NEPA 1969 as amended (42 United States Code [U.S.C.} 4321, *et seq*.), and related regulations and agency policies, direct all federal facilities to consider environmental consequences when planning for, authorizing, and approving federal actions. SPFL and NASA are collaborating on a proposed plan to develop a parcel of land for a space commerce and technology park to be known as Exploration Park.. This land would be developed as Phase 1 of Exploration Park. The parcel is owned by NASA KSC and would be leased to Space Florida (SPFL), which would develop the property and operate the park in partnership with the commercial sector. This EA is necessary to support NASA's compliance with NEPA, 40 CFR 1500-1508 and any other Federal or State environmental laws and regulations.

1.1 Background

NASA was created in 1958 to lead the nation's civilian space exploration and aeronautical technology development activities. It subsequently established a Launch Operations Center in Florida on Merritt Island during the 1960s (Figure 1-1). Today, it continues to operate KSC as the nation's primary Federal spaceport civil space activities. NASA operates the Space Shuttle Program, currently scheduled to retire in 2010, and is engaged in developing new capabilities to implement the Vision for Space Exploration (NASA 2004a). NASA also procures commercial launch services from providers for the launch of agency-developed and operated spacecraft aboard expendable launch vehicles (ELV) from a number of sites, including Cape Canaveral Air Force Station (CCAFS) adjacent to KSC.

Florida's Governor and Legislature created SPFL, at the time known as the Florida Space Authority (FSA), as a state government space agency in 1989. The mission of SPFL is to retain, expand and diversify the State's space-related industry. KSC is a major operational center within NASA for Space Shuttle, International Space Station (ISS), and Constellation Program activities. The purpose of developing Phase 1 of Exploration Park at KSC is to provide an ideally located site to enable commercial, research and development, and academic organizations to develop new, state-of-the-art facilities. These would help support the transition of the U.S. civil space program from Space Shuttle to Constellation Program activities. The Constellation Program is a component of NASA's Vision for Exploration, whose goals include the increasing support role for the private sector in long term space exploration and development activities (NASA 2004a). The development of Exploration Park Phase 1 would enable an increased diversity of activities associated with space research, technology, development, and operations to be located at KSC in close proximity to launch sites. These facilities would support and promote the expanded use of space and the development and application of new technologies useful in space and related activities.

During the late 1990s, NASA and SPFL collaborated to design and build a major new laboratory facility to support the scientific utilization of the International Space Station (ISS). The Space Life Science Lab (SLSL) was built on a 16 ha (40 ac) site on KSC adjacent to the newly proposed Exploration Park – Phase I (NASA 2000). The SLSL opened in 2003 and is anticipated to provide continued support for the long term research activities aboard the ISS and the ISS National Lab. Development of the parcel adjacent to the SLSL for other research, technology development, and commercial applications would help ensure maximum benefit from the unique capabilities of this world-class facility.

Between 2002 and 2005, NASA KSC and SPFL performed joint studies and site design activities to support the concept of developing a research and space commerce park then known as the International Space Research Park (ISRP). About 10 ha (25 ac) of the current proposed parcel was included in those studies and were anticipated to become a part of the park's long range build-out. The development of ISRP was intended to bring new research and development activities to KSC and further enable and promote Florida's space-related industries. From 2002 to 2004, NASA and SPFL conducted a joint Environmental Impact Study (EIS) of the 140 ha (345 ac) proposed ISRP property on KSC (NASA 2004b). Lands designated for ISRP were proposed to be developed in phases during a build-out anticipated to take approximately 20 to 25 years (NASA 2004b).

In 2006, the parcel now proposed as Phase 1 of Exploration Park was studied. NASA assessed 24 ha (60 ac) of land located adjacent to the ISRP for potential development (NASA Document KSC-TA-7926 ISRP Phase F Site Study, January 4, 2006). It was determined by the NASA Headquarters Environmental Office (Washington, D.C.) that a revision to the July 2004 ISRP EIS was not necessary for the additional boundary of Phase F (heretofore referred to as Phase 1). Rather, an EA would be sufficient to assess environmental impact concerns for the Phase 1 project. Hence, this EA is required prior to the proposed development of Phase 1 as one of the conditions of a NASA lease of the property to SPFL..

This EA will evaluate the environmental impacts of the Proposed Action: the development and operation of Exploration Park Phase 1 on KSC (Figure 1-2) and the surrounding area. However, as the impacts of the entire park project were assessed in the ISRP EIS, the primary focus of this Environmental Assessment will be the impacts related to developing the 40 additional acres of land not addressed in the original EIS. In addition, the No Action alternative will be analyzed in terms of the potential environmental consequences that may result if the proposed action is not recommended and present management of the land continues.

1.2 Federal Agency Involvement

In compliance with NEPA, NASA has established cooperating agency status with SPFL in order to analyze and review the proposed development of Phase 1 on KSC. The U.S. Fish and Wildlife Service (USFWS) at Merritt Island National Wildlife Refuge (MINWR) has management responsibilities for many areas on KSC, including the Proposed Action site and was consulted during the development of this EA.

1.2.1 Role of NASA

As the Federal landowner, NASA would lease the land to SPFL and coordinate with SPFL to ensure compliance with the EUL. Under the EUL, NASA would retain approval authority for uses and tenants, site development plans and standards, and environmental permits. Space Florida would develop a detailed land-use plan and development standards for Exploration Park in cooperation with NASA. In addition, NASA would furnish utilities and emergency services to Exploration Park under reimbursable arrangements negotiated in the land lease.

1.2.2 Role of USFWS

USFWS has management responsibilities for lands potentially affected by the activities evaluated in this EA. Through official agreement with NASA, USFWS manages the acreage of KSC not specifically used for space or related operations as MINWR. NASA coordinates all land uses and activities that may have impacts on USFWS responsibilities and missions, including those mandated by the Endangered Species Act (ESA). The land set aside for projects such as those described in the Proposed Action (Phase 1) currently remain under USFWS management (R. Hight, MINWR, pers. comm., 5 Sep 2008). Implementation of this action would require that the lands to be leased to SPFL be removed from the refuge as required under the agreement between NASA and the Fish and Wildlife Service.

1.2.3 Role of Space Florida

SPFL would lease the Phase 1 parcel from NASA and SPFL would partner with a commercial entity to develop and manage the Phase 1 site. Developed sites and/or buildings would be subleased to tenants pursuant to an approval process established in cooperation with NASA. SPFL, under Florida Statute, has municipal powers that would apply to building and utility regulation, health, safety and welfare regulation, and Phase 1 construction and tenant activity. SPFL would work with the commercial developer and property managers to ensure that all applicable building codes, regulations, and approved development standards would be followed and enforced.

1.3 Purpose and Need

1.3.1 SPFL Purposes

Development of Exploration Park - Phase 1 is part of SPFL's mission to provide economic development for the state through space-related business, transportation and educational activities, and its goal to enable the State of Florida to maintain its position as the world's premier location for space enterprise.

The State of Florida Legislature backed SPFL with significant authorities and economic development powers in order to execute its responsibilities, including:

- acquiring, owning and operating facilities, launch pads, experimental spaceport facilities, landing areas, ranges, payload assembly and processing buildings, laboratories, aerospace business incubators, launch vehicles, payloads, space flight hardware, and other aerospace-related systems or initiatives, including utilities, educational and cultural initiatives;
- issuing contracts, grants, and contributions;
- conducting research activities and experimentation;
- collecting revenue including Federal and other funding;
- designating spaceport territories and coordinating with municipalities on plans for territories;
- entering into cooperative agreements;
- providing sovereign immunity;
- issuing revenue bonds, assessment bonds, or any other bonds or obligations;
- making investments.

1.3.2 NASA Purposes

NASA's mission is to advance and communicate scientific knowledge and understanding of the earth, the solar system, and the universe; advance human exploration, use, and development of space; research, develop, verify, and transfer advanced aeronautics and space technologies.

KSC has a unique role in the pursuit of NASA's mission. KSC serves as NASA's launch and primary landing site for the reusable Space Shuttle, the primary launch site for NASA science missions on expendable launch vehicles, and the gateway to the International Space Station for most of its major elements and for continuing missions. In 2004, President Bush unveiled "The Vision for Exploration", with its fundamental goal to advance U.S. scientific, security, and economic interests through a robust space exploration program (NASA 2004a).

Some key objectives that KSC expects to achieve through the establishment of Exploration Park and Phase 1 are to:

- support development and implementation of the Constellation Program enabling long term U.S. exploration activities in space;
- foster new educational opportunities and world-class academic research;
- promote development and use of new technologies that contribute to space exploration and the improvement of life of earth;
- enable privately financed and operated capabilities to strengthen both the governmental and non-governmental use of space,
- expand access to and use of the capabilities of the Kennedy Space Center and neighboring space launch and landing sites.

1.3.3 Need for the Action

NASA seeks innovative partnerships with other government and private organizations to help it meet its mission. Many of the previously discussed support activities require close proximity to the launch and payload-processing infrastructure of KSC. However, non-governmental organizations also need greater flexibility regarding access and operations than are currently available at KSC. In light of these benefits, NASA determined a need to locate Exploration Park on KSC (NASA 2004b – ISRP). The SLSL was the first facility to be built as part of the Exploration Park. The proposed Phase 1 action would enable the State of Florida (through the statutory provisions of the management entities of Exploration Park), to develop and manage an area of land within KSC outside the controlled access areas but in close proximity to the infrastructure available at KSC.

Figure 1-1. General location of the Exploration Park-Phase 1 on Kennedy Space Center, Florida

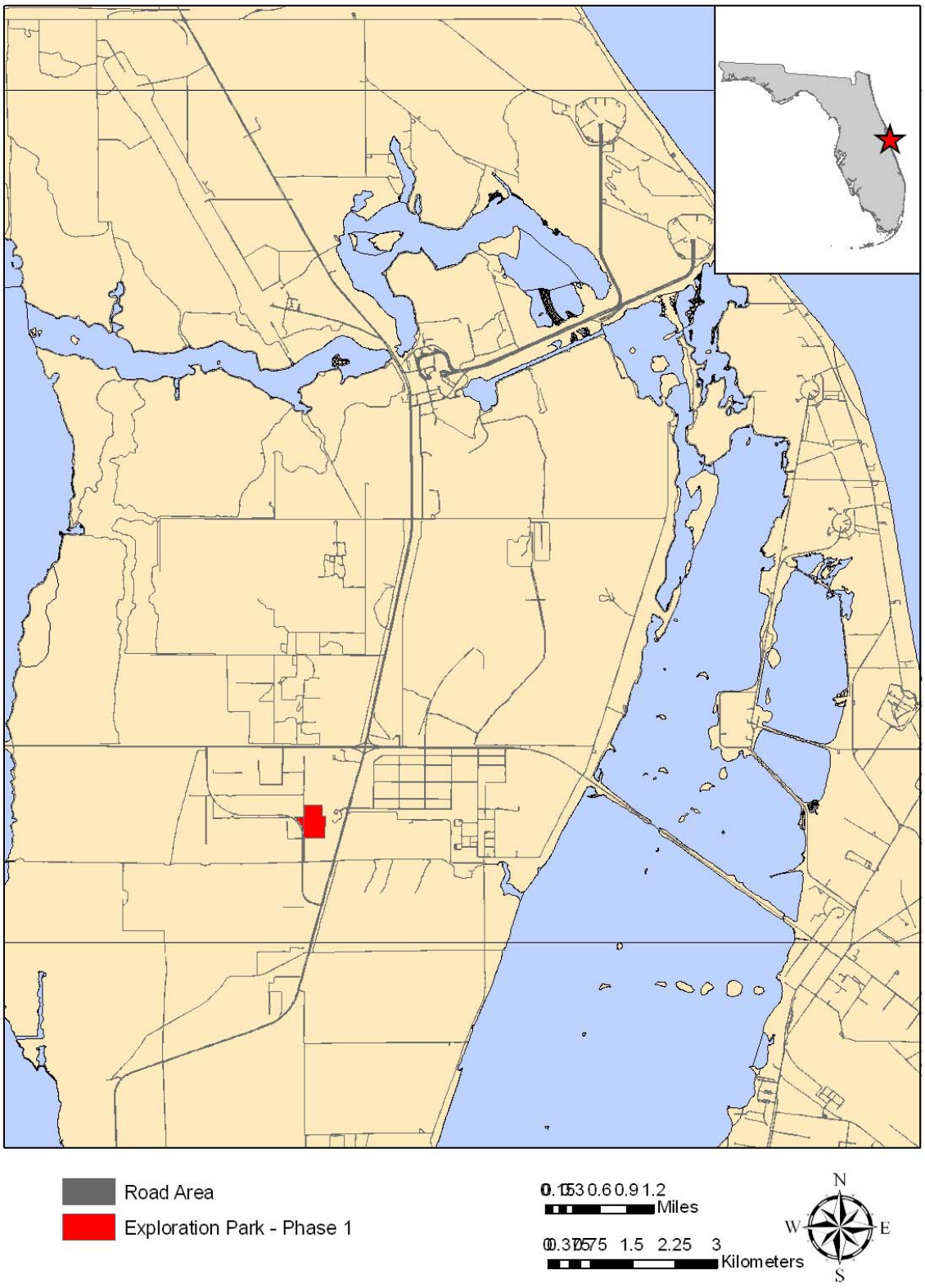


Figure 1-2. Expanded view of the proposed Exploration Park – Phase 1 site

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Chapter 2 describes the Proposed Action and No Action alternatives which were analyzed and are presented in this EA. The Proposed Action is to permit, through an EUL, the development and operation of Phase 1 on KSC. The No Action alternative states that the development of Phase 1 would not be permitted by NASA.

2.1. Existing Facilities and Current Uses

Currently, the proposed Phase 1 site is undeveloped and consists primarily of abandoned citrus groves and some small, relict hardwood hammocks and other disturbed forest. Space Commerce Way lies west of the site, and provides connectivity outside of the KSC security perimeter to NASA Parkway State Road (SR) 405 and SR 3 (Figure 1-2). The KSC Visitor Center is located approximately 0.4 kilometers (km) [0.25 miles (mi)] northwest of Exploration Park –Phase 1. The SLSL property boundary abuts the eastern boundary of the Phase 1 site. Approximately 0.25 miles (0.4 km) south of the site, is Ransom Road and the KSC Recycling and Marketing Facility.

2.2 Proposed Action

NASA's Proposed Action is intended to broaden the user base at KSC to include academic, commercial, and other non-NASA entities by leasing a 24 ha (60 ac) parcel of its property and permitting the development and operation of a mixed use technology and commerce park. The Proposed Action would allow for the greatest support of new activities aimed at maintaining current space-related business opportunities within the region and attracting new investment in aerospace technologies to the State of Florida (SPFL 2008).

2.2.1 Management Concept

Exploration Park - Phase 1 would serve as an example of a public-private partnership project that includes federal, state and local government and private enterprise. The management concept for Phase 1 incorporates aspects of successful models observed at other business and technology parks where unique interrelationships exist between the federal and state stakeholders. Several key characteristics and principles drive the management approach and structure proposed for Phase 1:

- The land of Phase 1 would remain federally owned. NASA would lease the land to SPFL under NASA's Enhanced Use Lease (EUL) authority.

- NASA, as the land owner, would retain certain decision rights for Phase 1 uses and tenants, site plans, development standards, and environmental permits.

- Phase 1would be relieved, to the maximum extent practical, of historical KSC regulatory and management practices not designed or intended for application to commercial developments. Phase 1 would still be subject to state requirements and federal laws and regulations applicable to non-Federal entities.

- SPFL would develop and maintain infrastructure improvements to NASA's property to enable the development of the Phase 1 parcel. These infrastructure improvements, including but not limited to roads, surface drainage structures, and utilities would become part of NASA's real property in accordance with the terms of the required lease agreement. Tenant site improvements (e.g., user facilities) would be owned by individual tenants or by developers who invest in the Phase 1 facilities with the intent to lease laboratories and offices to user organizations, including other federal agencies.

- An owners' association would be created to assist in the maintenance, long-term improvements and upkeep of the common areas (including signage and reserve areas).

The proposed management concept would allow developers and tenants to operate in a business environment that would be predictable and familiar, and would best accommodate commercial interests and practices.

2.2.2 Development Concept

SPFL would establish a partnership with a commercial developer for the proposed Phase 1 site. Major components of the conceptual Phase 1 development plan (SPFL 2008) for the 24.3 ha (60 ac) site include:

- Sited adjacent to the SLS Lab property to enable future collaborative efforts.
- Situated along Space Commerce Way, which provides connectivity to KSC's Visitor Center, the Astronaut Hall of Fame, KSC launch and operations hubs, CCAFS, and nearby metropolitan areas.
- Planned development of eight buildings and associated parking.
- Initial building development includes the development of the "main" building or "cornerstone facility "that could serve as offices, incubator and classroom spaces. This main building is envisioned as being anchored and/or owned by or for Space Florida. The proposed "cornerstone" facility would be a two-story building, identified in the concept plan as Building A (Figure 2-1), of approximately 4,645 square meters (m^2) or 50,000 square feet (ft^2). Following Building A, one new building would be added to the park every 18 to 24 months
- The development of this also includes planning for two single-story facilities that could accommodate high-bay production and testing spaces if required by the tenants of the proposed facilities.
- Approximately 315,000 square feet of educational, office/lab and flexible high-bay facilities (see Figure 2-1 for a conceptual site plan).
- Assessment of the potential for incorporating sustainable design elements as part of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, as developed by the U.S. Green Building Council (USGBC), which provides a suite of standards for environmentally sustainable construction (USGBC 2008).

Figure 2-1: Exploration Park-Phase 1 conceptual site master plan (SPFL 2008).

2.2.3 Proposed Design Standards and Covenants, Conditions and Restrictions

The development of covenants, conditions and restrictions or CCRs is a governance tool that works to ensure the maintenance of a safe and aesthetically pleasing environment for all future tenants and employees of the proposed business campus. In addition, a well thought-out set of CCRs would also protect the community interest in the development as well as protecting the park's investors. Technical standards and the design aspects of adopted covenants would be developed in consultation with the project's planners, engineers and architects and would not be finalized until all studies related to the existing zoning and other site analyses were completed. A strong enforcement section would serve to protect future occupants, building- and land-owners, park management and the development's neighbors. The authority to enforce the covenants would be vested with an owner's association. Details of each of the CCRs would be discussed in conjunction with SPFL to provide flexibility while maintaining quality control. CCRs would include components such as zoning/development guidelines, facility density, access, building setbacks, open space, buffers, site and architectural design, and project review.

2.2.4 Proposed Activities

SPFL, in partnership with NASA and commercial entities, has developed a cadre of potential uses that are believed to best represent current and future market interests, and are expected to help fulfill the missions and purposed of the state and federal government space agencies. One or more of the following four main activity focus areas are envisioned to be made available at the proposed Phase 1

center: education, technology and innovation development, industrial application and space industry support services.

2.2.4.1 Education

This component includes the development of shared academic and professional facilities needed to attract and network the best and brightest students, instructors and researchers to Exploration Park. It would serve as a global gathering and connecting place for NASA, university and private sector scientists, students and educators to provide opportunities for advanced technology training and coursework, and conferences and seminars focusing on next-generation space technology development. It would include classrooms and auditoriums, conference center spaces with state-of-the-art telecommunications and large band-width for video conferencing and computational facilities for 3-D simulations. Potential educational tenants currently include Florida universities such as Embry Riddle University, University of Central Florida, Florida State University, University of Florida, etc., as well as Massachusetts Institute of Technology (MIT), California Institute of Technology (Cal Tech), overseas universities world-wide, the International Space University (ISU) or other international space agencies, and other related and similar type educational users.

2.2.4.2 Technology and Innovation Development

The development of the technology and innovation component of the park is one of the key elements of creating those opportunities necessary to promote the advancement of new technologies from concept to product. The intent is to construct a multi-purpose/multi-tenant campus for developing and testing prototype components, creating new systems and technologies needed for next generation space exploration and as potential "headquarters" for those firms seeking a more permanent identity in affiliation with SPFL and NASA. This would include specialty laboratories such as wet labs, related multi-tenant offices, incubator space, shared conference spaces, flexible industrial and potential high-bay facilities. The potential technology and innovation tenants include research firms, laboratories, environmental sciences, commercialized private space/ sub-orbital firms, microelectronics and specialized material and composite firms, headquarter/corporate space (SPFL) and other related industries.

2.2.4.3 Industrial Application

The planning for the full development of Exploration Park must be flexible to include opportunities for the construction of light-industrial facilities that are geared towards the production of technologies and products developed as part of the technology and innovation development component of the project. Assisting firms in moving from research, development and testing to production, assembly and market would be the primary focus of this component of the park. This portion of the development would be set up to offer fully-served development sites that are either "pre-approved" or can have expedited approval for construction; the goal being to be able to offer facilities and land that can accommodate the development of buildings for the next stage of use at the park. This may include businesses that are looking to take advantage of the branding, co-location or clustering of industries at KSC or that are doing business with NASA, the U.S. Air Force (USAF), or the Department of Defense (DoD). Additionally, international government and business interests, or other related businesses could be considered. This project would also support the further development of spaceport facilities and other services related to private space transportation.

While this industry sector is varied among potential users; firms doing business or "evolving" out of the technology and innovation portion of this project would likely be the first round of potential users. Possible companies include Northrop Grumman, Harris Systems, and other firms currently or interested in doing business with NASA, as well as potential logistic firms to assist in the movement of goods related to the overall project.

2.2.4.4 Space Industry Support Services

To complement the development and expansion of the overall facilities potentially developed at Exploration Park, there are supportive services that should be considered as part of the project planning. This would provide commercial and retail services and potentially include areas and businesses that could serve as a gathering place for employees, clients and visitors of NASA, Exploration Park, other nearby businesses, and community interests. This could include multiple functionally-connected facilities with uses such as medical office, retail, restaurants, workout/gym/health clubs, childcare, or fuel or alternative energy stations. Potential users and tenants of the support service area are varied and more market-driven by the types and employment of nearby businesses and traffic into the area.

2.3 No Action Alternative

Under the No Action alternative, NASA would not lease the Phase 1 parcel to SPFL, and SPFL would not enter into a partnership with a commercial entity to develop the proposed Exploration Park-Phase 1 site. The education, research and development, light industry, and related space-support facilities, roads, parking lots and other associated infrastructure would not be built.

3.0 Affected Environment

Chapter 3 describes the environmental resources that could potentially be affected by the action alternative evaluated in this EA. KSC encompasses 56,451 ha (139,490 ac) on the east coast of central Florida (Figure 1-1) and includes uplands, wetlands, estuaries, coastal areas, as well space launch complexes and associated operational facilities. KSC is the launch site for NASA's Space Shuttle program and is the primary eastern U.S. Shuttle landing site. Since 2004, KSC has been developing its capabilities for the Constellation Program, whose Ares rockets will eventually replace the Space Shuttle (NASA 2004a). Approximately 3,035 ha (7,500 ac) of KSC are actively used to support space mission operations; while the remaining lands are managed by the USFWS as MINWR and by the National Park Service (NPS) as Canaveral National Seashore (CNS). This unique relationship between space flight and the protection of natural resources is carefully coordinated to ensure that the objectives of both interests are achieved with minimal conflict.

3.1 Facilities and Infrastructure

There are over 700 facilities located on KSC. Uses range from storage of toxic chemicals to launch support to offices. KSC facilities, equipment and personnel provide a variety of functions in support of their mission:

- Assemble, integrate, and validate Space Shuttle elements along with associated payloads including ISS elements and upper stage boosters
- Implement Constellation Program requirements for launch and ground support operations
- Conduct launch, recovery, and landing operations
- Design, develop, construct, operate, and maintain launch, landing and support facilities
- Maintain ground support equipment required to process launch vehicle systems and payloads
- Serve as the NASA point-of-contact for DoD launch activities and provide logistics support to NASA activities at KSC, CCAFS, Patrick Air Force Base (PAFB), Vandenberg Air Force Base (VAFB), and various contingency and secondary landing sites around the world
- Manage Shuttle flight hardware logistics
- Research and develop new technologies to support space launch and ground processing activities
- Provide government oversight and approval authority for commercial ELV operations.

3.1.1 Transportation

KSC is serviced by over 340 km (211 mi) of roadways, with 263 km (163 mi) of paved roads and 77 km (48 mi) of unpaved roads. NASA Causeway is the primary entrance and exit for cargo, tourists, and personnel. This four-lane road originates on the mainland in Titusville as State Route (SR) 405 and crosses the Indian River Lagoon (IRL) onto KSC. Once passing through the Industrial Area, the road reduces to two lanes of traffic, crosses over the Banana River, and enters CCAFS. The major north-south artery for KSC is Kennedy Parkway (SR 3). It can be accessed from the north where it intersects with US 1 south of Oak Hill, and from Titusville via SR 406/402. The southernmost entrance and exit for KSC is on SR 3 at north Merritt Island.

The proposed Phase 1 site is located along Space Commerce Way, which provides a connection for public traffic between SR 3 and SR 405. Access to the Phase 1 business park would be via Space

Commerce Way with a future planned connection to the SLSL to the east. Based on the 2003 traffic analysis associated with the International Space Research Park (ISRP) EIS, the full completion of the ISRP in its entirety was projected to generate a total of 6,451 average daily vehicle trips by 2010 and 21,204 average daily trips by 2022. The currently proposed Exploration Park Phase I, proposes to generate 2,555 average daily trips (roughly 40% of the 2010 projection and only 12% of the 2022 projection for the ISRP).

The 315,000 square feet of proposed building area were used to calculate the proposed trip generation based upon the Institute of Transportation Engineers' Trip Generation, Seventh Edition, trip rates for Land Use 760, Research and Development Center. The proposed Phase I was projected to generate a total of 2,555 Average Daily Trips, 391 Morning Peak Hour Trips (325 entering / 66 exiting), and 341 afternoon Peak Hour Trips (51 entering / 290 exiting). It should be noted that neither the 2003 ISRP trip generation calculations or the current Phase I trip generation calculations made allowances for multipurpose trips or pass-by trips (e.g.. a worker attending a class directly from work) in an effort to review a worst case scenario.

3.1.2 Wastewater Treatment

The sanitary sewer system at KSC consists of several lift stations that transfer wastewater to the CCAFS wastewater treatment plant. These lift stations are former Sewage Treatment Plants (STPs) that have been retrofitted. Lift station STP 1 is located south of the KSC Industrial Area, while STP 4 handles wastewater from the Vehicle Assembly Building (VAB) and other nearby facilities.

The proposed Phase 1 business park would require connection to STP 1 via the adjacent SLSL sewage system (NASA 2006). The No Action alternative would not require the installation of a sanitary sewer connection to the KSC sewage treatment infrastructure.

3.1.3 Electricity and Natural Gas

The electric power distribution system at KSC is a combination of a Florida Power and Light Company (FPL) transmission system and two NASA-owned distribution systems. FPL transmits 115 kilovolts (kV) to KSC, which are distributed to two major substations. The C-5 substation serves the Launch Complex (LC) 39 area, providing 13.8 kV, and the Orsino substation serves the Industrial Area, providing 13.2 kV, for a total of 25 % of the electricity currently allocated to KSC. From 2001 through 2006, electricity use on KSC ranged between 270,000 and 293,000 megawatt-hours, and electricity consistently provides 71 % of KSC's total energy with the remaining 28% coming from natural gas (SGS 2006). In 1994, KSC began converting some facilities, equipment, and vehicles to natural gas. A 40 km (25 mi.) pipeline was constructed by City Gas Company of Florida, which distributes the gas within KSC. In 2006, 3.6 million therms of natural gas were used (SGS 2006).

3.1.4 Communications

The KSC Communications System provides a variety of services including: 1) conventional telephone services; 2) transmission of voice data and video; 3) voice data and video services; and 4) operation and maintenance of KSC's cable plant. There are three major distribution and switching

stations located in the Industrial Area (First Switch) and in the VAB area (Second and Third Switches). These three stations provide service for over 18,500 telephones on KSC.

As proposed, Phase 1 would require connection to the NASA Communications Distributions and Switching Center (CDSC) via a switching station at the SLSL. A communications duct bank could be routed from SLSL to Phase 1 along the proposed road connecting the two facilities (NASA 2006). For the No Action alternative, new communications connections would not be required.

3.1.5 Potable Water

KSC's potable water is supplied by the City of Cocoa, which obtains its water from artesian wells located west of the St. Johns River in Orange County. Water enters KSC along SR 3 from a 60 centimeter (cm) [24 inch (in)] water main and extends north along SR 3 to the VAB Area. The average demand for water on KSC is 3.8 million liters (l)/day [1 million gallons (gal)/day] (NASA 2003). Total storage capacity at KSC is approximately 15 million l (4 million gal) in ten above-ground storage tanks (NASA 2003).

To provide the proposed Phase 1 business park with potable water, a connection to the main supply from the City of Cocoa would be required via existing water lines located along SR 3 and a water main at the SLSL (NASA 2002). These additional water connections would not be required for the No Action alternative.

3.1.6 Stormwater

Stormwater currently flows into the ditches on and surrounding the proposed site, while some drains into the ground. During periods of very high rainfall, excess water likely also reaches Space Commerce Way stormwater systems located west of the proposed site. The proposed Phase 1 business park buildings and associated pavement (roads, parking lots, sidewalks, etc.) would convert approximately 100,617 m^2 (1,083,030 ft^2) of land to impervious surfaces on the site. A stormwater management system of approximately 16,072 m^2 (173,000 ft^2) would be required to store and treat the additional runoff generated by impervious surfaces (J. Smith, O'Brien Atkins Associates, pers. comm., 13 Oct 2008). These improvements would not have to be developed under the No Action alternative.

3.2 Air Quality

The ambient air quality at KSC is predominantly influenced by daily operations, particularly vehicle traffic, but also utilities fuel combustion, and standard refurbishment and maintenance operations. Other operations occurring infrequently throughout the year, including launches and prescribed fires, also play a role in the quality of air at KSC as episodic events. Air quality at KSC is also influenced by emissions sources outside of KSC, primarily two regional oil-fired power plants located approximately 9.8 km (6 mi) west south west of the Phase 1 site.

Air quality on KSC is monitored by a Permanent Air Monitoring System (PAMS) station located north of the Industrial Area. The PAMS station continuously monitors concentrations of sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone, and collects meteorological data as well. KSC is currently located within an area classified as attainment with respect to the National Ambient

Air Quality Standards established by the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection (FDEP) for all criteria pollutants (NASA 2003).

A summary of air quality parameters collected from the PAMS A facility in 2007 is provided in Appendix 2 (Drese 2007). Primary or secondary air quality standards for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), or sulfur dioxide (SO_2) were not exceeded for that period (State and Federal Ambient Air Quality Standards can be found in Appendix 3). The maximum hourly average value for O_3 was 34.9 parts per billion (ppb) in April 2007. The maximum 24-hr average value for SO_2 was 15.9 ppb, in December 2007. The maximum hourly average value for NO_2 was 6.1 ppb in May 2007. The maximum hourly average value for CO was 17.3 ppm in February 2007. Total inhalable 10-micron particulates (PM-10) were monitored historically (1983 – 1989, 1992 – 1999) at the PAMS and two other sites on KSC. During those times, there was only one exceedance in PM-10; this occurred during the ground clearing for the International Space Station Facility (Drese 2006).

The maximum O_3 value usually occurs in April when the Bermuda High sets up a stagnant weather condition. The maximum CO level was probably the result of either the use of a portable generator, a vehicle motor running in the area, or center-wide controlled burns (NASA 2003). NO_2 and SO_2 emissions are related to fuel combustion by utilities and services and mobile sources. The strong correlation between elevated NO_2 and SO_2 levels and prevailing westerly winds suggest that the power plants to the west of KSC could be the primary source of these emissions (Drese 1985).

3.3 Climate

The climate at KSC is characterized as maritime-tropical with humid summers and mild winters. The area experiences moderate seasonal and daily temperature variations. Average annual temperature is 22° centigrade (C) [71° Fahrenheit (F)] with a minimum monthly average of 13° C (60° F) in January and a maximum of 28° C (81° F) in July. During the summer, the average daily humidity range is 70 to 90 %. The winter is drier with humidity ranges of 55 to 65 % (Mailander 1990).

Prevailing winds during the winter are steered by the jet stream aloft and are typically from the north and west. As the jet stream retreats northward during the spring, the prevailing winds shift and come from the south. During the summer and early fall, as the land-sea temperature difference increases and the Bermuda high-pressure region strengthens, the winds originate predominantly from the south and east.

The central Florida region has the highest number of thunderstorms in the U.S. during the summer months (May – September), and over 70 % of the annual 122 cm (48 in.) of rain occurs in the summer. During thunderstorms, wind gusts of more than 97 kilometers/hour (60 mi./hr.) and rainfall of over 2.5 cm (1.0 in.) often occur in a one-hour period, and there are numerous cloud-to-ground lightning strikes. Hurricanes can also develop, typically between August and October. The most active hurricane season in KSC's history was 2004, when damages to facilities exceeded $100 million. Additionally, many habitats, such as marshes, shoreline, and dunes were affected, at least temporarily, due to the storm surge and beach erosion (NASA 2004c).

3.4 Biological Resources

Biological resources include vegetation, wildlife, and habitats. Protected species and the overall biodiversity of the area are also considered in this section. The proposed Phase 1 site is to be situated on KSC in an abandoned citrus grove that is fringed by 3.15 ha (7.80 ac) of mesic hardwood hammock along the northern end.

The habitats found across KSC and the adjacent federal properties provide for some of the greatest wildlife diversity among Federal facilities in the continental U.S. (Breininger et al. 1994). This diversity can be attributed to several factors, including: KSC's position in a biogeographical transition zone, with faunal and floral assemblages derived from both temperate Carolinian and tropical/subtropical Caribbean biotic provinces (Ehrhart 1976, Sweet et al. 1979, Greller 1980, Stout 1979, DeFreese 1991). In addition, the area is encompassed within the Indian River Lagoon (IRL) watershed, considered to be the most diverse estuarine system in North America (The Nature Conservancy 2007). KSC is bordered on the west by the Indian River, on the southeast by the Banana River, and on the north by the Mosquito Lagoon. Further to the west of KSC lies the St. Johns River Basin ecosystem, one of the largest freshwater marsh systems in the state. KSC's proximity to the coast also encourages an abundance of migratory birds. Together, these factors contribute to the exceptional species diversity found at KSC (Breininger et al. 1994).

3.4.1 Land Cover

Land cover is the physical material at the surface of the earth, and includes vegetative communities, asphalt, bare ground, water, etc. For the purposes of this EA, land cover categories were based, in part, on a classification scheme developed for the Florida Land Use, Cover and Forms Classification System (Florida Department of Transportation Surveying and Mapping Thematic Mapping Section 1999) with site specific descriptions of class composition from Schmalzer and Hinkle (1985). Information regarding the vegetative communities associated with a land cover type can help predict what types of wildlife may utilize a certain land cover as habitat.

Florida's geological history has largely been determined by sea level changes that directly influence soil formation and topography, and result in the plant communities present today. A "ridge and swale" topography is present on KSC where there are adjacent bands of uplands and wetlands running in a generally north/south direction across the island. The dominant uplands communities are scrub and pine flatwoods (Provancha et al. 1986). Long, narrow freshwater marshes are interspersed among the bands of uplands. Forests occur on higher areas among marshes and lower areas among scrub and pine flatwoods (Breininger et al. 1994). Adjacent to the estuary that surrounds much of KSC, are salt marshes, various wetland shrub habitats, and mangrove swamps. A detailed list of land cover types and acreages found on KSC is in Appendix 4.

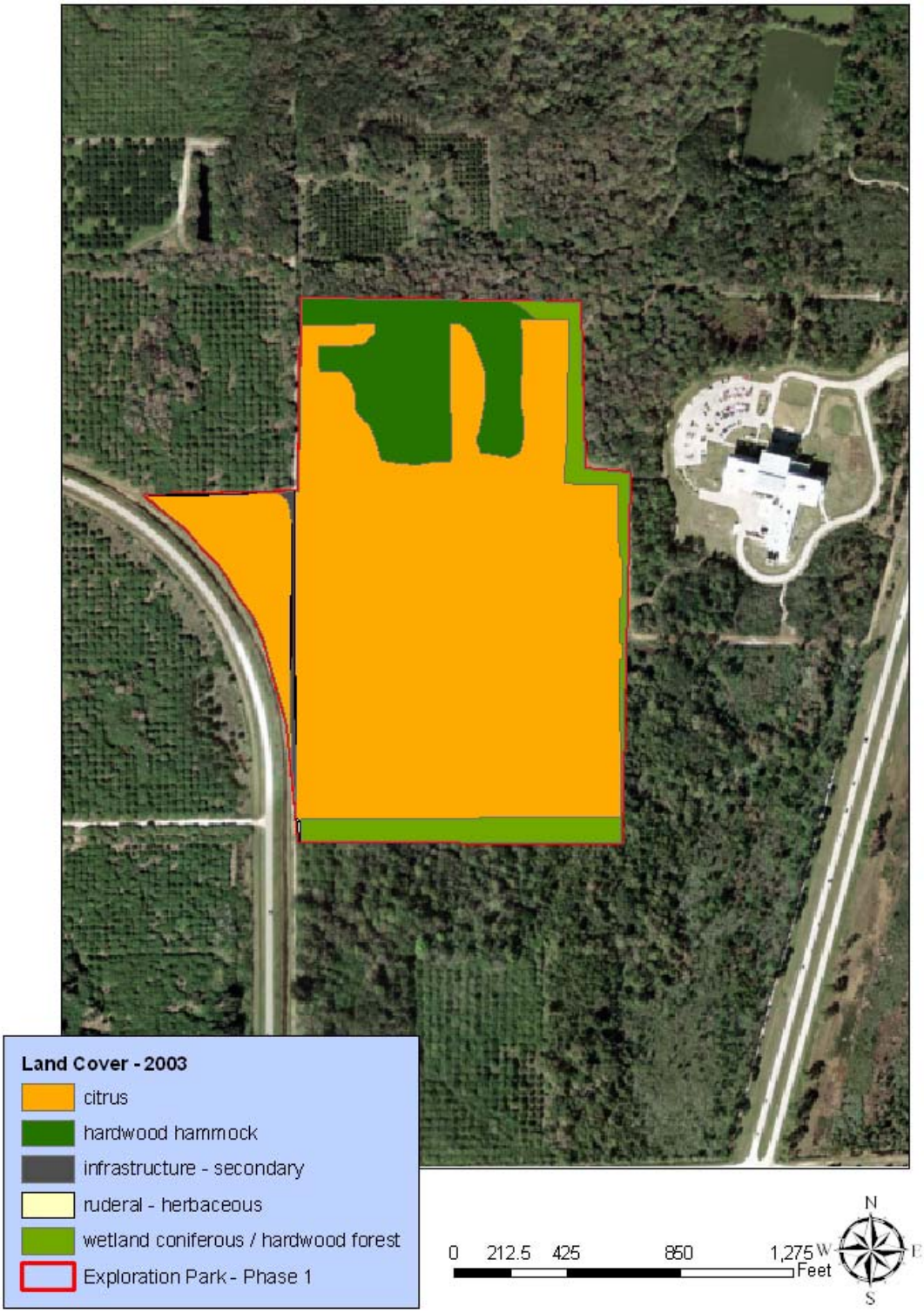
Most of the land within the Phase 1 project boundary consists of abandoned citrus groves with mesic to hydric hardwood hammock (wetland) intersecting the grove along the northern section of the property and a strip of highly disturbed forest along the eastern and southern boundaries (Table 3-1, Figure 3-1). The Phase 1 site hammock is part of a larger hammock that extends to the north where it ends along NASA Causeway (SR405). On 3 and 4 September 2008, the proposed site was surveyed to ground truth plant communities evident on aerial photographs with the following findings (P. Schmalzer and T. Foster, Dynamac, pers. comm., 4 Sep 2008): The dominant vegetation within the hammock consisted of red maple (*Acer rubrum*), live oak (*Quercus*

virginiana), cabbage palm (*Sabal palmetto*), hackberry (*Celtis laevigata*), and elm (*Ulmus americana*). Evidence that the hammock has been exposed to disturbance included piles of rock and a piece of an old metal pipe found within a hammock and plant debris, mostly Brazilian pepper (*Schinus terebinthifolius*), was piled along the edge of the hammock. Exotics were common along the hammock edge and included Surinam cherry (*Eugenia uniflora*), Brazilian pepper, primrose willow (*Ludwigia peruviana*), caesarweed (*Urena lobata*), and paper mulberry (*Broussonetia papyrifera*) and occasional throughout the hammocks, *Citrus* species were also present. This hammock notably lacked ephiphytes that are often found within the interior of larger, undisturbed hammocks.

Table 3-1: Phase 1 land cover types and areas within the proposed Phase 1 site boundary.

Land Cover Type	Hectares	Acres
Citrus	19.15	47.31
Wetland / Hardwood Hammock	3.15	7.80
Infrastructure - secondary	0.18	0.43
Ruderal - herbaceous	0.03	0.07
Wetland Coniferous / Hardwood Forest	1.79	4.42
Total:	**24.29**	**60.03**

Figure 3-1: Land cover types within the proposed Phase 1 site boundary.



3.4.2 Wildlife

In addition to literature reviews and KSC ecological database searches, a pedestrian survey to assess wildlife use on the proposed Phase 1 site was conducted on 3 and 4 Sep 2008.

3.4.2.1 Invertebrates and Fish

KSC's location within the Indian River Lagoon basin is important as the IRL was designated as an "estuary of national significance" in 1990 by the EPA. Over 400 species of fishes (Gilmore 1977, Snelson 1983), 260 species of mollusks, and 479 species of shrimps and crabs are supported within the IRL (Woodward-Clyde 1994). Commercially important species include game fish (e.g., snook, *Centropomus undecimalis*, seatrout, *Cynoscion nebulosus*, and tarpon, *Megalops atlanticus*) and crabs. In addition, several areas of the IRL are important shellfish harvesting areas. Lagoon habitats serve as nursery grounds for virtually all fish resident within the lagoon, as well as many offshore species. Studies of terrestrial invertebrates have been limited to research aimed at controlling salt marsh mosquitoes, *Ochlerotatus taeniorrhynchus* and *Ochlerotatus sollicitans* (Platts et al. 1943, Clements and Rogers 1964). A detailed biological survey of terrestrial invertebrates has not been performed on KSC or within the Phase 1 site.

The stormwater detention ditch along Space Commerce Way and drainage ditches on the proposed site contain several minnow species in the Fundulidae and Poeciliidae families (J. Provancha, Dynamac, pers. comm., 3 Sep 2008) and possibly larger fish species that are able to tolerate fluctuating conditions found in these waters.

3.4.2.2 Herpetofauna

Fifty species of reptiles and 19 species of amphibians have been documented as occurring on KSC (Seigel et al. 2002). Six of these species are federally protected as Threatened (T) and Endangered (E), some of which will be further discussed in Section 3.5.1.

Three herptile species of the 69 documented are not federally listed, but are protected by the State of Florida. These include the Florida gopher frog (*Rana capito aesopus*), the gopher tortoise (*Gopherus polyphemus*), and the Florida pine snake (*Pituophis melanoleucus mugitis*). The Florida gopher frog and Florida pine snake are uncommon on KSC and little is known about their numbers or distribution. Neither of these two species would be expected to be supported within the current habitats underlying the proposed Phase 1 site as they typically inhabit drier, upland areas.

Conversely, the gopher tortoise is common, wide-spread, and well studied on KSC. The gopher tortoise inhabits the uplands where it excavates burrows for shelter from weather, climate, predators and fire. Many other vertebrate and invertebrate species also use the tortoise burrows, and for this reason, the tortoise is considered a keystone species. Because gopher tortoises prefer the uplands habitats that are typically used for development, and are often found in previously disturbed areas, conflicts with operations occasionally arise. There is currently no evidence of gopher tortoises (*Gopherus polyphemus*) on the site and evaluations of the soils suggest the area is not conducive for this species to burrow (B. Bolt and J. Provancha, Dynamac, pers. comm., 3 Sep 2008). These observations corroborate the findings of wildlife surveys conducted in 2002 in areas on the proposed site and vicinity (NASA 2002). Gopher tortoises require drier, well-drained soils in which to

excavate their burrows, and the soils on the proposed Phase 1 site are generally poorly drained (B. Bolt and P. Schmalzer, pers. Comm., 3 and 4 Sep 2008).

Reptile and amphibian species likely to be found on the proposed site include some that are typically found in hammocks or can persist in the fallow citrus groves which are being colonized by non-native plant species. Anoles (*Anolis* spp.), various tree frogs (*Hyla* spp.), and five-lined skink (*Eumeces fasciatus*) were documented on the site in 2002 (NASA 2002). Cuban anoles (*Anolis sagrei*), considered an exotic pest, were observed also in 2008 (B. Bolt, pers. Comm., 3 Sep 2008).

3.4.2.3 Birds

KSC provides habitat for 330 bird species (USGS 2007); nearly 90 species nest on KSC, many of which are year-round residents. There are over 100 species that reside in the area during the winter. The remaining species regularly use KSC lands and waters for brief periods of time, usually during migration. KSC lies within the Atlantic flyway, a major migratory bird corridor that extends from the Artic coast of Alaska to the mainland of South America. Millions of songbirds, seabirds, birds of prey, and waterfowl follow the Atlantic flyway every fall and spring. Migratory birds are federally protected through the Migratory Bird Treaty Act of 1918, and the list currently contains over 800 species.

The hammock located on the north end of the proposed site is a likely stop-over site for a number of migrating birds during part of each year. During a May 2002 wildlife survey, several migratory birds were documented on the proposed Phase 1 site (NASA 2002). The only migratory bird observed on the site in 2008 was the northern cardinal (Cardinalis cardinalis), a resident species in Florida (B. Bolt and J. Provancha, Dynamac, pers. comm., 3 Sep 2008).

Although monocultures typically do not support a high diversity of birds, citrus groves have the potential to provide useful habitat for some species during various times of the year. At least 20 bird species were shown to utilize a 16 ha (40 ac) grove in Central Florida during the fall migration, with species including several neotropical migrants and raptors (Jones 1999). However, few resident birds are supported by citrus groves and these are expected to be habitat generalists such as mocking birds (Mimus polyglottos), various doves, and non-native bird species.

Three species of birds that occur on KSC are federally protected under the Endangered Species Act (ESA) 1973 (see Appendix 5 for a list of State and Federally listed species documented on KSC). Of these, scrub-jays and wood storks are discussed further in Section 3.5.1. In addition, there are 12 species that are protected by the State of Florida (Appendix 5). Six of these belong to a group of birds commonly called waders (Order Ciconiiformes). The wading bird population on KSC is very large; it is estimated that between 5,000 and 15,000 birds are present at any given time, depending on the season (Smith and Breininger 1995). The largest numbers occur during the spring and the fewest birds are present in the winter. Large numbers tend to be found along larger water bodies and impoundments. The closest larger sites are 3.7-5.3 km (2.3 to 3.4 miles) away. Wading birds may forage along the stormwater detention ditch adjacent to Space Commerce Way, as well asdrainage ditches on the proposed site, although these are very overgrown (J. Provancha, Dynamac, pers. comm, 16 Sep 2008). No wading birds were sighted on the Phase 1 site during recent surveys and wading bird nesting colonies have not been documented within the immediate vicinity during ongoing wading bird research on KSC (B. Bolt., Dynamac, pers. comm., 3 Sep 2008).

Of the remaining six State-listed bird species, three are common KSC year-round residents (eastern brown pelican, *Pelecanus occidentalis carolinensis*, black skimmer, *Rynchops niger*, and the southern bald eagle, *Haliaeetus leucocephalus*). The least tern (*Sterna antillarum*) is common, but immigrates each winter, and the remaining two species are common in the winter (Arctic peregrine falcon, *Falco peregrinus tundrius*, and southeastern American kestrel, *Falco sparverius paulus)*. Of these only the peregrine falcon, American kestrel and bald eagle would be expected to occasionally utilize the Phase 1 site.

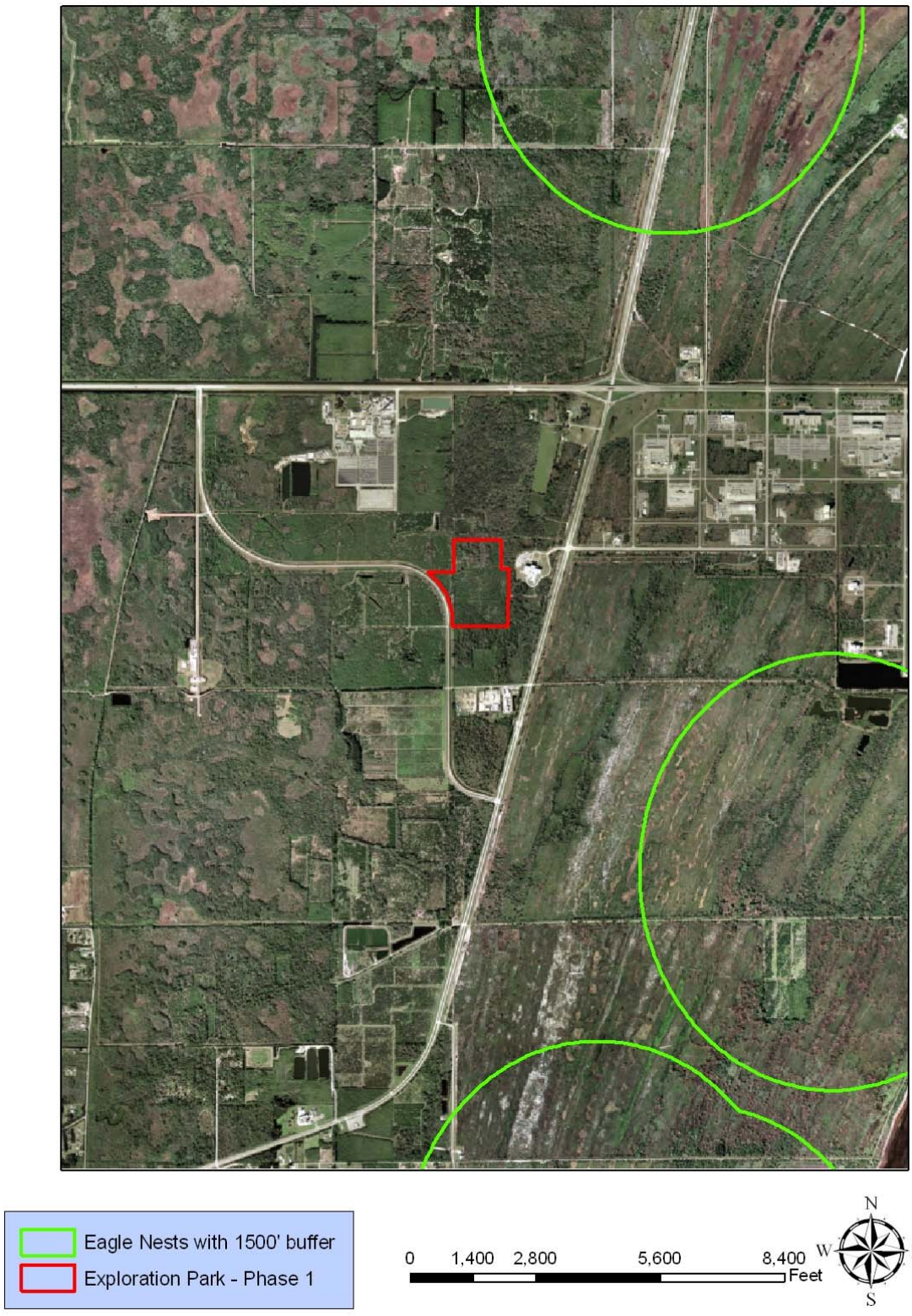
KSC supports an annual average of 14 breeding pairs of the threatened southern bald eagle; see Figure 3-2 for 2007/2008 nest sites. Production for the 2004 – 2006 seasons averaged between eight and 14 fledglings (Bolt and Cancro 2006). In Florida, bald eagles generally use mature live pines and pine snags within pine flatwoods habitats. They will also occasionally build nests on man-made towers. KSC offers ideal habitat for bald eagle nesting due to the wide expanse of relatively undisturbed pine flatwoods, and the freshwater and estuarine wetland complex that provides a diversity of excellent foraging habitats (Hardesty and Collopy 1991). The proposed site does not provide suitable nesting habitat for bald eagles.

3.4.2.4 Mammals

Thirty species of mammals inhabit KSC lands and waters (Ehrhart 1976). Typical terrestrial species include the opossum (*Didelphis virginiana*), hispid cotton rat (*Sigmodon hispidus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), and bobcat (*Lynx rufus*). Due to the regional loss of large carnivores such as the Florida panther (*Puma concolor coryi*) and red wolf (*Canis rufus*), the bobcat and otter now hold the position of top mammalian predators on KSC, although coyote (*Canis latrans*), have also been documented (M. Legare, MINWR, pers. comm., 28 Aug 2008). Additionally, the loss of top carnivores and anthropogenic landscape changes has resulted in a proliferation of mid-level predators such as the raccoon and opossum. Opportunistic species such as the cotton rat and eastern cottontail rabbit (*Sylvilagus floridanus*) often account for a large portion of the small mammal biomass, rather than habitat-specific species such as the State-listed Florida mouse (*Podomys floridanus*) and the federally protected southeastern beach mouse (*Peromyscus polionotus niveiventris*). At least three species of bats have been documented and they occasionally use facilities as roosts sites. A very large, reproductively active bat roost is located in the bridge on SR 3 where it crosses over SR 405, just inside the KSC security gate. Several thousand bats are thought to use this bridge year-round. Two mammal species common in the waters of the IRL are the Atlantic bottlenosed dolphin (*Tursiops truncatus*) and the West Indian manatee (*Trichechus manatus*).

Mammal species most likely to be found on the proposed Phase 1 site are habitat generalists that are able to utilize disturbed areas. None of these are protected species, but include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), raccoons, opossums, cotton rats, cottontail rabbits, and non-native mammals such as nine-banded armadillos (*Dasypus novemcinctus*) and feral hogs (*Sus scrofa*). On KSC, hogs are actively trapped and removed through a program managed by MINWR to minimize their detrimental impacts on native communities (USFWS 2007a). Previous wildlife surveys found feral hogs, raccoons, and armadillos to be common on the proposed site (NASA 2002). The most recent survey documented feral hogs, raccoons, and rabbits (*Syvilagus* spp.) on the site based on sightings and tracks (B. Bolt and J. Provancha, Dynamac, pers. comm., 3 Sep 2008).

Figure 3-2: Bald eagle nest buffer zones in the vicinity of the proposed Phase 1 site.



3.5 Threatened and Endangered Species

3.5.1 Listed Wildlife

Sixteen ESA-listed wildlife species have been documented on KSC, which is more than on any national wildlife refuge in the continental U.S. Six of these are only incidentally present and do not make important contributions to the area's biota: hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempi*), snail kite (*Rosthrhramus sociabilis*), Audubon's crested caracara (*Polyborus plancus audubonii*), piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii*).

The following ten federally listed species occur on KSC either commonly or occasionally (Appendix 5): loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), eastern indigo snake (*Drymarchon couperi*), Atlantic salt marsh snake (*Nerodia clarkii taeniata*), wood stork (*Mycteria americana*), Florida scrub-jay (*Aphelocoma coerulescens*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), and the West Indian manatee (*Trichechus manatus*). The American alligator (*Alligator mississippiensis*) remains on the federally protected list only because it is similar in appearance to another listed species, the American crocodile (*Crocodylus acutus*). Six of the federally listed animals are marine and/or estuarine species and would not be found on the site. The southeastern beach mouse is primarily a coastal species, with a small KSC population found on Merritt Island north of the VAB (Provancha et al. 2005). Scrub-jays are also habitat specialists, whose scrub requirements have been extensively surveyed and modeled (Breininger 1981, 1992, Breininger et al. 1991). Potential scrub-jay habitat in the vicinity of the proposed site is depicted in Figure 3-3. Only the alligator, wood stork, and indigo snake have reasonable potential for association with the Phase 1 site.

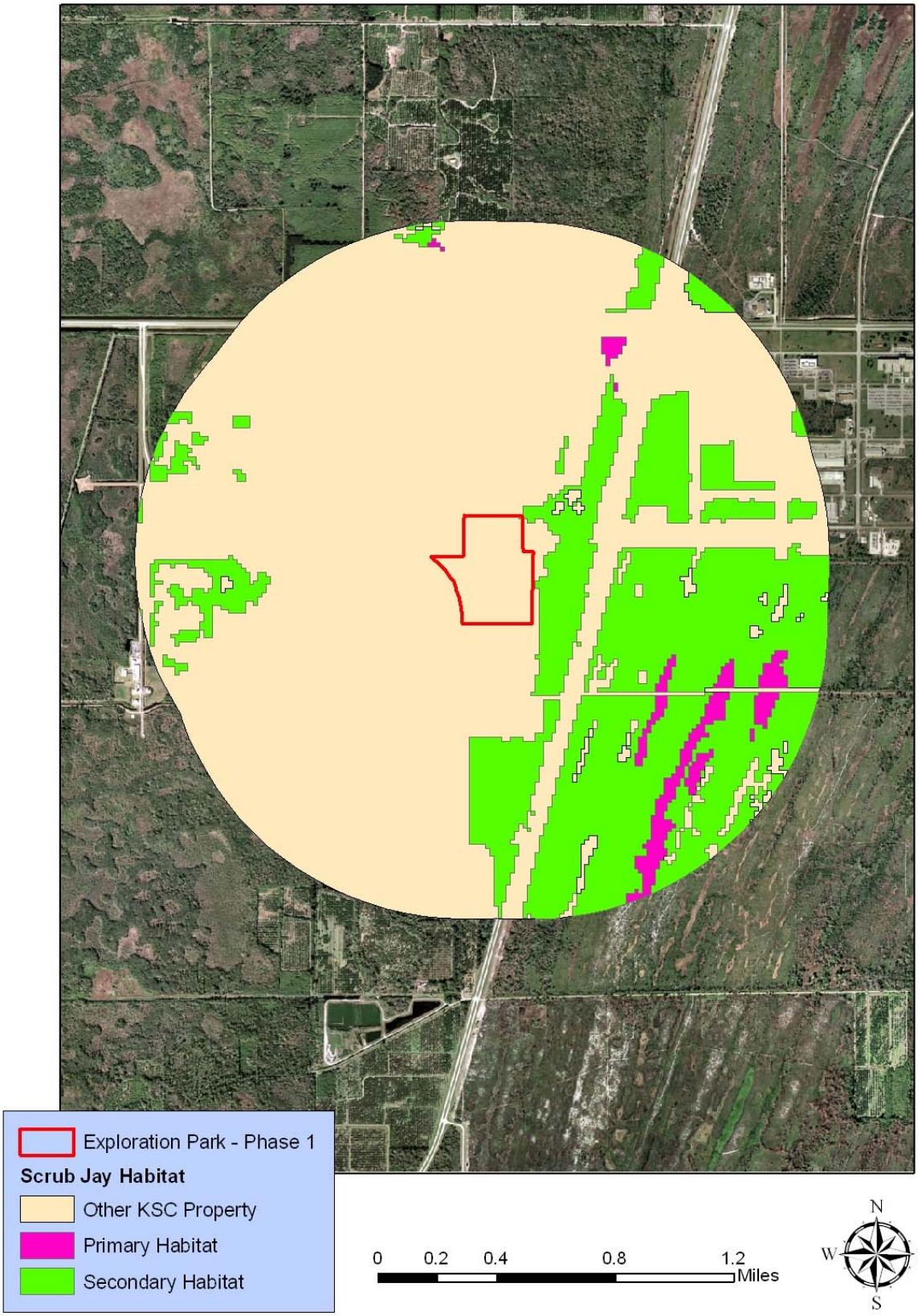
3.5.1.1 American Alligator

Alligators are abundant on KSC and can sometimes cause problems related to traffic safety and encounters with people around and within facilities. Alligators are likely to intermittently utilize the canal adjacent to Space Commerce Way and the drainage ditches on the proposed site during periods when water levels are sufficiently high. They were not observed during any of the 2008 surveys when water levels were probably near record highs due to rainfall in August associated with Tropical Storm Fay.

3.5.1.2 Eastern Indigo Snake

Eastern indigo snakes were federally listed as threatened under the Endangered Species Act in 1978. They are thought to be common on KSC, although actual population numbers are difficult to obtain. Research on home range sizes, habitat use, and trapping methods using radio tagged indigos has been conducted on KSC since the early 1990s (Breininger et al. 2004; Dyer 2004). Eastern indigo snakes have very large home ranges and use a variety of habitat types that include uplands, wetlands, hammocks, and disturbed areas. Because indigos have large ranges which include various habitats, the proposed site could be occasionally utilized by one or more snakes.

Figure 3-3: Primary and secondary scrub-jay habitat in the vicinity of the Phase 1 site.



3.5.1.3 Wood Stork

Wood storks are federally protected as endangered. Wood stork populations have declined sharply in Florida, from 60,000 pairs in the 1930s to 11,232 pairs in 2006 (USFWS 2007b). Wood storks are present on KSC throughout the year, with an apparent influx of non-resident birds during the winter which utilize the many ditches for foraging (E. Stolen, Dynamac, pers. comm., 16 Sep 2008). Wood storks were first recorded nesting on KSC in 1972; in subsequent years, 300 – 400 pairs were documented, representing almost 10 percent of the Florida population (USFWS 2007a). Freezes in the mid-1980s severely reduced the KSC mangrove population, the wood stork's primary nesting substrate in this area, and the number of nests varied from zero to 122 through 1990. Wood stork nesting has not been documented on KSC since 1990, although the mangroves have recovered and support other wading bird nests (Smith and Breininger 1995).

Drainage ditches that run along and through the citrus groves and the Space Commerce Way stormwater detention ditch adjacent to the Phase 1 site could be used as foraging areas by wood storks at times when water levels are suitable. However the ditches within the grove area are densely vegetated with large Brazilian peppers and Australian pines (*Casuarina* spp.) reducing access to these sources (J. Provancha, Dynamac, pers. comm, 16 Sep 2008). The Phase 1 site does not contain any suitable nesting areas for wood storks.

3.5.2 Listed Plants

No federally listed plant species have been found on KSC. KSC supports 33 plant species that are protected by the State of Florida, either as threatened, endangered, or commercially exploited (NASA 2002, Schmalzer and Foster 2005). No threatened and endangered plants were observed during a plant community survey performed by Dynamac on 4 Sep 2008 (P. Schmalzer and T. Foster, Dynamac, pers. comm., 4 Sep 2008).

3.6 Cultural Resources

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. For ease of discussion, cultural resources have been divided into archaeological and historical resources.

In March 2003, Archaeological Consultants, Inc. (ACI) conducted a cultural resource assessment survey (CRAS) as part of the International Space Research Park EIS (ACI 2003, NASA 2004b) which included lands being evaluated for this EA. In developing the ISRP CRAS, a comprehensive review of archaeological and historical literature, records, and other documents, and data pertaining to the ISRP and adjacent areas was conducted. The focus of the research was to ascertain the types of cultural resources known in the ISRP project area and vicinity, their temporal/cultural affiliations, site location information, and other relevant data. In addition to a review of sites listed in the National Register of Historic Places, the Florida Master Site File (FMSF), and other relevant sources it included field surveys. One of these field studies was a survey of the SLSL expansion site (as mentioned in Section 1.1, and referred to as Phase F in the 2004 ISRP EIS. Phase F was a 10 ha (24 ac) parcel which lies within the footprint of the current proposed action site. Archaeological field

survey methods on the ISRP Phase F site consisted of ground surface reconnaissance and limited subsurface testing (ACI 2003).

3.6.1 Archaeological Resources

Based on the 2004 ISRP CRAS report (ACI 2003), the current proposed action site lies in an area of KSC which is considered to have a low site location potential for archeological resources. At the time of the 2003 ACI survey, six shovel tests were excavated in the SLSL Phase F site (which roughly corresponds with the northwest corner of the current proposed site). All of the tests yielded negative results.

3.6.2 Historical Resources

The proposed site is unlikely to contain any extant historical (pre-1953) resources. This determination is based on the findings reported in the 2003 ACI CRAS for the ISRP and Phase F sites (ACI 2003, NASA 2004b).

3.7 Geology and Soils

3.7.1 Geology

Geology, geohydrology and soils of Kennedy Space Center were described in detail by Schmalzer and Hinkle (1990). Their review described KSC sediments as consisting primarily of marine and lagoonal materials that have accumulated during alternating periods of deposition and erosion since the Eocene. The surface sediments are of Pleistocene and Recent ages. Fluctuating sea levels correlating to alternating glacial and interglacial cycles have shaped the formation of the barrier islands. Merritt Island is an older landscape whose formation may have begun as much as 240,000 years ago, although most of the surface sediments are not that old. Cape Canaveral likely dates from less than 7,000 years before present, as does the barrier strip separating Mosquito Lagoon from the Atlantic Ocean. Deep aquifers beneath KSC are recharged inland but are highly mineralized in the coastal region and interact little with surface vegetation. The surficial aquifer is recharged by local rainfall. Relict dune ridges in the center of Merritt Island are important to its recharge. Discharge is from evapotranspiration, seepage to canals and ditches, seepage into interior wetland swales, and seepage into impoundments, lagoons, and the ocean. This aquifer exists in dynamic equilibrium with rainfall and with the fresh-saline water interface. Freshwater wetlands depend on the integrity of this aquifer, and it provides freshwater discharge to the lagoons and impoundments.

3.7.2 Soils

The soils of KSC are mapped in the soil surveys for Brevard County (Huckle et al. 1974) and Volusia County (Baldwin et al. 1980). Fifty-eight soil series and land types are represented, even though Merritt Island is a relatively young landscape and one formed from coastal plain deposits. The primary source of parent material for KSC soils is sands of mixed terrestrial and biogenic origin. The terrestrial material originated from southern rivers carrying sediments eroded from highly weathered Coastal Plain and Piedmont soils; these sediments are quartzose with low feldspar content (Milliman 1972). These sediments moved south through long-shore transport and may have been

reworked repeatedly. The biogenic carbonate fraction of the sand is primarily of mollusk or barnacle origin with lesser contributions of coralline algae and lithoclasts; some may be reworked from offshore deposits of coquina and oolitic limestone (Milliman 1972). Soils on CCAFS and the barrier island section east of Mosquito Lagoon are younger than those of Merritt Island and, therefore, have had less time to weather. Well-drained soil series (e.g., Palm Beach and Canaveral) in these areas still retain shell fragments in the upper layers, while those inland on Merritt Island (e.g., Paola and Pomello) do not. The presence of shell fragments influences soil nutrient levels, particularly calcium and magnesium, and pH. The eastern and western sections of Merritt Island also differ in age. The eastern section of Merritt Island inland to about SR 3 has a marked ridge-swale topography, presumably retained from its formation as a barrier island; west of SR 3, the island is flatter, without obvious ridges and swales, probably due to the greater age of this topography. Differences in age and parent material account for some soil differences, but on landscapes of Merritt Island with similar age, topography has a dramatic effect on soil formation. Relatively small elevation changes cause dramatic differences in the position of the water table that, in turn, affect leaching, accumulation of organic matter, and formation of soil horizons. In addition, proximity to the lagoon systems influences soil salinity (NASA 2003).

Historically a wet area, the three soil types found on the proposed site consist of deep, poorly drained soils of low permeability (see Table 3-2). The Copeland-Bradenton-Wabasso Complex makes up the dominant soil on the site, accounting for 93 percent of the soils (Figure 3-4). Drainage ditches and bedding made these areas suitable for citrus (USDA 1974). Prior to the modifications made to accommodate citrus production, the naturally-occurring plant communities that would typically be found on these soils include species that can tolerate periodic root inundation.

During the last decade the Florida Research Center for Agricultural Sustainability (FLARES) was under contract to the Merritt Island NWR to utilize the Phase 1 site and other historical citrus groves on KSC as demonstration sites for sustainable and environmentally sound citrus production. Calcium arsenate, used in Florida during the 1950s and 60s on grapefruit groves, has been banned for use on citrus groves for decades. It is unlikely that it was used on the Phase 1 site as the area has not been used for grapefruit production (R. Adair, FLARES, pers. comm., 21 Nov 2008). Copper is generally only used on fresh fruit citrus and only two small groves on the northern edge of the site have been used for that purpose. Approved fungicides are also used on fresh fruit citrus crops. Most of the site has been fallow for at least 10 years. This abandoned portion of the site was used primarily for juice fruit production (R. Adair, FLARES, pers. comm., 21 Nov 2008). The only chemicals used on that portion of the site would have included petroleum spray oil, Roundup (glyphosate) and Landmaster 2 (glyphosate and 2,4-D, isopropylamine salt, and fertilizers (R. Adair, FLARES, pers. comm., 21 Nov 2008). Copper and fungicides are not used by FLARES on juice fruit citrus crops (R. Adair, FLARES, pers. comm., 21 Nov 2008).

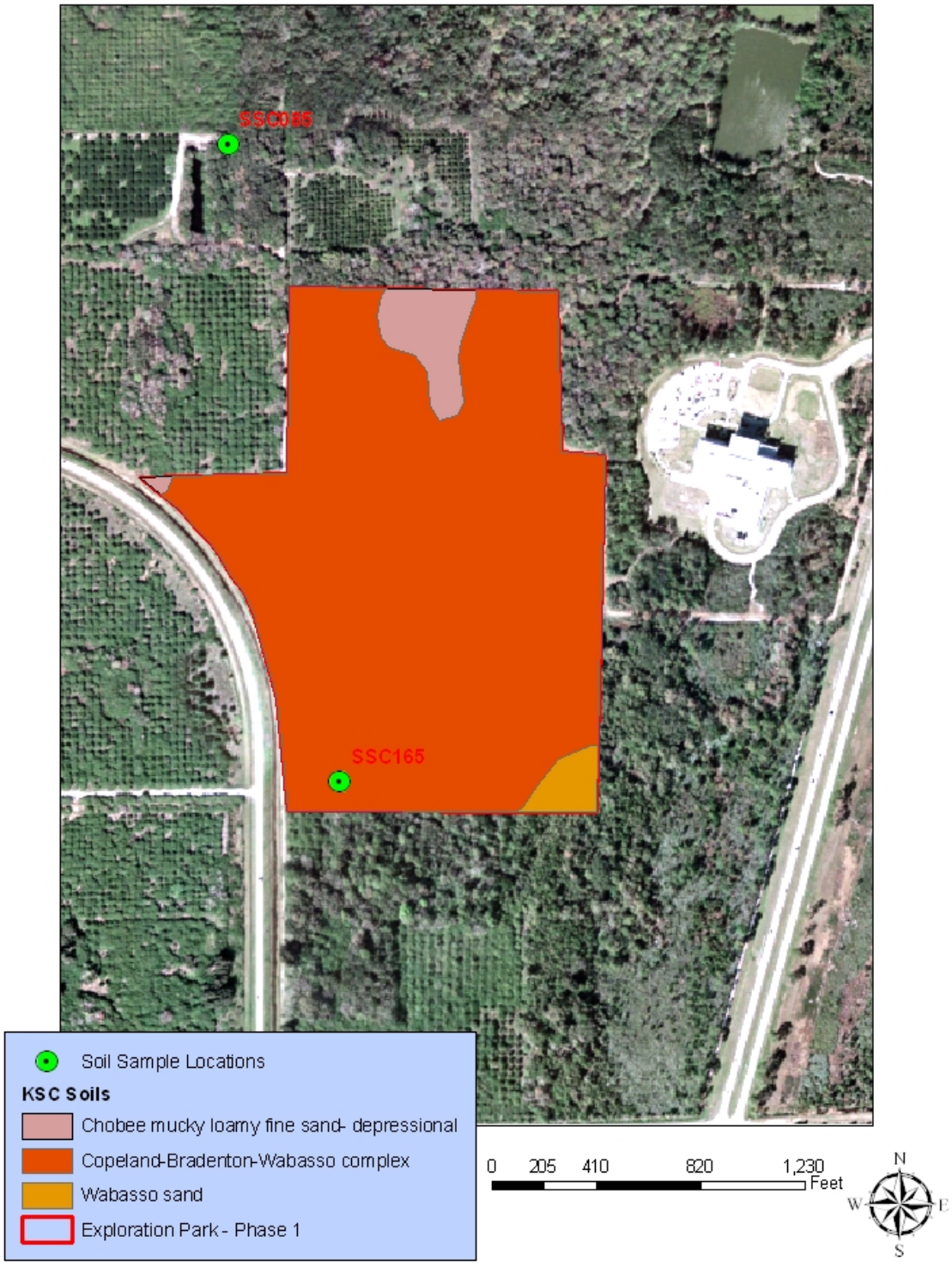
A KSC baseline study, completed in 1999, documented the background chemical composition of the soils, groundwater, surface water and sediments (Schmalzer et al. 2000). Soil samples from 200 soil sampling locations, within 10 soil classifications through out KSC, were analyzed for organochlorine pesticides, aroclors, chlorinated herbicides, polycyclic hydrocarbons (PAH), total metals, pH, cat ion exchange capacity (CEC), bulk density, resistivity, and soil texture. One sediment sample (SSC165) analyzed during the 2000 study was located on the proposed Phase 1 site (Figure 3-4). Organochlorine pesticide, aroclor, and chlorinated herbicide levels were below reporting limits for SSC165. For PAHs, benzo(a)athracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)

perylene, and indeno(1,2,3-cd)pyrene, had concentrations that were higher than the detectable limits (Schmalzer et al. 2000). PAHs can have biotic origins, although most naphthalenes are of human origin and are generally petroleum byproducts or coal-tar derivatives. Concentrations of metals in the soil samples were at low levels, except lead and mercury, which were slightly higher than the detectable limit (Schmalzer et al. 2000).

Table 3-2: Soil types and coverage within the proposed Phase 1 site boundary

Soil Type	Hectares	Acres
Wabasso Sand	0.50	1.23
Chobee Mucky Loamy Fine Sand- depressional	1.14	2.81
Copeland-Bradenton-Wabasso Complex	22.66	56.00
Total:	**24.29**	**60.03**

Figure 3-4: Soils within the proposed Phase 1 boundary.


SSC085
SSC165
Soil Sample Locations
KSC Soils
Chobee mucky loamy fine sand- depressional
Copeland-Bradenton-Wabasso complex
Wabasso sand
Exploration Park - Phase 1
0 205 410 820 1,230
Feet
N
W
E
S

3.8 Noise

Noise generated at KSC originates from six different sources: 1) launches, 2) Space Shuttle reentry sonic booms, 3) aircraft, 4) industrial operations, 5) construction, and 6) traffic. Noise generated above ambient levels by these sources has the potential to adversely affect both wildlife and humans. Some typical values for noise levels from construction and vehicles are shown in Appendix 6.

Baseline noise studies have not been performed directly at the proposed site. However, a noise study performed as part of the Shuttle Landing Facility Environmental Assessment (NASA 2007a) monitored ambient sound levels at various stations on KSC. One of the noise monitoring sites in the 2007 study was located along Swartz Road, approximately 5 km (3.2 miles) north of the Phase 1 site. During the study, noise levels ranged between approximately 50 and 80 dBA, with the highest noise levels corresponding to take-offs and landings of a supersonic F104 aircraft at the Shuttle Landing Facility (Comprehensive Health Services 2007). On a daily basis, noise levels on the proposed site are mostly governed by traffic along Space Commerce Way, while occasional higher noise levels are caused by aircraft operating at the SLF, as well as shuttle and rocket launches on KSC and CCAFS.

3.9 Surface Water Quality

The surface waters in and surrounding KSC are shallow estuarine lagoons and include portions of the Indian River, the Banana River, Mosquito Lagoon, and Banana Creek. The area of Mosquito Lagoon within the KSC boundary and the northernmost portion of the IRL, north of SR 406, are designated by the State as Class II, Shellfish Propagation and Harvesting. All other surface waters at KSC have been designated as Class III, Recreation and Fish and Wildlife Propagation. All surface waters within MINWR are designated as Outstanding Florida Waters as required by Florida Statutes for waters within national wildlife refuges.

NASA, the USFWS, and the St Johns Water Management District maintain water quality monitoring stations at surface water sites within and around KSC. The data collected are used for long-term trend analysis to support land use planning and resource management. KSC surface water quality is generally good, with the best water quality being found adjacent to undeveloped areas of the IRL, such as Mosquito Lagoon, and the northernmost portions of the Indian River and Banana River (NASA 2003).

Although some ditches occur on the Phase 1 site, these do not connect to any nearby waterways. The Space Commerce Way stormwater detention ditch runs the length of the road, on the east side, but it does not connect to the larger canal adjacent to SR 405.

3.10 Groundwater Quality

The State of Florida uses four categories to rate the quality of groundwater in a particular area. The criteria for these categories are based on the degree of protection that should be afforded to that groundwater source, with Class G-I being the most stringent and Class G-IV being the least. The groundwater at KSC is classified as Class G-II, which means that it is a potential potable water source and generally has a total dissolved solids content of less than 10,000 milligrams/liter (parts per million) (NASA 2003).

The subsurface of KSC is comprised of the Surficial Aquifer, the Intermediate Aquifer, and the Floridan Aquifer. Recharge to the Surficial Aquifer system is primarily due to the infiltration of precipitation; however, the quality of water in the aquifer beneath KSC is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the IRL. This is evident by the high mineral content, principally chlorides, that has been measured in groundwater samples collected during various KSC surveys (Schmalzer et al. 2000).

The proposed site lies over the West Plain Subaquifer, a Surficial Aquifer considered to be fair to poor in terms of its ability to recharge the underlying aquifer systems (Edward E. Clark 1985 & 1987).

3.11 Socioeconomics

KSC is Brevard County's largest single employer and a major source of revenue for the local economy. KSC operations create a chain of economic effects throughout the region. Each job created within Brevard County's space industry is estimated to generate an additional 1.93 jobs within the region (NASA 2003). Other large employers in the county are Patrick Air Force Base, the Brevard County School District, and Health First. Approximately 14,595 personnel were employed at KSC in 2005, a number that includes contractor, construction, tenant, and permanent civil service employees (NASA 2005). On KSC, civil service employees account for approximately 12 % of the total workforce. The highest employment levels at KSC were recorded during the Apollo program. In 1968, KSC recorded a peak population of 25,895, with an estimated one in four workers in Brevard County employed at KSC. Employment levels dropped precipitously following the Apollo program to a historic low in 1976, when a total of 8,441 personnel were employed. Employment levels rose sharply in 1979 when KSC was designated as the launch and operations support center for the Space Shuttle program.

Approximately 50 % of the people at KSC have positions directly related to the Shuttle and payload processing operations. The remaining workforce is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. The largest concentration of personnel is stationed in the LC 39 Area, and the next largest concentration is in the Industrial Area. Remaining personnel are stationed at various outlying facilities.

Most of the Phase 1 site consists of abandoned grapefruit trees which were last in production over ten years ago and are too old to be of any potential economic value (R. Adair, Florida Research Center for Agricultural Sustainability, Inc., pers. comm., 16 Sep 2008).

3.12 Land Use

Land and open water resources of KSC comprise 56,451 ha (139,490 ac) in Brevard and Volusia Counties, and are located along the east coast of central Florida at 28^{o} 38'N, 80^{o} 42'W (NASA 2003). The majority of the land areas comprising KSC are on the northern part of Merritt Island, which forms a barrier island complex with adjacent Cape Canaveral (NASA 1979). Undeveloped areas, including uplands, wetlands, mosquito control impoundments, and open water areas, comprise approximately 95 % of the total KSC area (NASA 2003). Nearly 40 % of KSC consists of open

water, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek (NASA 2003).

KSC was established under NASA jurisdiction for the purpose of implementing the Nation's space program (NASA 2003). NASA maintains operational control over approximately 3,035 ha [7,500 acres (ac)] of KSC. This area comprises the functional area, which is dedicated to NASA operations (Stoeckel, pers. comm.). Undeveloped operational areas are dedicated safety zones around existing facilities or are reserved for planned and future expansion.

The overall land use and management objectives of NASA and KSC are to maintain the Nation's space mission operations while supporting alternative land uses that are in the Nation's "best interest" under the Space Act (NASA 2003). Towards these ends, KSC developed a Land Use Plan in 1999 and then participated in the development of the Cape Canaveral Spaceport Master Plan, in cooperation with the 45th Space Wing and the Florida Space Authority. These plans provide an overall context for future land uses on KSC while not identifying any specific facility or land development projects. Such future projects will be driven by program changes and management decisions as yet undefined.

The designation of MINWR and CNS, in 1963 and 1975, respectively, on the 53,420 ha (132,000 ac) outside of NASA's operational control reflects this "best interest" objective. Both MINWR and CNS effectively provide a buffer zone between NASA operations and the surrounding communities. NASA delegated land management responsibilities for MINWR to the USFWS and for CNS to the NPS. The USFWS and NPS exercise management control over agricultural, recreational, and environmental programs within their respective jurisdictions (NASA 2003). NASA remains the landowner and maintains the option to remove lands from the MINWR or CNS as needed to support the space program (NASA 2003). NASA, working in partnership with the USFWS and NPS, has demonstrated that through careful land planning and management, the requirements of space flight and protection of natural resources can be achieved with minimal conflict (NASA 2003).

The land underlying the proposed footprint is currently under MINWR management (R. Hight, USFWS, pers. comm., 5 Sep 2008) and has been designated for citrus production since the early 1970s (USFWS 2006). A small section on the northern portion of the proposed site was in production until July 2008, while the remainder of the site has been abandoned for over 10 years (R. Adair, The Florida Research Center for Agricultural Sustainability, pers. comm., 16 Sep 2008). The site would be removed from MINWR supervision under the proposed action.

4.0 Environmental Consequences

Chapter 4 summarizes the potential impacts Proposed Action and No Action could have on environmental resources at KSC. Seventeen resource categories were analyzed (Table 4-1).

4.1 Summary and Status of Impacts

Potential impacts to resources resulting from the implementation of the Proposed and No Action alternatives were identified and placed into one of the following classifications:

- None – no impacts expected
- Minimal - impacts are not expected to be measurable, or are too small to cause any discernable degradation to the environment
- Minor - impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation
- Major - impacts could individually or cumulatively be substantial

4.1.1 No Action Alternative

Under the No Action alternative, development and operation of the aerospace business park would not occur at KSC. Educational activities, technology and innovation development, industrial application and space industry support services requiring use of facilities like those envisioned under the Proposed Action would have to be developed and conducted elsewhere, precluding the potential contribution to diversifying KSC's program base and eliminating anticipated positive economic impacts in aerospace-related employment and commerce. KSC would lose opportunities to support the nation's space policy for expanding commercial sector participation in civil space endeavors and complementary activities.

The land within the proposed Phase 1 boundary would remain fallow and likely become further invaded with non-native plant species, as these areas are not expected to be significantly managed by MINWR due to their degraded status and the effort and costs required to restore these resources (USFWS 2007a). Socioeconomics would be the only resource affected under the No Action alternative (Table 4-1). Potential future employment opportunities and their secondary economic effects would remain unrealized. Impacts to the local economy are expected to be major. According to the report, "Workforce Transition Strategy Space Shuttle and Constellation Workforce Focus", the total workforce at KSC is expected to decline to 3,800 in FY 2013 (NASA 2008). Even at half (600 employees) of the expected final occupation of the proposed Phase 1 business park for that year, the projected work force would represent over 15 percent of the total workforce at KSC, a substantial number.

4.1.2 Proposed Action

Impacts from the development and operation of the proposed aerospace business park range from none to major (Table 4-1). A discussion of these impacts follows in Section 4.2.

Table 4-1: Resources Matrix for the proposed the Exploration Park Phase 1.

Resource/Issue		Proposed Action	No Action
Transportation	C*	Minimal	None
	O*	Minor	None
Waste Water	C	Minor	None
	O	Minor	None
Electricity/Natural Gas	C	Minor	None
	O	Minimal	None
Communications	C	Minor	None
	O	None	None
Potable/Fire Water	C	Minor	None
	O	Minor	None
Stormwater	C	Minor	None
	O	Minimal	None
Air Quality	C	Minimal	None
	O	Minimal	None
Biological Resources *Land Cover*	C	Minor	None
	O	Minor	None
Biological Resources *Wildlife*	C	Minimal	None
	O	Minor	None
Threatened and Endangered Species	C	Minimal	None
	O	Minimal	None
Cultural Resources	C	None	None
	O	N/A	None
Geology and Soils	C	Minor	None
	O	None	None
Noise	C	Minor	None
	O	None	None
Surface Water Quality	C	Minor	None
	O	Minimal	None
Ground Water Quality	C	Minimal	None
	O	Minimal	None
Socioeconomics	C	Minor	Minimal
	O	Major	Major
Land Use	C	Minor	None
	O	Minimal	Minimal

* C = impacts from construction
* O = impacts from operations
N/A = not applicable

4.2 Analysis of Impacts from the Proposed Action

4.2.1 Facilities and Infrastructure

Under the Proposed Action, an incremental increase of up to 800 permanent employees could become housed at the Phase 1 development; the addition of this many people would be considered a minor impact as it represents only 15 percent of the current (NASA 2008) workforce. The proposed Phase 1 design is estimated to support approximately 29,264 m^2 (315,000 ft^2) of educational, office, laboratory, and flexible high-bay facilities upon build-out (SPFL 2008). The footprint of the buildings, roads, parking lots, sidewalks and other related infrastructure would total approximately 100,617 m^2 / 1,083,030 ft^2 (24.8 ac / 10.0 ha) (J. Smith, O'Brien Atkins Associates, pers. comm., 13 Oct 2008).

4.2.1.1 Transportation

Construction - The construction activities of the new facilities, parking lots and roads under the Proposed Action would be expected to have minor impacts to transportation routes within KSC. Increased construction traffic would occur during normal working hours and could cause some traffic delays. However, the majority of the construction activities would be in an isolated area and the capacity of all affected roads would not be exceeded by this increase in vehicles. The build out estimates for the original ISRP was determined not to create any critical violations of traffic level of service standards (NASA 2004b) related to construction of the facilities.

Operation – Access to the proposed business park would be provided by a connecting road that would be constructed at the intersection of Space Commerce Way and Ransom Road. This would eventually be followed by a road connecting the park to SLSL. The currently proposed Exploration Park Phase I, proposes to generate 2,555 average daily trips (roughly 40% of the 2010 projection and only 12% of the 2022 projection for the ISRP). The build out estimates for the original ISRP was determined not to create any critical violations of traffic level of service standards (NASA 2004b) related to operation of the facilities.

4.2.1.2 Waste Water

Construction - The construction of the proposed Phase 1 facilities would require connections to the KSC or nearby municipal sanitary sewer system as these presently do not exist at the site. A connection to the KSC sewage system via a life station located at the SLSL. This would require several hundred meters (yards) of trenches to be dug between the proposed site and the SLSL (NASA 2006). The impact of this is considered to be minor and could be mitigated with a corridor that would run through the disturbed habitats of the old grove.

Operation - Based on the projected occupants estimated for the proposed research park, approximately 68,137 LPD (18,000 GPD) of wastewater would be generated (NASA 2006). This volume is anticipated to be accommodated by the existing KSC sewage system and is expected to have a minor impact.

4.2.1.3 Electricity and Natural Gas

Construction - For the proposed Phase 1 development, underground power could be routed from 13.2 kVa lines at SLSL. These could be laid down along the same utility corridor required for the sewage lines to minimize the amount of soils and vegetation disturbance. Similarly, a connection to the nearby natural gas line that services the SLSL could be made. It is expected that the construction of these connections would have minor impacts.

Operation - Upon completion of the Phase 1 park, its electrical use would be expected to be readily accommodated by the KSC electrical infrastructure. In addition, sustainable facility designs in accordance with LEED certification, such as day-lighting of interior space is expected to help reduce energy consumption. Therefore, electrical use by Phase 1 is expected to have minimal impacts. Natural gas usage is also anticipated to have minimal impacts.

4.2.1.4 Communications

Construction – If NASA CD&SC were to be used as the communications provider, a ductbank for copper and fiber optic cabling ductbank could be routed from the SLSL switching station to the proposed site along a future connecting road. Where possible, the new ductbank would be constructed in existing ruderal areas along easements to avoid disturbing soils and hammocks. Impacts from the construction of communication lines is expected to be minor.

Operation – No impacts are expected from Phase 1 communication activities.

4.2.1.5 Potable/Fire Water

Construction - potable and fire water lines would need to be laid to serve the proposed business park. These lines would need to be constructed to tie in to the existing main located at the SLSL. To minimize impacts to soils and vegetation, these lines would need to be located along existing easements and combined with other infrastructure. These impacts are considered to be minor.

Operation - Approximately 91,200 liters per day (LPD) / [24,000 gallons per day (GPD)] of potable would be required by the estimated 1,200 occupants for the proposed research park (NASA 2006). The City of Cocoa has sufficient capacity to accommodate this level of water consumption anticipated for the proposed business park, and the impact is expected to be minor.

4.2.1.6 Stormwater

Construction – As described in Sections 3.1.6 and 4.2.1, approximately 100,617 m^2 (1,083,030 ft^2) of impervious surfaces (buildings, roads, parking lots, etc.) would be added to the site. A stormwater management system of approximately 16,072 m^2 (173,000 ft^2) would be required (J. Smith, O'Brien Atkins Associates, pers. comm., 13 Oct 2008) on the proposed site to store and treat the added runoff and could include one or both of citrus groves located at the northern end of the site. This option would preclude using additional hammocks as stormwater detention areas. In addition, the stormwater detention ponds would be partially surrounded by hammocks, minimizing disturbance to wading birds and other wildlife that would likely utilize these artificial wetlands. It is

anticipated that the effects of the construction of a stormwater management system for the proposed site will be temporary and minor.

Operation - Stormwater system operations for the proposed development is expected to have minimal impacts. These areas are likely to provide some habitat, at least during certain times of the year, for wading birds and other wildlife species.

4.2.2 Air Quality

Construction - Site preparation and construction of the proposed Phase 1 park would produce minimal impacts to the surrounding air quality. Land clearing and other construction would generate airborne particulates from earth moving, as well as hydrocarbon exhaust from heavy equipment and generators. These impacts are expected to be small in scope and of short duration. Best Management Practices would be employed to mitigate for emissions due to earth movement, which would include water spraying for dust control.

Operation - The following threshold levels are used to describe “major” sources of air pollution:

- Produce threshold quantities for any individual emissions unit or activity that emits or has the potential to emit 227 kg/yr. (500 lbs./yr.) or more of lead and lead compounds, 454 kg/yr. (1,000 lbs./yr.) or more of any hazardous air pollutant (HAP), 1,134 kg/yr. (2,500 lbs./yr.)or more of total HAP, or 4,536 kg/yr. (5 tons/yr.) or more of any other regulated pollutant, and require an individual construction permit prior to construction [Chapter 62-213.300(2) F.A.C.].

- Produce threshold quantities as a facility that emits or has the potential to emit 4,536 kg/yr. (5 tons/yr.) or more of lead and lead compounds, 9,072 kg/yr. (10 tons/yr.) or more of any HAP, 22,680 kg/yr. (25 tons/yr.) or more of total HAP, or 90,720 kg/yr. (100 tons/yr.) or more of any other regulated pollutant, and require a construction and an operating permit [Chapter 62-213.300(2) F.A.C.].

Operational sources of air pollution are categorized based on their emission sources. These would include chemicals produced by a variety of activities envisioned for the proposed research park, including light industry, aerospace testing, and life science and engineering laboratories. Tenants of the proposed research park would be included in the KSC Title V Operating Permit if their operations were directly supporting NASA missions or under NASA contracts. For operations not funded by NASA, tenants would apply for their own operating permits if they expected to have any significant air pollution sources, operations, or processes. Other permits (Chapters 62-4, 62-210, 62-212, F.A.C.) would also be required, including state construction and new source review (NSR) and prevention of significant deterioration (PSD) permits. On-site diesel generators could potentially release fumes, although this would be infrequent and of relatively small quantities. In addition, vehicles used by occupants and in support of the proposed activities would emit exhaust. An estimate for the increase in vehicles trips per day due to the proposed action would be approximately 2,555 (See Section 3.1.1). Typical emission rates from that estimated level of vehicle usage would not be sufficient to push air quality measurements into noncompliance. Hence, operation of the proposed facilities is not expected to produce amounts of emissions above threshold levels and the effect on air quality is expected to be minimal.

4.2.3 Biological Resources

4.2.3.1 Land cover

Construction - Under the Proposed Action, the site encompasses a total of 24.29 ha (60.03 ac) that could be taken from currently undeveloped land. The infrastructure footprint (facilities, roads, parking lots, footpaths, landscaped areas, lawns, and stormwater management systems) within the site covers approximately 41 percent of the site (10 ha or 24.8 ac). Phase 1 is anticipated to be a minor impact within KSC as the total site boundary represents less than 0.05 percent of the total KSC area. Approximately 79 percent of the current land cover with the site (19.15 ha / 47.31 ac) is citrus groves. Most of these citrus groves have been abandoned for over 10 years and are overgrown with Brazilian pepper and other non-native weeds. At the northern end of the site is a hardwood hammock (3.15 ha / 7.80 ac) that has been exposed to some level of disturbance due to the dumping of concrete slab and old pipes. Along the southern end of the site is a narrow strip of disturbed forest that has been highly invaded by Brazilian pepper. Figure 3-1 and Table 3-1 show the locations, and amounts of the specific impacted land cover types.

Currently, there is no final design for the proposed Phase 1 business park, and therefore, no specific mitigation plans for changes in land cover and associated habitat loss. Pending the outcome of this EA, appropriate, detailed plans would be developed as part of the permitting process. The current plan option reduces impacts from the proposed development on the site by concentrating the facilities, roads, and parking lots in areas that now consist of abandoned citrus groves. The stormwater detention ponds could be built in between the wetland hammocks in areas that are currently orange trees. As mentioned previously in Section 4.2.3.1, this would help maintain the integrity of the hammocks while increasing the usefulness of the stormwater detention areas for wildlife.

Operation - Currently the proposed site is fallow and being invaded by non-native plants. The site is not actively managed by MINWR, whose habitat restoration program generally focuses on sites that are less degraded and not in close proximity to KSC developed areas (USFWS 2006). Such unmanaged areas can become vectors for invasive plants and non-native animals, which could impact nearby, more natural areas. Once developed, it is expected that the site will be planted with native plant species, while invasive non-native plants would be controlled to some extent. The impact of operations on land cover is expected to be minor.

4.2.3.2 Wildlife

Construction - The primary impact expected to wildlife from development of the Proposed Action would be the loss of terrestrial habitat. However, most of the species that might be directly affected by the Phase 1 development are common on KSC, as well as regionally, and are not legally protected (Breininger et al. 1994). The loss of a maximum of 24.29 ha (60.03 ac) as described in the Proposed Action comprises approximately 0.04 percent of the habitat not used for space operations on KSC that is available for wildlife. Most of the site is already seriously disturbed and invaded with non-native plants and of little value to most wildlife species, except common habitat generalists and non-

native species. The hammocks are likely utilized by several, mostly common, native species of wildlife, and may also be used as roosting and foraging areas during parts of the year by migratory birds. These woods make up less than one percent of the total estimated area covered by hammocks on KSC. The impact to wildlife populations and biodiversity on KSC from this action is expected to be minimal.

Operation - Buildings can create wildlife hazards through the fatal collisions of migratory songbirds with windows (especially tinted varieties), with nation-wide mortality estimates ranging between 98 to 976 million birds annually (USWFS 2008). There are a variety of structural designs that could be incorporated into the plans of the proposed facilities to minimize this risk. Wildlife-vehicle collisions could also increase slightly due to the presence of more cars on the project site roadways. Speed limit and other signs could help reduce these impacts.

4.2.4 Threatened and Endangered Species

Construction - Twenty seven federally and state-protected wildlife species documented on KSC are listed in Appendix 5. Eight of these species could potentially occur in the habitat types that would be impacted by the Proposed Action (Table 4-2). This impact is expected to be minimal.

A habitat generalist, the eastern indigo snake has been documented using all of the vegetated habitats present within the Proposed Action alternative, and at least one indigo snake has been recorded occurring in the vicinity of the site (NASA 2002). However, the impact to eastern indigos for the loss of 23.14 ha (57.20 ac) of habitat is expected to be minimal. The average home range size for male indigos in Brevard County was 118 ha (291 ac.) and the smallest range recorded was 65 ha (161 ac.) (Legare et al., unpublished data). Average home range for females was 41 ha (101 ac.) and the smallest recorded was 30 ha (74 ac.). The entire acreage that would be developed for the Proposed Action is approximately three-fourths the size of the smallest home range expected for a single indigo snake.

Wood storks and other wading birds may occasionally utilize the drainage ditches on the proposed site, although access to these waters is limited due to an overgrowth of non-native trees and shrubs (J. Provancha, Dynamac, pers. comm., 16 Sep 2008). The stormwater detention ditch along Space Commerce Way is utilized as a foraging area by wading birds. Wood storks likely also use this ditch periodically throughout the year, whenever water levels are of suitable depth. Construction activities, especially of the proposed access road along the west bank of the Space Commerce Way ditch, may temporarily disturb wood storks and other wading birds. However, the planned stormwater management system that would be required for the proposed site could serve as a foraging area for wading birds, including wood storks, as these species frequently utilize man-made wetlands (USFWS 2007b). Overall, construction of the proposed site is not expected to have any long-term, negative impacts to wood storks and other wading birds.

Impacts to alligators from the proposed action are expected to be minimal. As may be expected for wading birds, the stormwater detention areas associated with the proposed action could benefit alligators.

Gopher tortoises and their burrows were not documented on the site, as would be expected given the area's relatively wet characteristics (B. Bolt and J. Provancha, Dynamac, pers. comm., 3 Sep 2008). In addition, most of the nearby surrounding habitats are also not suitable for gopher tortoises, and it

is unlikely that they would utilize the proposed site as a foraging area. Still, before any construction would begin, surveys for gopher tortoises and their burrows would be done, and if found, the tortoises would be captured and relocated to the nearest adjacent suitable habitat in accordance with the KSC Gopher Tortoise Relocation Policy. Impacts would be classified as minimal.

Operation - During the operational phase of the proposed action, disturbance to wildlife from vehicles and pedestrians are likely to be the primary impacts. These are expected to be minimal, as many birds and other wildlife species readily habituate to the presence of cars and people (Whittaker and Knight 1998). There is expected to be some risk of vehicle collisions with wildlife on the proposed site and access road. However, posted speed limits are anticipated to be relatively low. In addition, speed reduction devices and "Give Wildlife A Brake" signs would help further reduce the risk of vehicle-wildlife collisions.

Table 4-2: Protected wildlife species potentially occurring in the habitats impacted by the development of the proposed Phase 1 business park.

SCIENTIFIC NAME	COMMON NAME	LEVEL OF PROTECTION	
Amphibians and Reptiles		**STATE**	**FEDERAL**
Alligator mississippiensis	American alligator	SSC	T(S/A)
Drymarchon couperi	Eastern indigo snake	T	T
Birds			
Egretta thula	Snowy egret	SSC	-
Egretta caerulea	Little blue heron	SSC	-
Egretta tricolor	Tricolored heron	SSC	-
Eudocimus albus	White ibis	SSC	-
Ajaia ajaja	Roseate spoonbill	SSC	-
Mycteria americana	Wood stork	E	E

Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance

4.2.5 Cultural Resources

Based on previous studies performed on and near this site, the area has been identified as having a low potential for impacts to cultural resources (ACI 2003, NASA 2004b). Furthermore, there are no known archeological or historic properties within the site. Therefore, no impacts to cultural resources are expected.

4.2.6 Geology and Soils

Construction - Any potential impacts to the geology and soils of the proposed Phase 1 business park would be due to site preparation activities. Land clearing and excavation for facility foundations and stormwater management systems would require that the upper layers of the soil strata be removed. This alteration of the site may affect the flow patterns of surface runoff from rainfall events, but would be mitigated for with the site grading and construction of a suitable stormwater system to contain and treat runoff. Impacts are expected to be minor.

Operation - None of the activities within the three action alternatives would produce impacts to the geologic strata or soils of the local area or region.

4.2.7 Noise

Construction - Noise generated during the construction phases of the proposed business park would potentially have discernable, but temporary effects on wildlife occurring nearby. Construction noise sources and levels that could be expected on the site are listed in Appendix 6, with the highest levels reaching 111 decibels, A-weighted (dBA). However, construction would take place in areas that already experience noise associated with vehicles using Space Commerce Way. Also, noise attenuation rates are such that at a distance of 120 m (400 ft), between 60 and 75 percent of the noise level has dissipated (Suter 2002). The majority of research related to the effects of noise on wildlife has been conducted on laboratory animals and the results extrapolated (Brown 2001). Some buffering of noise is afforded to wildlife by vegetation; with attenuation rates of up to 10 dBA per 100 m (328 ft.) having been demonstrated in vegetated areas (Price et al. 1988). Based on that rate, noise would be expected to carry 300 - 400 m (984 - 1,312 ft.) away from the construction sites. Beyond this distance, noise levels would be lower than what has been experimentally shown to have deleterious effects on animals (Brown 2001). Wildlife occurring closer to noise sources would be free to move away or find shelter (e.g., burrows). There are no wading bird colonies, documented eagle nests (Figure 3-2), or other protected bird species' nesting habitat within 400 m (1,312 ft.) of the site. Therefore, noise impacts are expected to be minor. Permissible noise exposure limits for humans are established by the Occupational Safety and Health Administration (OSHA). Away from the site, noise levels are expected to be below the OSHA recommended 8-hour time weighted level of 85 dBA (OSHA 2008).

Operation - No environmental consequences related to noise are expected from operations associated with the activities planned under the proposed action.

4.2.8 Surface Water Quality

Construction - The construction of the proposed Phase 1 park would have minor effects on surface water quality. During land-clearing and other site development activities, impacts to surface waters from erosion and sedimentation would be controlled by using Best Management Practices (BMPs).

Operation - The operation of the proposed Phase 1 business park would have minimal impacts on the surface water quality of the site and surrounding area. As discusses in Section 4.2.1.2, a stormwater management system would be built to treat increased runoff caused by new roads, parking lots, buildings and other impervious areas.

4.2.9 Groundwater Quality

Construction - The groundwater quality at the proposed site is affected by runoff that percolates into the surficial aquifer. Construction at the proposed site could temporarily increase the amounts of sedimentation and pollutants that could migrate into the groundwater system. These impacts would be reduced by employing BMPs and are expected to be minimal.

Operation - The various activities outlined in Section 2.2.4 associated with the proposed Phase 1 business park are expected to have a minimal effects on groundwater quality. Runoff from roofs, roads, parking lots, landscaped areas, and lawns would be absorbed and treated by the required surface water management system, preventing transfer of any associated pollutants into the groundwater.

4.2.10 Socioeconomics

Construction - A total of 70 construction workers are expected to be required during the construction of the proposed Phase 1 site (A. Odessey, SPFL, pers. comm., 9 Oct 2008). These would be drawn from the local workforce with an anticipated positive impact to the area's economy. At any one time, KSC already employs has a relatively large number of construction workers, and this impact to area's socioeconomics and the local workforce would likely be minor.

Operation - During their operational phase of the proposed action, the four main categories of activities (Section 2.2.4) and their associated workforce, are anticipated to have an impact on socioeconomics. Under the Proposed Action, approximately 800 employees would occupy the facilities planned for the site. Many of labor categories would require advanced degrees and/or training, including educational staff, science and medical researchers, test engineers, software engineers, aeronautical engineers, mechanical engineers, and safety and quality assurance personnel. Additional staff would be comprised of technicians, ground operations personnel, facility personnel, and maintenance workers. The Chief Financial Office at KSC generates annual reports which highlight the economic impacts of KSC locally and state-wide. According to a recent report, average, spendable earnings of each KSC worker was estimated at $77,600, which was more than twice the wage level of the average Brevard County worker (NASA 2007b). Total gross earnings of all NASA/KSC workers in Florida were estimated at $1.1 billion in Fiscal Year (FY) 2007. In addition, each job at KSC has been calculated to generate close to 2.5 jobs state-wide (NASA 2007b), and non-labor purchases by KSC totaled $703 million in FY 2007 (NASA 2007b). The results of these economic reports show that in addition to the technical and social benefits derived from KSC's activities, the economic effects extend state-wide. The total economic impact of the proposed activities could be in the millions of dollars, and would rise with each successive year of increased activity.

4.2.11 Land Use

Construction - A relatively small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. KSC covers 56,451 ha (131,990 ac) of which 5.4 percent is designated as operational area. The approximately 24.29 ha (60.03 ac)of land that would be developed under the Proposed Action would represent less than 0.04 percent of the total area of KSC; and this would be considered a minor impact. Furthermore, the consolidation of facilities and infrastructure would minimize the impacts related to development.

Operation - The operation of the Phase 1 business park would have minimal impacts to the existing land use. Currently the land is no being utilized for citrus production, nor are there immediate plans by MINWR to restore the area due to the high cost associated with those efforts and the fact that these areas have long lost their former biological characteristics due to past land use and the invasion

of non-native plants (USFWS 2006). In addition, the proposed land use would be consistent with surrounding uses of the adjacent SLSL and KSC in general.

4.3 Cumulative Impacts

4.3.1 No Action Alternative

If no action is taken, cumulative impacts are anticipated to be major for the local economy in light of the projected workforce level and economic activity. The unrealized job opportunities will also mean a diminished potential level of associated primary and secondary economic benefits to the local economy.

4.3.2 Proposed Action Alternative

The anticipated cumulative impact from the proposed development of the Phase 1 site is related to development of the land. The alteration of pervious to non-pervious surface and the loss of habitat constitute a land use change. However, the acreage of the Proposed Action alternative is small 24.29 ha (60.03 ac) as compared to the total amount of undeveloped habitat on KSC 53,416 ha (131,990 ac). In addition, the proposed site is immediately adjacent to an already developed, disturbed area and most of it would occur in land cover types that are relatively common on KSC.

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5.0 Environmental Justice

On February 11, 1994, the President of the U.S. signed Executive Order (EO) 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The general purposes of the EO are to: 1) focus the attention of Federal Agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster non-discrimination in Federal programs that substantially affect human health or the environment; and 3) give minority and low income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment. The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA's mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Space Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and, 5) consider both normal operations and accidents. KSC has developed a plan to comply with the EO and NASA's agency-wide strategy.

Neither of the alternatives described in this EA (Proposed Action and No Action) would be expected to produce any consequences related to Environmental Justice. The proposed activities would be implemented within the boundaries of KSC. The closest residential areas are 3.9 km (2.5 mi) south on Merritt Island, and 12 km (7.6 mi) west in Titusville. The closest one on north Merritt Island is extremely low density and the distance to the Titusville areas preclude any direct impacts from construction. Operational impacts are expected to be negligible in the residential areas based on data models and surveys. Economic impacts are not expected to adversely affect any particular group. Construction personnel would be drawn from the local workforce and provide economic benefits to the local area. At full capacity, the proposed business park is anticipated to employ a workforce of 800 people, benefiting the local economy.

6.0 Preparers, Contributors, and Contacts

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Foster, Tammy	Dynamac Corporation	Plant Ecologist	Data and text
Odyssey, Allison	Space Florida	Project Engineer	Administration and review
Pieper-Schmitz, Rhonda	Motorist Design	Transportation Engineer	Data and text
Provancha, Jane	Dynamac Corporation	Senior Scientist	Project Manager, Field, data, text
Shaffer, John	NASA KSC, Environmental Planning	Lead, Environmental Planner	KSC Environmental Office NEPA Consultation
Van Den Ende, Oliver	Dynamac Corporation	Environmental Scientist	Data, text; Document administration

7.0 Literature Cited

Baldwin, R., C.L. Burch, R.B. Hinton, H.H. Huckle, P. Nichols, F.C. Watts, and J.A. Wolfe. 1980. Soil survey of Volusia County, Florida. USDA Soil Conservation Service, Washington, D.C. 207 p. and maps.

Bolt, M.R. and R.R. Cancro.2006. Annual Eagle Reproduction Survey on Kennedy Space Center. Unpublished report to the NASA Environmental Program Branch.

Breininger, D. R. 1981. Habitat preferences of the Florida Scrub Jay (*Aphelocoma coerulescens coerulescens*) at Merritt Island National Wildlife Refuge, Florida. M.So Thesis. Department of Biological Sciences, Florida Institute of Technology, Melbourne, Florida.

Breininger, D. R. 1992. Habitat model for the Florida Scrub Jay on Kennedy Space Center. NASA Technical Memorandum 107543. John F. Kennedy Space Center, Florida.

Breininger, D. R., M. J. Provancha and R. B. Smith. 1991. Mapping Florida Scrub Jay habitat for purposes of land-use management. Photogrammetric Engineering and Remote Sensing 57:1467-1474.

Breininger, D.R., M.J. Barkaszi, R.B. Smith, D.M. Oddy, and J.A. Provancha. 1994. Endangered and potentially endangered wildlife on John F. Kennedy Space Center and faunal integrity as a goal for maintaining biological diversity. NASA Technical Memorandum 109204.

Breininger, D. R., M. L. Legare, and R. B. Smith. 2004. Eastern indigo snakes (Drymarchon couperi) in Florida: Influence of edge effects on population viability. Pages299-311 in H. R. Akçakaya, M. Burgman, O Kindvall, P. Sjorgren-Gulve, J. Hatfield, and M. McCarthy, editors. Species conservation and management: case studies. Oxford University Press.

Brown, L. 2001. Overview of research on the effects of noise on wildlife. in Proceedings of the Effects of Noise on Wildlife Conference, Happy Valley-Goose Bay, Labrador. Institute for Environmental Monitoring and Research, 2: 10-14.

Clements, B.W. and A. J. Rogers. 1964. Studies of impounding for the control of salt marsh mosquitoes in Florida, 1958-1963. Mosquito News, 24: 265-276.

Comprehensive Health Services. 2007. Environmental Noise Assessment of the F104 Flight Test at Kennedy Space Center, Florida, April 17, 2007. Prepared for NASA KSC Environmental Office by Comprehensive Health Service, Inc., Industrial Hygiene Office (CHS T200704-2000).

DeFreese, D.E. 1991. Threats to biological diversity in marine and estuarine ecosystems of Florida. Coastal Management, 19: 73-101.

Drese, J.H. 1985. Air Quality Summary and Monitoring Status at John F. Kennedy Space Center for the First Quarter (January-March) 1985. NASA/KSC Biomedical Office. Contract No. NAS 10-10285. John F. Kennedy Space Center, Florida.

Drese, J. 2006. Air quality summary and monitoring status at John F. Kennedy Space Center for the fourth quarter (October – December) 2005, and the first, second, third quarters 2006. Prepared for the NASA KSC Environmental Program Branch, Contract # NAS10-0200, DRD No. 004.

Drese, J. 2007. Kennedy Space Center Annual Air Quality Report.

Dyer, K.J. 2004. Habitat use and seasonal activity of selected snakes on John F. Kennedy Space Center, Florida. Masters Thesis, University of Central Florida, Orlando. 42 pp.

Edward E. Clark Engineers-Scientists, Inc. 1985. KSC subsurface hydrology and groundwater survey: the site specific program. KSC-DF-3081. Kennedy Space Center, Florida.

Edward E. Clark Engineers-Scientists, Inc. 1987. KSC subsurface hydrology and groundwater survey. Volume IV. The areawide groundwater survey program. KSC-DF-3081. Edward E. Clark Engineers-Scientists, Inc., Kennedy Space Center, Florida. Contract No. NAS10-11293.

Ehrhart, L.M. 1976. A study of diverse coastal ecosystem on the Atlantic Coast of Florida: Mammal studies. Final report to NASA KSC. Grant No. NGR10-019-004. Kennedy Space Center, Florida.

Florida Department of Transportation. 1999. Florida Land Use, Cover and Forms Classification System (FLUCCS). Florida Department of Transportation Thematic Mapping Section.

Gilmore, R.G. 1977. Fishes of the Indian River Lagoon and adjacent waters, Florida. In: Bulletin of the Florida State Museum, 22: 101-147.

Greller, A.M. 1980. Correlation of some climatic statistics with distribution of broadleaved forest zones in Florida. U.S.A. Bulletin of the Torry Botanical Club 107: 189-219.

Hardesty, J.L., and M.N. Collopy. 1991. History, demography, distribution, habitat use, and management of the Southern Bald eagle (*Haliaeetus l. leucocephalus*) on Merritt Island National Wildlife Refuge, Florida. National Fish and Wildlife Foundation, Log Ref #88-93.

Huckle, H.F., H.D. Dollar, and R.F. Pendleton. 1974. Soil survey of Brevard County, Florida. U.S. Dept. of Agricultural, Soil Conservation Service, Washington, D.C., USA. 231 pp.

Jones, G.A. 1999. Neotropical migrant use of a commercial citrus grove for fall stopover. North American Bird Bander. 24: 20-33.

Mailander, J.L. 1990. The Climate of the Kennedy Space Center and Vicinity. NASA Technical Memorandum No. 103498. Kennedy Space Center, Florida.

Milliman, J.D. 1972. Atlantic Continental Shelf and Slope of the United States – petrology of the sand fraction of sediments, Northern New Jersey to Southern Florida. U.S. Geological Survey Professional Paper 529-J. Washington, D.C. 40 pp. and maps.

NASA. 1979. Environmental Impact Statement for the John F. Kennedy Space Center.

NASA. 2000. Environmental Assessment for The Space Experiments Research and Processing Laboratory (SERPL). Dynamac Corporation for the National Aeronautics and Space Administration John F. Kennedy Space Center Environmental Program Office Kennedy Space Center, FL.

NASA. 2002. Revised Flora and List of Threatened and Endangered Plants for the John F. Kennedy Space Center Area, Florida. Dynamac Corporation for KSC NASA. NASA/TM-2002-211175. 75 pp.

NASA. 2003. Environmental Resource Document, Kennedy Space Center. KSC-PLN-1911 Revision D. https://tdksc.ksc.nasa.gov/servlet/dm.web.Fetch/KSC-PLN-1911_Environmental_Resources_Document_Rev_D.pdf?gid=28575.

NASA. 2004a. The Vision for Space Exploration. NASA Headquarters. NP-2004-01-334-HQ. 32 pp. http://www.nasa.gov/pdf/55583main_vision_space_exploration2.pdf.

NASA. 2004b. Final Environmental Impact Statement for the International Space Research Park at the John F. Kennedy Space Center, Florida. NASA KSC Environmental Program Office.

NASA. 2004c. Kennedy Space Center Annual Report. Kennedy Space Center, Florida. 50 pp. http://www.nasa.gov/centers/kennedy/pdf/118281main_AR2004.pdf

NASA. 2007a. Final Environmental Assessment for Expanded Use of the Shuttle Landing Facility. John F. Kennedy Space Center, Environmental Program Office. 116 pp.

NASA. 2007b. Economic Impact of NASA In Florida FY 2007. Chief Financial Office, Kennedy Space Center, Florida. 28 pp.

NASA. 2008. Workforce Transition Strategy, Initial Report, Space Shuttle and Constellation Workforce Focus. 33 pp.

OSHA. 2008. Occupational Noise Exposure. http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735 . Accessed: 18 Sep 2008.

Platts, N.G., S.E. Shields, and J.B. Hull. 1943. Diking and pumping for control of sand flies and mosquitoes in Florida salt marshes. J. Economic Entomology., 36: 409-412.

Price, M.A., K. Attenborough, and N.W. Heap. 1988. Sound attenuation through trees: measurements and models. Journal of the American Statistical Association, 84: 1836-1844.

Provancha, M.J., P.A. Schmalzer, and C.R. Hinkle. 1986. Vegetation types (Maps). John F. Kennedy Space Center, Biomedical Operations and Research. (Maps in Master Planning Map format, digitization by ERDAS, Inc.).

Provancha, J.A., and C.R. Hall. 1991. Observations of associations of sea grass beds and manatees in East Central Florida. Florida Scientist 54:87-98.

Provancha, J.A., R.B. Smith, and B.A. Homa. 2005. Final Report Southeastern Beach Mouse Abundance and Distribution on Kennedy Space Center and Merritt Island National Wildlife Refuge, Florida. Submitted to: U.S. Fish and Wildlife Service, Jacksonville Ecological Services Office, FL.

Schmalzer, P.A. and C.R. Hinkle. 1985. A brief overview of plant communities and the status of selected plant species at John F. Kennedy Space Center, Florida. Report submitted to NASA, Biomedical Operations and Research Office, John F. Kennedy Space Center.

Schmalzer, P. and R. Hinkle. 1990. Geology, geohydrology, and soils of NASA, Kennedy Space Center: A review. http://ntrs.nasa.gov

Schmalzer, P. A., M. A. Hensley, M. Mota, C.R. Hall, and C. A. Dunlevy. 2000. Soil, Groundwater, Surface Water, and Sediments of Kennedy Space Center, Florida: Background Chemical and Physical Characteristics. NASA Technical Memorandum 2000-20853. 595 pp.

Schmalzer, P.A. and T.E. Foster. 2005. Multi-species scrub plant survey in Brevard County, Florida, for occurrence of Federally listed endangered or threatened scrub plant species. Final report to Brevard County Natural Resources Management Office. Dynamac Corporation, Kennedy Space Center, Florida. 79 p.

Seigel, R.A., R.B. Smith, J. Demuth, L.M. Ehrhart, and F.F. Snelson, Jr. 2002. Amphibians and reptiles of the John F. Kennedy Space Center, Florida: A long-term assessment of a large protected habitat (1975-2000). Florida Scientist 65:1-12.

SGS. 2006. Kennedy Space Center energy utilization and consumption report. JBOSC NAS 10-99001.

Smith, R.B. and D.R. Breininger. 1995. Wading bird populations of the Kennedy Space Center. Bulletin of Marine Science 57:230-236.

Snelson, F.F., Jr. 1983. Ichthyofauna of the northern part of the Indian River Lagoon System, Florida. Florida Scientist, 46 : 187-206.

Space Florida. 2008. Exploration Park Development and Operations Plan.

Stout, I.J. 1979. Terrestrial community analysis. Vol. I of IV: a continuation of baseline studies for environmentally monitoring space transportation systems (STS) at John F. Kennedy Space Center. NASA Contract Report No. 10-8986.

Suter, A.H. 2002. Construction noise: Exposure, effects, and the potential for remediation; a review and analysis. American Industrial Hygiene Association Journal, 63:768–789.

Sweet, H.C., J.E. Poppleton, A.G. Shuey, and T.O. Peoples. 1979. Vegetation of central Florida's east coast: the distribution of six vegetation complexes on Merritt Island and Cape Canaveral Peninsula. Remote Sensing of Environment, 9:93-108.

The Nature Conservancy. 2007. Indian River Lagoon. 22 Jan 2007. http://www.nature.org/wherewework/northamerica/states/florida/preserves/art16218.html

U.S. Department of Agriculture (USDA). 1974. Soil survey of Brevard County, Florida. USDA Soil Conservation Service in cooperation with University of Florida Agricultural Stations. 123 pp.

U.S. Fish and Wildlife Service. 2006. Habitat Mangement Plan for MINWR. 239 pp.

U.S. Fish and Wildlife Service. 2007a. Draft Merritt Island NWR Comprehensive Conservation Plan and Environmental Assessment. Merritt Island National Wildlife Refuge. http://www.fws.gov/southeast/planning/DraftDocsPg4.htm

U.S. Fish and Wildlife Service. 2007b. Wood stork (Mycteria americana) 5-Year Review: Summary and Evaluation. Southeast Region. Jacksonville Ecological Services Field Office. Jacksonville, Florida.

U.S. Fish and Wildlife Service. 2008. Division of Migratory Bird Management. Arlington, Virginia. http://library.fws.gov/Bird_Publications/songbrd.html#1 Accessed: 18 Sep 2008.

U.S. Geological Survey. 2007. Bird Checklists of the United States, Merritt Island NWR, Titusville, Florida. 22 Jan 2007. http://www.npwrc.usgs.gov/resource/birds/chekbird/r4/merritt.htm

U.S. Green Building Council (USGBC). 2008. LEED Rating Systems. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222. Accessed: Oct 2008.

Whittaker, D. and R. L. Knight. 1998. Understanding Wildlife Responses to Humans. Wildlife Society Bulletin, 26:312-317.

Woodward-Clyde. 1994. Biological Resources of the Indian River Lagoon, Vols. 1 and 2. Final report to the Indian River Lagoon National Estuarine Program. Melbourne, FL.

8.0 Appendices

Appendix 1: Public Review Letters of Comment

BREVARD County
BOARD OF COUNTY COMMISSIONERS

FLORIDA'S SPACE COAST

NATURAL RESOURCES MANAGEMENT OFFICE
2725 Judge Fran Jamieson Way, Building A-219, Viera, FL 32940

Rec'd 11/7/08

November 4, 2008

John Shaffer
NASA lead, Environmental Planning
Kennedy Space Center, FL 32899

Subject: Draft Environmental Assessment (DEA) for Exploration Research Park Phase 1 at John F. Kennedy Space Center, Florida

Dear Mr. Shaffer:

This Office has a few suggestions to improve the assessment. There is no discussion on current site conditions from an agricultural chemicals aspect. Has the site been checked for, at a minimum, arsenic, copper and petroleum? The Oak Grove site on the north end of NASA had copper impacts around a well used for grove chemical mixing and there is good evidence for arsenic contamination in old groves across the state from calcium arsenate treatments; therefore, it is possible there may be some residual chemicals on this site.

There is also a discrepancy between figure 2-1 and 3-1. Figure 2-1 shows wetlands on the northern portion of the property while Figure 3-1 shows wetlands running from the northeast corner along the eastern edge and along the southern edge. The area labeled 'Wetlands' on Figure 2-1 is shown as hardwood hammock. This needs to be clarified. It is difficult to ascertain where the wetlands actually are using the soil layer alone since NRCS recognizes all soils on site as hydric.

Sincerely,

Deborah S. Coles

Deborah S. Coles
Management and Planning Program Manager

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Responses to comments from the Brevard County Natural Resources Management Office:

Soil Contamination
As described on page 29 of the EA, during 1998 and 1999, a baseline study was conducted on KSC to document the background chemical composition of the soils, groundwater, surface water and sediments (Schmalzer et al. 2000). Soil samples from 200 soil sampling locations, within 10 soil classifications through out KSC, were analyzed for organochlorine pesticides, aroclors, chlorinated herbicides, polycyclic hydrocarbons (PAH), total metals, pH, cat ion exchange capacity (CEC), bulk density, resistivity, and soil texture. One of these samples (SSC165) was located on the Exploration Phase 1 Site. Arsenic levels were between 0.6 and 0.7 mg/kg, just above the detectable limit, and well below 8.5 mg/kg, the KSC-wide average for this metal. The soil concentration of copper in this sample was 110 mg/kg, slightly below the KSC background rate of 139 mg/kg. Neither of these values for arsenic and copper exceed levels (Soil Cleanup Target Levels) for areas designated for commercial and/or industrial use. These values are similar to those determined for samples taken in the vicinity of the Phase 1 site on a 2004 Phase II Assessment of areas designated for the ISRP. During that study, samples were collected just west of Space Commerce Way.

During the last decade the Florida Research Center for Agricultural Sustainability (FLARES) was contracted by the Merritt Island NWR to utilize the Phase 1 site and other historical citrus groves on KSC as a demonstration site for sustainable and environmentally sound citrus production. Calcium arsenate, used during the 1950s and 1960s in Florida on citrus groves (specifically grapefruit), but has been banned for use on citrus groves for decades. It is unlikely that it was used on the Phase 1 site as the area has not been used for grapefruit production (R. Adair, FLARES, pers. comm., 21 Nov 2008). In addition, copper is generally only used on fresh fruit citrus and only two small groves on the northern edge of the site have been used for that purpose. Approved fungicides are also used on fresh fruit citrus crops. Most of the site has been fallow for at least 10 years. This abandoned portion of the site was used primarily for juice fruit production (R. Adair, FLARES, pers. comm., 21 Nov 2008). The only chemicals used on that portion of the site would have included petroleum spray oil, Roundup (glyphosate) and Landmaster 2 (glyphosate and 2,4-D, isopropylamine salt, and fertilizers (R. Adair, FLARES, pers. comm., 21 Nov 2008). Copper and fungicides are not used by FLARES on juice fruit citrus crops (R. Adair, FLARES, pers. comm., 21 Nov 2008).

Wetlands in Figures 2.1 and 3.1
The northern section of the site on Figure 2.1 is correctly labeled as “wetlands.” That figure was taken from the Space Florida, 2008, Exploration Park Development and Operations Plan. Figure 3.1 was generated for this EA using the detailed KSC land cover nomenclature (hardwood hammock) which is also a wetland community type. The other wetland type on the map is hardwood forest and is labeled as “wetland coniferous/hardwood forest”, whereas the “wetland” prefix is not shown with the hardwood hammock label.

Appendix 2: KSC Air Quality Data Summary PAMS A, 2007 .....

PARAMETERS	STANDARDS*	January	February	March	April	May	June
OZONE	Primary	23.7	31.5	30.7	34.9	32.3	30.8
(PPB)	75 (1-HR)[1]	(100.0%)	(100.0%)	(90.3%)	(100.0%)	(100.0%)	(100.0%)
SULFUR	Primary	4.8	7.4	4.0	6.2	6.9	6.5
DIOXIDE	140 (24-H)[2,3]						
(PPB)	Secondary	8.4	17.4	7.4	8.3	10.7	6.2
	500 (3-HR)[2]	(100.0%)	(100.0%)	(90.2%)	(96.8%)	(100.0%)	(93.0%)
NITROGEN							
DIOXIDE							
(PPB)	50 (1-HR)[1]	0.5	2.0	3.1	1.4	6.1	0.2
	Primary	0.73	0.75	0.76	0.733	0.616	0.513
	50 (Ann. Avg.)[3]	(87.8%)	(74.4%)	(84.8%)	(65.1%)	(100.0%)	(100.0%)
CARBON	Primary	0.9	17.3	0.3	0.6	1.6	0.2
MONOXIDE	35 (1-HR)[1]						
(PPM)	Secondary	0.763	3.638	0.125	0.2	0.838	0.125
	9 (8-HR)[2]	(100.0%)	(92.4%)	(88.7%)	(100.0%)	(100.0%)	(100.0%)
PARAMETERS	**STANDARDS***	**July**	**August**	**September**	**October**	**November**	**December**
OZONE	Primary	23.0	30.1	26.2	26.9	30.0	---
(PPB)	75 (1-HR)1	(100.0%)	(100.0%)	(100.0%)	(99.9%)	(99.2%)	(0.0%)
SULFUR	Primary	7.8	9.5	12.5	12.8	15.3	15.9
DIOXIDE	140 (24-H)2,3						
(PPB)	Secondary	9.5	10.7	15.7	36.1	14.8	14.4
	500 (3-HR)2	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(67.4%)
NITROGEN	50 (1-HR)1	0.5	0.2	0.2	0.4	---	---
DIOXIDE	Primary	0.293	0.268	0.276	0.0	---	---
(PPB)	50 (Ann. Avg.)3	(58.3%)	(100.0%)	(100.0%)	(8.7%)	(0.0%)	(0.0%)
CARBON	Primary	0.7	8.9	0.7	0.2	0.5	0.8
MONOXIDE	35 (1-HR)1						
(PPM)	Secondary	0.400	4.700	0.675	0.200	0.500	0.563
	9 (8-HR)2	(100.0%)	(99.3%)	(100.0%)	(100.0%)	(100.0%)	(67.4%)

*Federal and State Standards

PARAMETERS	FEDERAL[3] AND STATE STANDARDS	MIN.	MAX.	MEAN	STD.DEVIATION	% VALID
OZONE	Primary					
(PPB)	75 (1-HR)[1]	23.0	34.9	29.1	3.7	90.8
SULFUR	Primary					
DIOXIDE	140 (24-H)[2,3]	4.0	15.9	9.1	4.0	
(PPB)	Secondary					95.6
	500 (3-HR)[2]	6.2	36.1	13.3	8.0	
NITROGEN	50 (1-HR)[1]	0.2	6.1	1.5	1.9	64.9
DIOXIDE	Primary					
(PPB)	50 (Ann. Avg.)[3]	0.268	0.760	0.549	0.217	77.9 w/o
						Nov.- Dec.
CARBON	Primary					
MONOXIDE	35 (1-HR)[1]	0.2	17.3	2.7	5.2	
(PPM)	Secondary					95.7
	9 (8-HR)[2]	0.125	3.638	1.061	1.490	

KEY:

1 - Maximum hourly average concentration (not to be exceeded more than once per year)

2 - Maximum time-period average concentration (not to be exceeded more than once per year)

3 - Federal and State standard values are identical except for SO2; State Primary (24-hour) is 100 PPB

21 days are required to yield a valid month

No exceedance level set for NO2 to date. 50 PPB is considered significantly high.

( ) Indicates percent of valid data Capture

--- Indicates instrument down-time

Appendix 3: State and Federal Ambient Air Quality Standards

Pollutant	Average Time	State of Florida Standard	Federal Primary Standard	Federal Secondary Standard
Carbon Monoxide	8 hour*	9 ppm (10 mg/m_3)	9 ppm (10 mg/m_3)	
	1 hour*	35 ppm (40 mg/m_3)	35 ppm (40 mg/m^3)	
Lead	Quarterly Arithmetic Mean	1.5 $\mu g/m^3$	1.5 $\mu g/ m^3$	(same as primary)
Nitrogen Dioxide	Annual Arithmetic Mean	0.05 ppm (100 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	(same as primary)
Ozone	1 hour+	0.12 ppm (235 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	(same as primary)
	8 hour^	0.08 ppm (157 $\mu g/m^3$)	0.08 ppm (157 $\mu g/m^3$)**	(same as primary)
Sulfur Dioxide	Annual Arithmetic Mean	0.02 ppm (60 $\mu g/m^3$)	0.03 ppm (80 $\mu g/m^3$)	
	24 hour*	0.1 ppm (260 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	
	3 hour*	1300 $\mu g/m^3$ (0.5 ppm)		1300 $\mu g/m^3$ (0.50 ppm)
Inhalable Particulates (PM-10)	Annual Arithmetic Mean	50 $\mu g/m^3$	50 $\mu g/m^3$	(same as primary)
	24 hour*	150 $\mu g/m^3$	150 $\mu g/m^3$	(same as primary)
Particulates (PM-2.5)	Annual Arithmetic Mean		15 $\mu g/m^3$ **	(same as primary)
	24 hour		65 $\mu g/m^3$ **	(same as primary)
*Not to be exceeded more than once per year. (Parenthetical value is an approximately equivalent concentration.)				
+Not to be exceeded an average of more than one day per year.				
^Maximum 8 hour average concentration. Twenty-one days (70%) are required to yield a valid month. (%) – Percent of valid data for month.				
** The ozone 8 hour standard and the PM-2.5 standards are included for information only. A 1999 Federal court ruling blocked implementation of these standards, which EPA proposed in 1997. EPA has asked the U.S. Supreme Court to reconsider that decision.				
Source: Florida Department of Environmental Regulation (FDER) 1982.				

Appendix 4: KSC Land Cover Types and Areas.

Land cover Type	KSC+MINWR Area (ha/ac.)
Infrastructure - primary	533.5 / 1,318.2
Infrastructure - secondary	202.3 / 499.9
Estuary	12,157.0 / 30,040.7
Water - interior - salt	2,559.4 / 6,324.4
Water - interior - fresh	359.2 / 887.5
Barren land - may be inundated	75.6 / 186.9
Beach	26.1 / 64.6
Ditch	126.6 / 312.9
Marsh - saltwater	3,880.0 / 9,587.7
Marsh - freshwater	2,247.5 / 5,553.7
Mangrove	518.2 / 1,280.5
Wetland scrub-shrub - saltwater	636.3 / 1,572.4
Wetland scrub-shrub - freshwater	1,944.6 / 4,805.3
Wetland coniferous / hardwood forest	611.6 / 1,511.2
Wetland hardwood forest	406.2 / 1,003.9
Ruderal - herbaceous	1,382.6 / 3,416.5
Citrus	705.5 / 1,743.3
Ruderal - woody	461.5 / 1,140.3
Australian pine	32.6 / 80.5
Coastal strand	135.8 / 335.5
Oak scrub	4,990.2 / 12,331.2
Palmetto scrub	1,101.4 / 2,721.5
Pine flatwoods	920.0 / 2,273.5
Upland coniferous forest	72.7 / 179.6
Modified from Schaub 2005	

Appendix 5: State and federally listed wildlife species documented from KSC, Florida.

SCIENTIFIC NAME	COMMON NAME	LEVEL OF PROTECTION	
Amphibians and Reptiles		**FWC**	**USFWS**
Alligator mississippiensis	American alligator	SSC	T(S/A)
Caretta caretta	Loggerhead	T	T
Chelonia mydas	Atlantic green turtle	E	E
Dermochelys coriacea	Leatherback sea turtle	E	E
Drymarchon couperi	Eastern indigo snake	T	T
Gopherus polyphemus	Gopher tortoise	T	-
Nerodia clarkii taeniata	Atlantic saltmarsh snake	T	T
Pituophis melanoleucus mugitus	Florida pine snake	SSC	-
Rana capito aesopus	Florida gopher frog	SSC	-
Birds			
Ajaia ajaja	Roseate spoonbill	SSC	-
Aphelocoma coerulescens	Florida scrub-jay	T	T
Charadrius melodus	Piping plover	T	T
Egretta caerulea	Little blue heron	SSC	-
Egretta rufescens	Reddish egret	SSC	-
Egretta thula	Snowy egret	SSC	-
Egretta tricolor	Tricolored heron	SSC	-
Eudocimus albus	White ibis	SSC	-
Falco peregrinus tundrius	Arctic peregrine falcon	E	-
Falco sparverius paulus	Southeastern American kestrel	T	-
Haliaeetus leucocephalus	Bald eagle	T	-
Mycteria americana	Wood stork	E	E
Pelecanus occidentalis carolinensis	Eastern brown pelican	SSC	-
Rynchops niger	Black skimmer	SSC	-
Sterna antillarum	Least tern	T	-
Mammals			
Peromyscus polionotus niveiventris	Southeastern beach mouse	T	T
Podomys floridanus	Florida mouse	SSC	-
Trichechus manatus	West Indian manatee	E	E

Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance

Appendix 6: Noise levels (in decibels, A-weighted) measured on KSC, Florida.

		DISTANCE FROM SOURCE [a]			
SOURCE	**NOISE LEVEL (Peak)**	**15 m (50 ft.)**	**30 m (100 ft.)**	**60 m (200 ft.)**	**120 m (400 ft.)**
Construction					
Heavy Trucks	95	84-89	78-83	72-77	66-71
Pickup Trucks	92	72	66	60	54
Dump Trucks	108	88	82	76	70
Concrete Mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Paver	109	80-89	74-83	68-77	60-71
Generator	96	76	70	64	58
Shovel	111	91	85	79	73
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Caterpillar	103	88	82	76	70
Dragline	105	85	79	73	67
Shovel	110	91-107	85-101	79-95	73-95
Dredging	89	79	73	66	77
Pile Driver	105	95	89	83	77
Ditcher	104	99	93	87	81
Fork Lift	100	95	89	83	77
Vehicles					
Diesel Train	98	80-88	74-82	68-76	62-70
Mack Truck	91	84	78	72	66
Bus	97	82	76	70	54
Compact Auto	90	75-80	69-74	63-68	57-62
Passenger Auto	85	69-76	63-70	57-64	51-68
Motorcycle	110	82	76	70	64
[a] Assume 6 dBA decrease for every doubling of distance. Modified from Suter 2002					