ENVIRONMENTAL ASSESSMENT
FOR
FLIGHT VEHICLE AND LANDING SUPPORT COMPLEX
AT THE
SHUTTLE LANDING FACILITY

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Environmental Assessment for Flight Vehicle and Landing Support Complex at the Shuttle Landing Facility, Kennedy Space Center, Florida

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Abstract

This Environmental Assessment (EA) addresses the proposed action to construct the Flight Vehicle and Landing Support Complex (FVLSC) on approximately 20 acres of land adjacent to the Shuttle Landing Facility (SLF) at Kennedy Space Center (KSC), Florida. The complex would consist of facilities in support of several existing and proposed programs including Space Shuttle support and the X-34 Program.

Three alternative locations plus a fourth No Action alternative were evaluated to determine the extent of impacts to the environment at KSC. All four alternatives are located adjacent to and associated with the SLF.

EXECUTIVE SUMMARY

This Environmental Assessment (EA) addresses the proposed action to construct the Flight Vehicle and Landing Support Complex (FVLSC) on approximately 20 acres of land adjacent to the Shuttle Landing Facility (SLF) at Kennedy Space Center (KSC), Florida. The proposed complex would include three new facilities: Facility and hangar to support the X-34 flight vehicle, a Staging and Maintenance Hangar, and a Multi-Use Facility. The latter building would consist of space to accommodate office personnel and provide space for an avionics laboratory to support the Landing Aids (LAPS) program; personnel, high bay area and shop; personnel area and clean work area to support the X-34 program. A hangar adjacent to the Multi-Use Facility will house the X-34 vehicle and an L-1011 aircraft, while a second hangar will provide storage and maintenance space for ground support equipment (GSE).

Three alternative locations were evaluated to determine the extent of impacts to the environment at KSC. Alternative 1 (the Proposed Action) is located on the north side of the Shuttle Towway. Alternative 2 is located on the south side of the Towway and Alternative 3 is located northwest of the Mate/Demate Device (MDD). The No Action Alternative involves constructing facilities for the LAPS and Convoy Operations Personnel (COP) programs, but does not involve constructing a hangar for the X-34 Program. The site for the No Action Alternative was chosen as the site for implementation evaluated in an earlier EA (KSC 1997-B). This decision was documented in a *Finding of No Significant Impact* dated January 13, 1997. It is important to note that this assessment does not address the impacts of implementing the X-34 program at KSC, which are left to other programatic documents. Only impacts of the construction and operation of the proposed facilities are addressed here.

This document describes those portions of the KSC environment which relate to each of the alternatives. Issues identified are utilities, air quality, biological resources, threatened and endangered species, cultural resources, geology, noise, surface water quality, groundwater quality, socioeconomics, and land use. The results of the assessment of these environmental issues indicate that minimal impacts at the Proposed Action site are increased loads to existing utilities; air quality impacts resulting from the construction of the facility (i.e., elevated dust levels); surface water impacts due to construction of ingress and egress routes over existing

surface water ditch; and minimal effects to biological resources due to removal of approximately 20 acres of habitat, including both uplands and wetlands. No impacts are expected to cultural resources, threatened or endangered species, groundwater quality, or site geology.

Implementation of any of the alternatives to the Proposed Action would have the potential for greater impacts to biological resources and wetlands. The No Action alternative, would also produce impacts to several Threatened species.

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List of Abbreviations and Acronyms

ADA	American with Disabilities Act
ASCE	American Society of Civil Engineers
ASTs	aboveground storage tanks
BMPs	Best Management Practices
CCAS	Cape Canaveral Air Station
CNS	Canaveral National Seashore
CO	carbon monoxide
COE	Army Corps of Engineers
COP	Convoy Operations Personnel
dBA	decibels, weighted to the A-scale
EA	Environmental Assessment
EO	Executive Order
EPA	Environmental Protection Agency
FPL	Florida Power and Light
ft	feet
ft^2	square feet
FVLSC	Flight Vehicle and Landing Support Complex
gal	gallons
GSE	ground support equipment
ha	hectares
in	inch
kg	kilogram
km	kilometers
KSC	Kennedy Space Center
kVA	kilovolt/amps
L	liters
LAPS	Landing Aids Facility
LFBB	Liquid Flyback Booster
m	meters
m^2	square meters
MDD	Mate/Demate Device
mgd	million gallons per day
mi	miles
MINWR	Merritt Island National Wildlife Refuge
mLd	million liters per day
NAAQS	National Ambient Air Quality Standards
NGVD	National Geodetic Vertical Datum
NHPA	National Historical Preservation Act
NMI	NASA Management Instruction
NO_2	nitrogen dioxide
NPS	National Park Service
O_3	ozone
OFW	Outstanding Florida Waters
OSHA	Occupational Safety and Health Administration
PAMS	Permanent Air Monitoring System
POL	petroleum/oil/lubricant
RLV	Reusable Launch Vehicle

List of Abbreviations and Acronyms (continued)

SLF	Shuttle Landing Facility
SO_2	sulfur dioxide
STS	Space Transportation System
STS	Space Transport System
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
VAB	Vehicle Assembly Building

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1.0 PURPOSE AND NEED FOR ACTION

1.1 Purpose

The purpose of the proposed action is to implement the best engineering solution for the construction and operation of the new Flight Vehicle and Landing Support Complex (FVLSC) at the Kennedy Space Center (KSC) (Figure 1). The new complex located near the Shuttle Landing Facility (SLF) would accommodate the proposed X-34 Facility and Hangar, the Landing Aids Facility (LAPS), the Convoy Operations Personnel (COP) and the Staging and Maintenance Hangar. One segment of the FVLSC, the Multi-Use Facility, is designed to accommodate office personnel and provide space for an avionics laboratory to support the LAPS program and clean work area to support the X-34 program. A hangar adjacent to the Multi-Use Facility would house the X-34 vehicle and an L-1011 aircraft, while a second hangar would provide storage and maintenance space for ground support equipment (GSE).

1.2 Need for Action

As the primary landing site for Space Shuttle missions, it has become imperative to protect the GSE that services NASA's Orbiter fleet. This will require the construction of new facilities to house the expensive and unique equipment to protect it from environmental exposure and expand its life expectancy and reliability. A secondary benefit from the construction of new facilities for the GSE would be a centralization of all equipment and the personnel who perform the work on the Space Shuttles. Currently, several of the larger support vehicles are parked at the Midfield Parksite while other equipment and personnel are housed in Facility J6-2377, approximately 3.2 km (2 mi) to the south of the Midfield Parksite on Kennedy Parkway North. The consolidation of the GSE away from the Midfield Parksite would also greatly enhance the aesthetic quality of the Runway Viewing Area for guests and visitors attending the landing of a Shuttle Orbiter.

Along with the GSE, the LAPS and X-34 programs would also benefit from the construction of the FVLSC. The LAPS are presently housed east of the SLF Ramp in numerous trailers. To reduce the amount of empty office space existing at KSC, a program was initiated to remove all trailers to eliminate the costs associated with leasing and provide personnel a more resilient place in which to work. The construction of the new FVLSC provides housing for the LAPS program personnel as well as gaining greater storage and operating

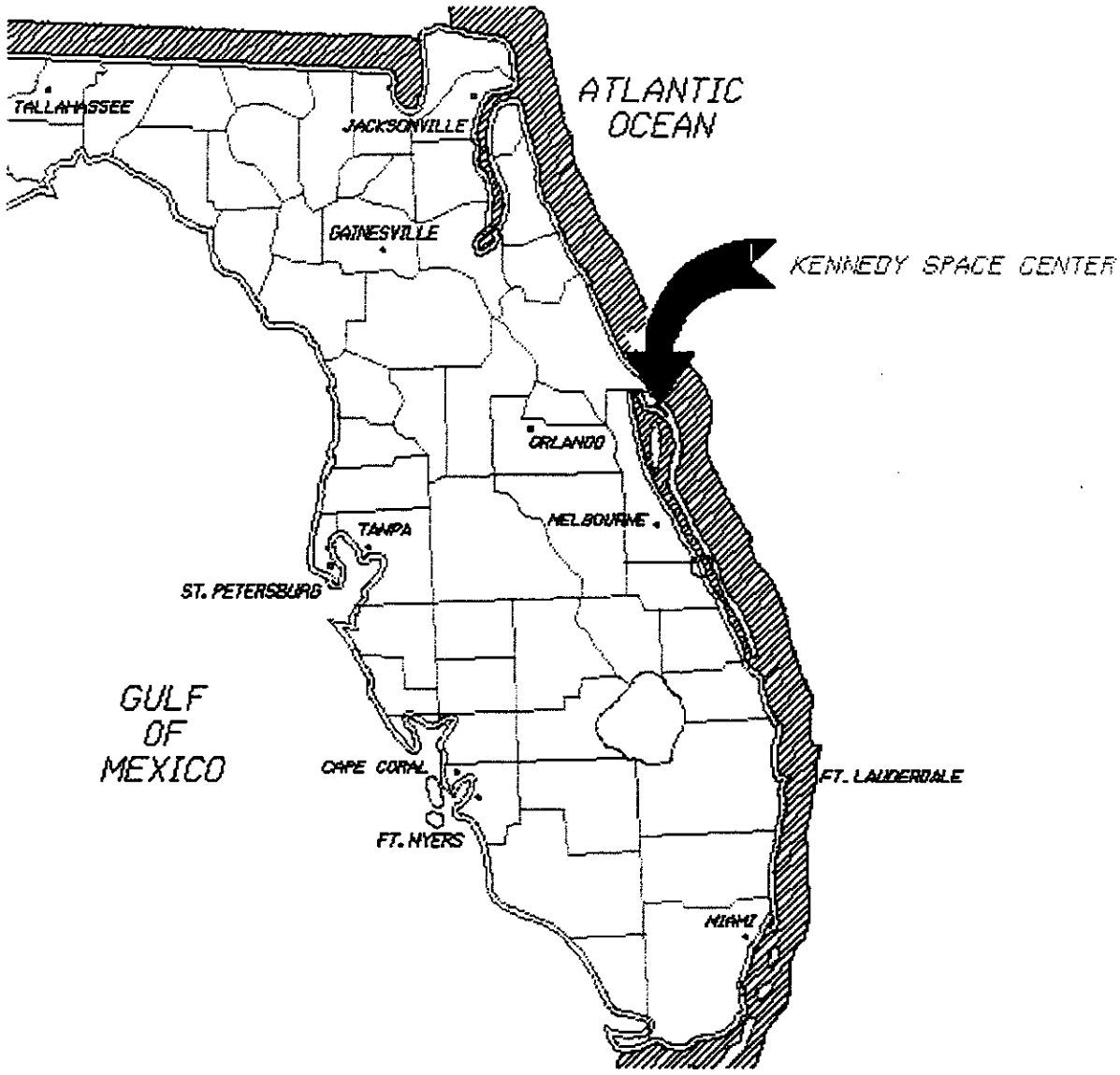

Figure 1: General Location Map of Kennedy Space Center

space and providing room for a new avionics laboratory.

The hangar and operations building for the X-34 is proposed to support NASA's future commitment to space exploration and development of alternative launch vehicles. The X-34 is the latest in the design of Reusable Launch Vehicle (RLV) technology in which KSC has been designated as the potential primary launch site for the second phase of the test program. The construction of this support structure is a primary incentive in the decision to implement this portion of the X-34 program at KSC. In addition, at the end of the X-34 program this facility would be available to support other flight vehicle programs.

Finally, consolidation of operations and personnel in a centrally located area would save time, construction costs, and synergize resources. Specific advantages to developing a combined facility would be reduced site development costs, reduced cost of extending utilities, and provide greater operations efficiency at the SLF.

It is important to note that this assessment does not address the impacts of implementing the X-34 program at KSC, which are left to other programatic documents. Only impacts of the construction and operation of the proposed facilities are addressed here.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 General

In an effort to continue to be the forerunner in space exploration, NASA is proposing to construct a multi-use hangar facility, that could be utilized by a number of different space related vehicles. Various vehicle programs that could possibly be supported in this proposed facility would be the X-34 program, VentureStar, Liquid Flyback Booster (LFBB), and Space Shuttle. This new facility would include a vehicle hangar, apron, parking, staging and maintenance hangar, access roads, and a multi-use office/laboratory building. The facility would be approximately 8 ha (19.9 acres) in size. A site plan of the individual buildings and hangars for the FVLSC is shown in Figure 2.

The vehicle hangar would be large enough to support an L-1011 aircraft which is associated with the X-34 program. Operational requirements for the hangar include a concrete apron for aircraft access to the hangar, a clean work area, an air conditioned engine workshop with access to the hangar, mechanical, plumbing, fire protection, electrical and communications as required, and air conditioned office space for 25 employees. The design of the hangar must also satisfy the Americans with Disabilities Act (ADA) requirements.

The Staging and Maintenance Hangar, a prefabricated metal building, would be utilized for the storage of Orbiter ground support equipment (GSE). The floor area should be approximately 2,032 m^2 (21,875 ft^2) with an 8.3 m (27 ft) clearance height. This facility is to be designed for the GSE including the Purge Transporter which has a turning radius of 47.6 m (156 ft). A petroleum/oil/lubricant (POL) waste facility will be located within this portion of the facility. Space would be available for future expansion for a 31,780 kg (35 ton) bridge crane. Mechanical, plumbing, fire protection, electrical and communications as required, would also be included in this portion of the facility. The design of the hangar would be to American Society of Civil Engineers 7-95 requirements (ASCE 1995).

The multi-use and laboratory facility would be used jointly to support the X-34 program, the COP, and the LAPS. This facility will provide office space for managers, engineers, technicians and clerical staff. The LAPS requires an avionics laboratory with 2.5 to 3.0 m (8 to 10 ft) ceiling

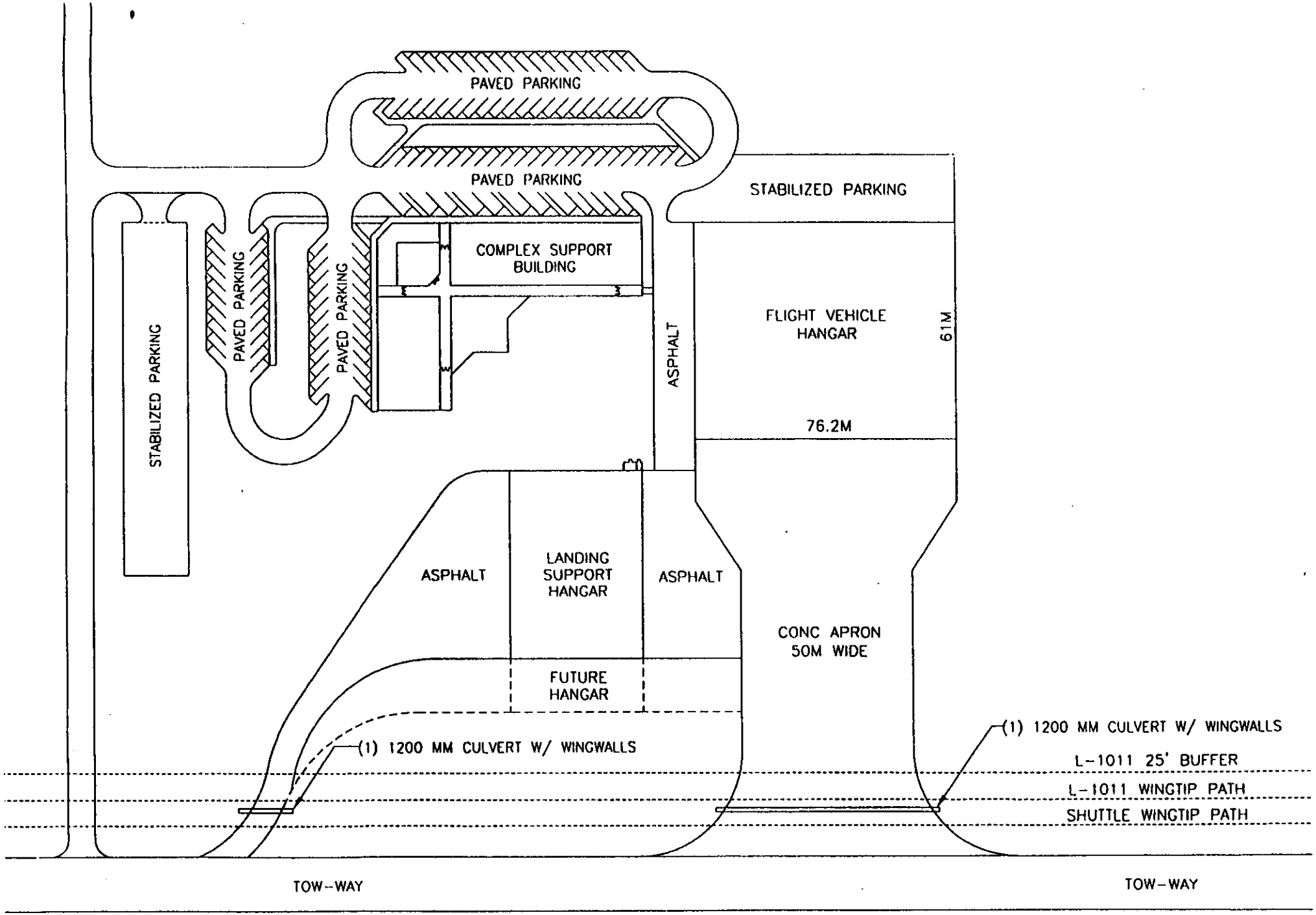

Figure 2: Site Plan of Proposed Flight Vehicle & Landing Support Complex (FVLSC)

throughout. The COP requires a high bay area with a ceiling height of 4.9 m (16 ft). This high bay area would be used as a shop area. These areas will all have mechanical, plumbing, fire protection, electrical, and communication as required. The design of this facility meets ADA requirements.

Four alternatives are considered for the construction of the FVLSC at KSC. These are shown on Figures 3 and 4 and include: 1) Proposed Action: Construct the FVLSC along the north side of the Shuttle Towway; 2) Alternative 2: Construct the FVLSC along south side of the Shuttle Towway; 3) Alternative 3: Construct the FVLSC northwest of the MDD apron; and 4) No Action. Under the first three alternatives, the same design of the FVLSC, as described in this section, was placed over each site to evaluate the impacts of construction on various environmental issues. However, the No Action alternative utilizes a different design, which only incorporates the COP and Staging and Maintenance Hangar.

2.2 Proposed Action: Construct the FVLSC along the north side of the Shuttle Towway

The Proposed Action is to construct the facility complex at the western end of the Shuttle Towway. This alternative will impact approximately 7.3 ha (18 acres) of undeveloped land located near the SLF. Implementation of this alternative would require the clearance of fences, power poles, and other structures near the towway to accommodate the landing gear track and wingspan of an L-1011 aircraft.

2.3 Alternative 2: Construct the FVLSC along the south side of the Shuttle Towway

This alternative is to construct the facility complex on the south side of the Shuttle Towway, which is located near the SLF and will impact primarily undeveloped land. Implementation of this alternative would also require clearance of power poles or other structures to accommodate the landing gear track and wingspan of an L-1011 aircraft.

2.4 Alternative 3: Construct the FVLSC northwest of the Mate/Demate Apron

This alternative is to construct the facility complex northwest of the MDD Apron, K6-2313, in the vicinity of the SLF. This location would utilize the existing apron for access to the site from the SLF, however, clearances of power poles, existing structures and facilities would need

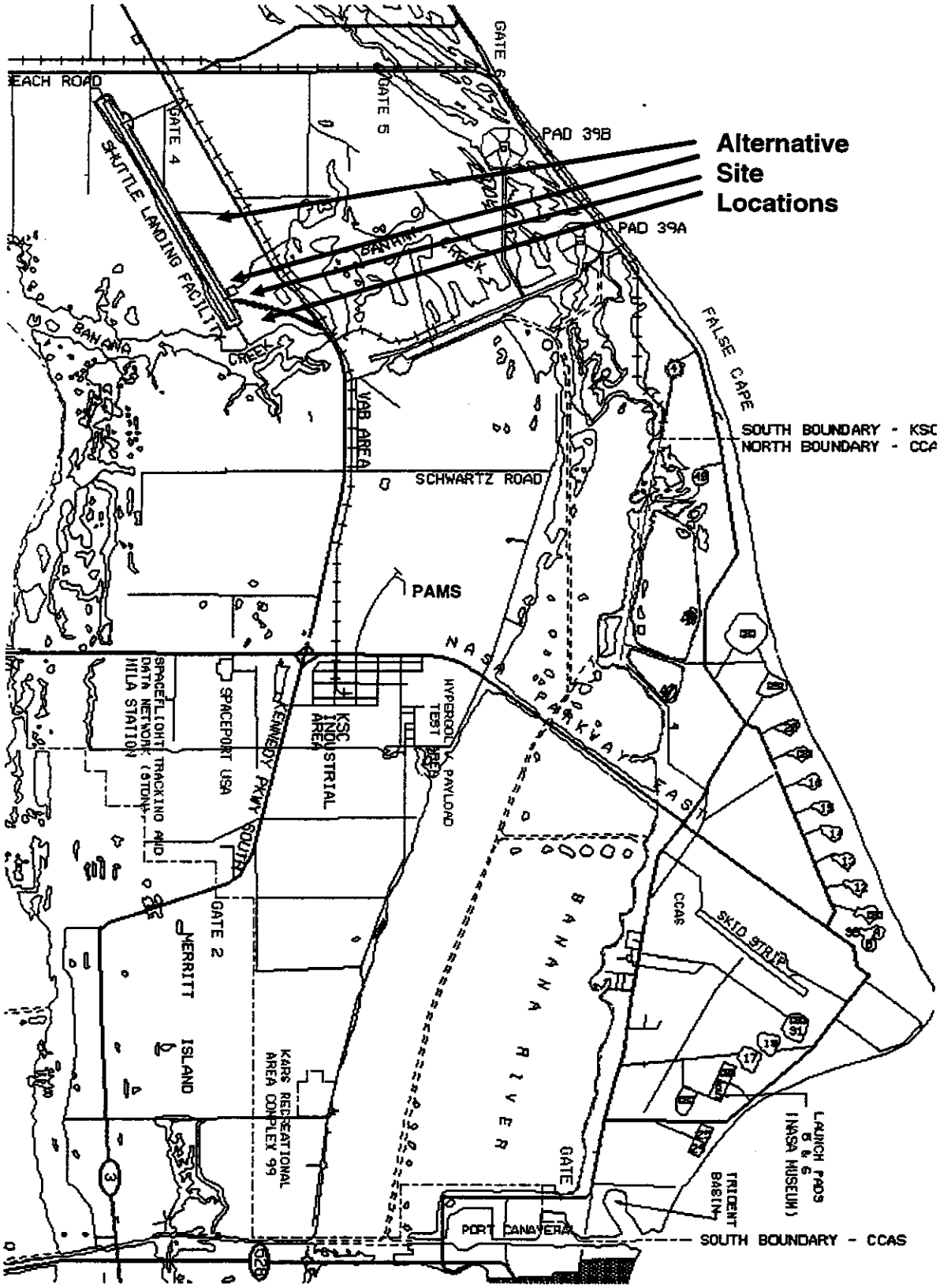

Figure 3: Alternative Site Locations

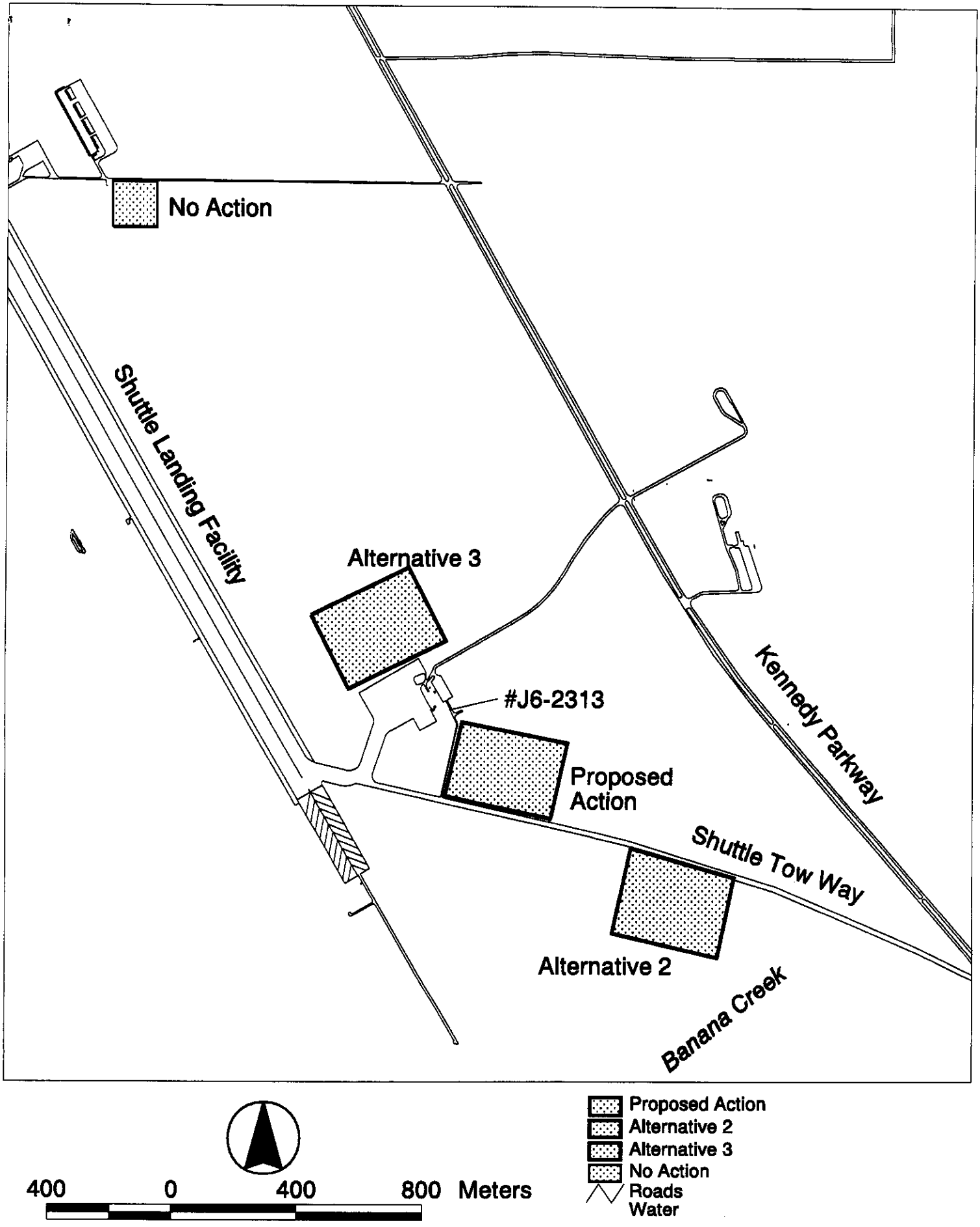

Figure 4. Site Plan of Alternative Sites for the FVLSC

to be accommodated for the landing gear track and wingspan of an L-1011 aircraft.

2.5 No Action

The COP and the Staging and Maintenance Hangar would be constructed at the Midfield Parksite along the south side of Sharkey Road. The facility will consist of two buildings totaling 1.03 ha (2.55 acres) in area. This preferred alternative location was reviewed in a previous EA (KSC 1996) along with five other alternative sites. The LAPS personnel would be located at this new facility. Implementation of this alternative would not provide a facility to support the X-34 program.

3.0 Affected Environments

3.1 General

KSC encompasses nearly 56,000 ha (140,000 acres) on the east coast of central Florida and is bordered on the west by the Indian River Lagoon, on the southeast by the Banana River, and on the north by the Mosquito Lagoon. KSC is the primary launch site for NASA's Space Shuttles with two active launch pads and is the primary eastern U.S. landing site for Space Shuttle fights. In addition to supporting the nation's space mission operations, KSC contains within its boundaries the Merritt Island National Wildlife Refuge (MINWR) and the Canaveral National Seashore (CNS), which are managed by the U.S. Fish and Wildlife Service (USFWS) and the National Park Service (NPS), respectively. This unique relationship between space flight and preservation of the environment is carefully managed to ensure that both objectives are pursued without conflicting with one another. The existing environment at each of the alternative sites is described in detail in the following sections.

3.2 Facilities and Infrastructure

Transportation

KSC is serviced by over 340 km (211 mi) of roadway with 263 km (163 mi) of paved roads and 77 km (48 mi) of unpaved roads. Of the five access roads onto KSC, NASA Parkway West serves as the primary access road for cargo, tourists, and personnel entering and leaving. This four-lane road originates in Titusville as State Road 405 and crosses the Indian River Lagoon onto KSC. Once passing through the Industrial Area, the road reduces to two lanes of traffic. It then crosses the Banana River and enters the and Cape Canaveral Air Station (CCAS). The third point of entry onto KSC is from the south via South Kennedy Parkway, which originates on north Merritt Island as State Road 3. This road is the major north-south artery for KSC and is also a four-lane highway. The fourth entry point is accessible from Titusville along Beach Road, which connects to North Kennedy Parkway. The final access point is south of Oak Hill at the intersection of U.S.1 and North Kennedy Parkway.

Access to the Proposed Action Alternative and Alternative 3 is from Astronaut Road off of Kennedy Parkway North (Figure 5). Access to Alternative 2 is directly from Kennedy Parkway North, while access to the No Action alternative is

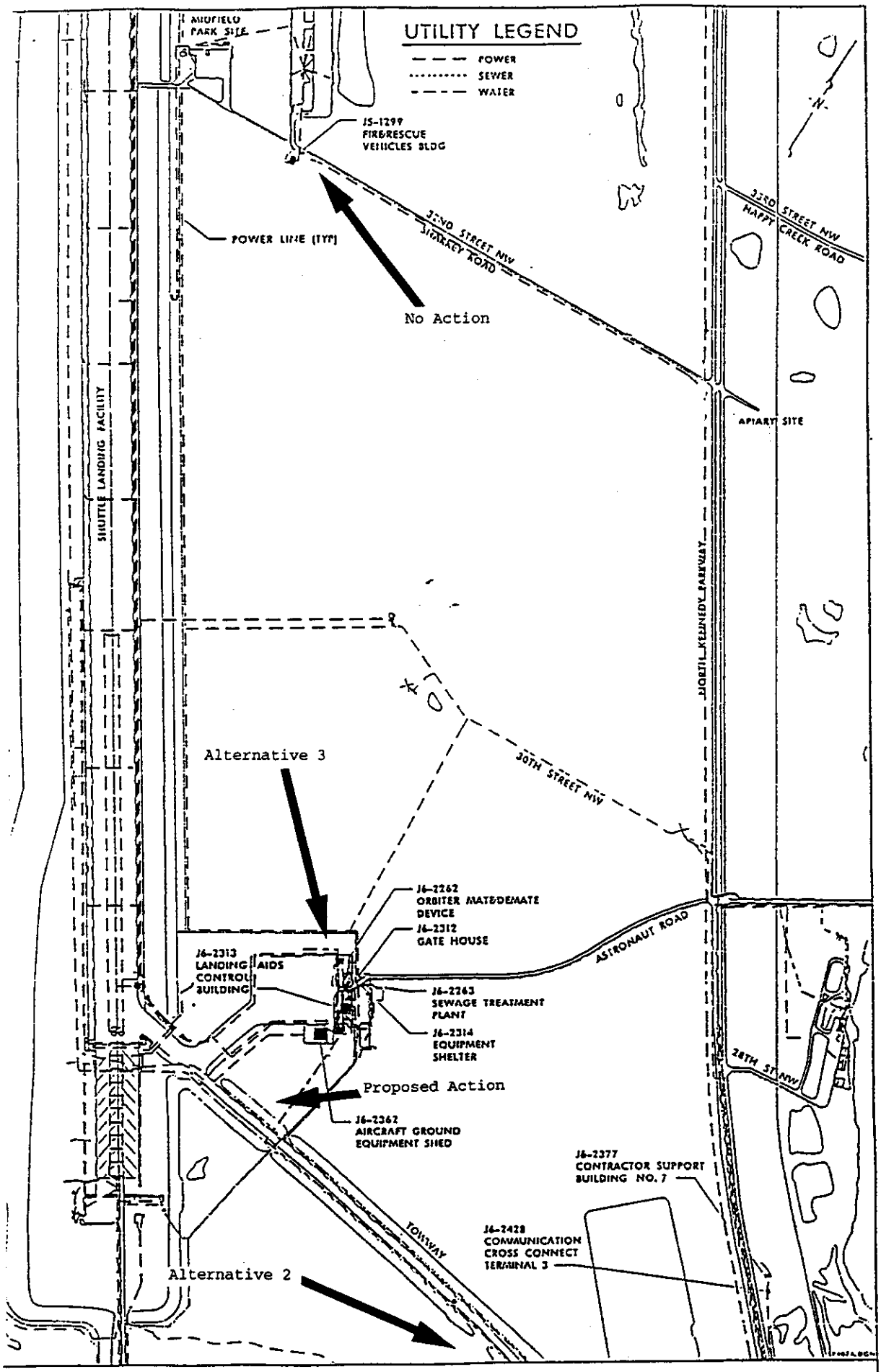

Figure 5: Utility Locations at Alternative Sites

from Sharkey Road off of Kennedy Parkway North.

Wastewater Treatment

The sanitary sewer system at KSC is composed of several centralized sewage treatment plants designed to treat effluent in specific areas of KSC. Sewage Treatment Plant (STP) #1 is located south of the KSC Industrial Area and serves the Unified S-Band, the Visitors Complex, and the Industrial Area. STP #4 is located in the Vehicle Assembly Building (VAB) Area and serves the SLF and the VAB Area. STPs #5 and #6 serve LC-39A and LC-39B, respectively. In addition to these plants, several isolated facilities utilize small package plants to treat effluent while still others use septic tanks and drain fields.

For the Proposed Action and for Alternative 3, there exist three lift stations at the SLF Ramp Area which ultimately flow to the existing force main on Kennedy Parkway North. The nearest wastewater connection at Alternative 2 is the force main on Kennedy Parkway North. No wastewater connections exist in the vicinity of the No Action alternative.

Electricity

The power and lighting distribution systems for KSC and CCAS have a total capacity of 137,000 kilovolt/amps (kVA) which is provided by Florida Power and Light (FPL). The power entering KSC is distributed from two main switching stations. These are the C-5 Substation which services the LC-39 Area and the Orsino Substation which services the Industrial Area. The high voltage power is distributed from the substations by approximately 434 km (270 mi) of overhead and underground power lines to the transformers and substations at the various facilities.

Power for the Proposed Action and for Alternative 2 is supplied by an underground power cable (13.8 kV) buried in a duct bank on the north side of the towway (Figure 5). Power for Alternative 3 is supplied by cable originating along Kennedy Parkway North. Electrical connections also exist at the Mid-field Parksite for the new facilities to be built as part of the No Action alternative.

Communications

The KSC Communications System provides a variety of services at KSC including 1) conventional telephone service; 2) transmission of large volumes of test data to central

collection or reduction stations; 3) transmission of timing information from operations centers to data gathering instrumentation at widely scattered locations; 4) transmission of weather and range safety data; 5) communication with satellites, Space Shuttles, and other hardware in space. The major segments of the KSC Communications System are the three distribution and switching stations. These are the First Switch - Industrial Area, the Second Switch - VAB Area, and the Third Switch - VAB Area. These three stations combine to provide service for over 18,500 telephones on KSC.

Communications for the Proposed Action, for Alternative 2, and for Alternative 3 travel within the duct bank lying along the north side of the towway (Figure 5). No communication connections exist in the area of the No Action alternative.

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 State Road 3 from a 60 cm (24 in) water main and extends north along Kennedy Parkway South to the VAB area. The average daily demand for water is 3.8 mLd (1 mgd). Total storage capacity at KSC is approximately 15 million L (4 million gal) in 10 ASTs. LC-39 has a 4 million L (1 million gal) ground storage tank and a 950,000 L (250,000 gal) elevated storage tank. An identical water tower is found in the Industrial Area. Fire suppression system booster pump stations and a potable water system emergency pump are located within the Utility Annex, which receives its supply from the VAB area ground storage tank.

Potable water service for the Proposed Action and for Alternative 2 is provided by the 30 cm (12 in) water line running along the south side of the towway (Figure 3). Potable water service for Alternative 3 is provided by the 15 cm (6 in) water line supplying service to the SLF Ramp Area. No potable water connections exist at the Mid-field Parksite for the No Action alternative.

3.3 Air Quality

The ambient air quality at KSC is predominantly influenced by daily operations such as vehicle traffic, utilities fuel combustion, standard refurbishment and maintenance operations, and incinerator operations. Air quality is also influenced to some extent by emissions sources outside of

KSC, primarily two regional power plants located within a 18.5 km (10 mi) radius of KSC. In addition to these sources, other operations occurring on an infrequent basis throughout the year also play a role in the quality of air at KSC. These include space launches and land management practices which influence air quality as episodic events.

The ambient air quality is monitored by a Permanent Air Monitoring System (PAMS) station (Figure 3). The PAMS station continuously monitors the concentrations of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and total inhalable (10-micron) particulates, as well as meteorological data. Currently, KSC is located within an area which is classified as attainment with respect to National Ambient Air Quality Standards (NAAQS) established by the EPA for all criteria pollutants (KSC 1997-A).

Air quality in the vicinity of the SLF is generally good, with the ambient air quality being affected primarily by aircraft exhaust emissions produced by Orbiter carrier, shuttle training, landing system, and NASA executive aircraft. These operations influence the levels of hydrocarbons, CO, NO_2, and particulate matter. However, they are performed on a planned, infrequent schedule and are not a point of continuous emissions.

3.4 Biological Resources

Vegetation

There are three prominent types of terrestrial communities represented at KSC which are characterized by well drained, acidic, sandy soils. Also known as uplands, these areas experience only brief periods of standing water due to the high permeability of the soils in which they exist. These communities are highly dependent upon periodic fire to perpetuate regrowth and habitat maintenance. Pine flatwoods are one such terrestrial community found at KSC. This community is dominated by an overstory of slash pine (*Pinus elliottii*) and an understory of myrtle oak (*Quercus myrtifolia*), sand live oak (*Q. germinata*), Chapman oak (*Q. chapmanii*), and saw palmetto (*Serenoa repens*). Another type of terrestrial community is the upland xeric hammocks. These communities are dominated by an overstory of live oak (*Q. virginian*) and cabbage palm (*Sabal palmetto*), while the understory is dominated by saw palmetto. The third type of terrestrial community is the scrub habitat, which is further divided into two categories. The first category is the Oak scrub which is dominated by myrtle oak, sand live oak,

Chapman oak, and saw palmetto. The second category is Saw palmetto scrub which is dominated by saw palmetto shrubs such as *Lyonia spp., Ilex spp.,* and a few scrub oaks.

Uplands on the site of the Proposed Action include xeric oak, pine flatwoods, and temperate/tropical hardwoods. Vegetation included in these uplands are wax myrtle, live oak, saw palmetto, galberry, slash pine, cabbage palm, and sweet bay. The area of uplands on this site is approximately 5.4 ha (13.4 acres). Other sections of this site consist of disturbed areas which include paved areas, waterways, and disturbed brush. These areas account for roughly 1.7 ha (4.2 acres). The land cover of the site, including wetland, upland, and disturbed areas is detailed in Figure 6.

Uplands on the site of Alternative 2 include mixed hardwoods, palmetto prairies, and temperate/tropical hardwoods. Vegetation included in these uplands are wax myrtle, live oak, saw palmetto, galberry, wire grass, and sweet bay. The area of uplands on this site is approximately 4.4 ha (10.9 acres). Other sections of this site consist of disturbed areas which include paved areas, waterways, spoil area, and disturbed brush. These areas account for roughly 1.0 ha (2.5 acres). The land cover of the site, including wetland, upland, and disturbed areas is detailed in Figure 7.

Uplands on the site of Alternative 3 include cabbage palm and temperate/tropical hardwoods. Vegetation included in these uplands are live oak, saw palmetto, galberry, slash pine, cabbage palm, cedar and sweet bay. The area of uplands on this site is approximately 3.3 ha (8.2 acres). Other sections of this site consist of disturbed areas which include paved areas, waterways, and disturbed brush. These areas account for roughly 0.4 ha (0.9 acres). The land cover of the site, including wetland, upland, and disturbed areas is detailed in Figure 8.

Uplands at the site of No Action alternative include a maintained vehicle access road and xeric oak, approximately 1 ha (2.5 acres). The land cover of the site, including wetland, upland, and disturbed areas, is shown in Figure 9.

Wetlands and Floodplains

The wetland communities at KSC can be categorized as freshwater lake and stream systems, brackish water lagoons, open oceans or bays, and forested and herbaceous wetlands. KSC is bordered on the western edge by the Indian River

Figure 6 : Proposed Action Land Cover Map.

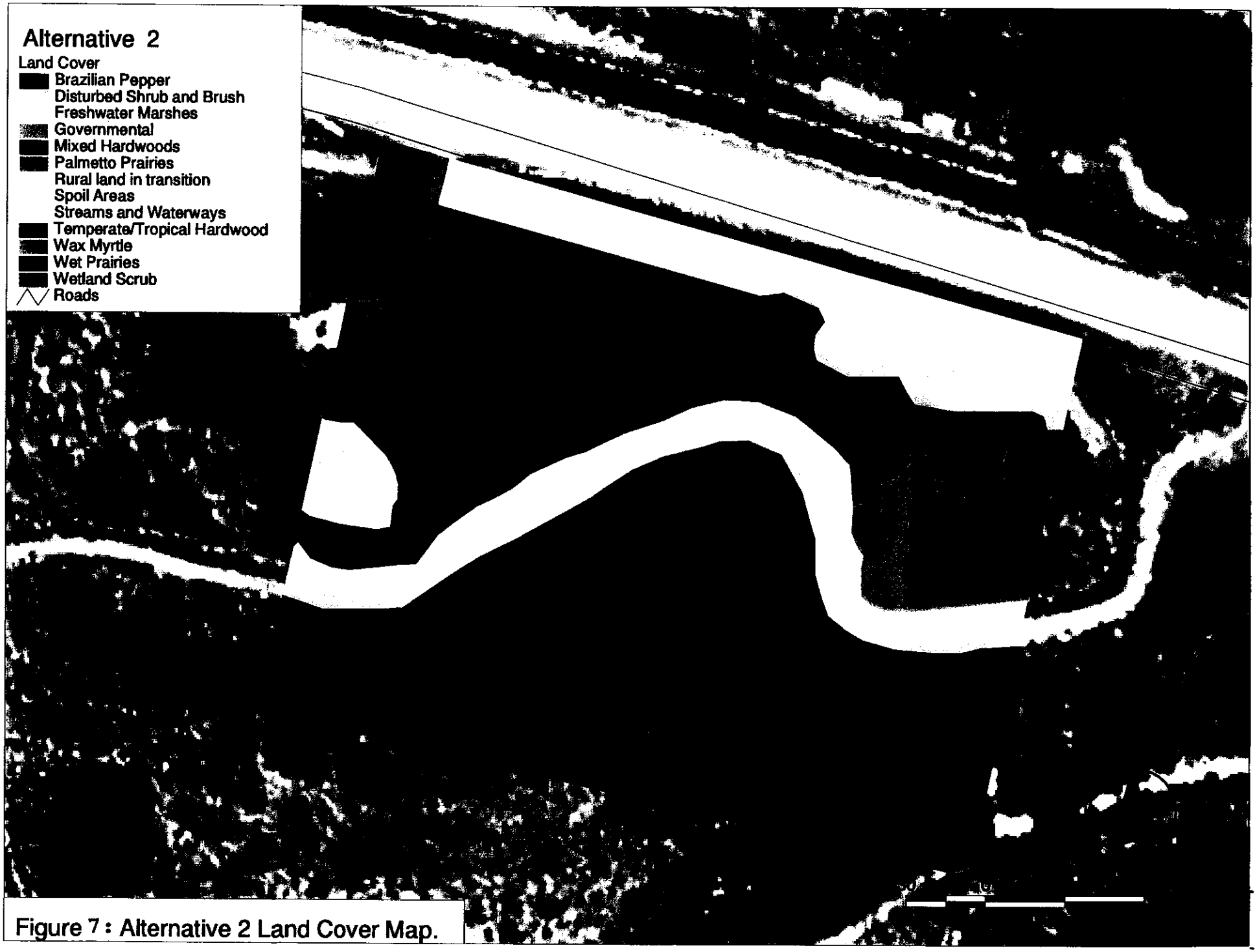

Figure 7 : Alternative 2 Land Cover Map.

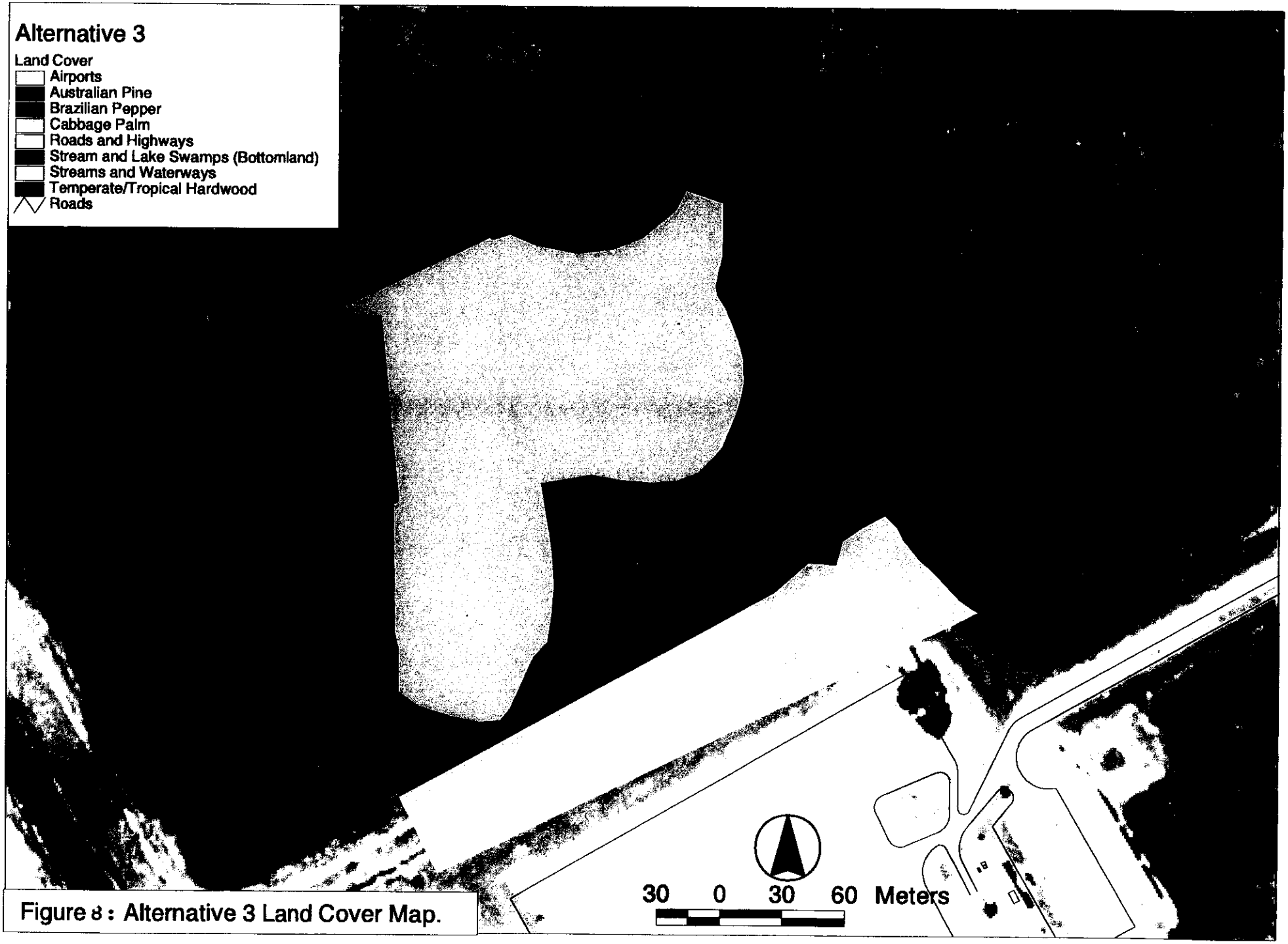

Figure 8 : Alternative 3 Land Cover Map.

Figure 9. No Action Land Cover Map.

Lagoon, a brackish water lagoon system that supports an abundant variety of plant and animal life. This system is dominated by shallow flats and dense growths of submerged aquatic vegetation including manatee grass, shoal grass, widgeon grass, and various macroalgae such as *Gracilaria, Caulerpa, Sargassum,* and *Acanthopora.* The aquatic communities found most often in the inland areas of KSC are various forms of wetlands. These include hardwood swamps, willow swamps, freshwater swale marshes, cattail marshes, cabbage palm savannas, and mixed salt-tolerant grass marshes. Many wetlands within MINWR provide habitat for approximately 200,000 individual waterfowl, including blue herons, egrets, wood storks (*Myceteria americana*), cormorants, and brown pelicans (*Pelecanus occidentalis caroliensis*) (KSC 1997).

Wetlands on the Proposed Action site include wet prairies and wetland scrub. Vegetation included in these wetlands are wax myrtle, sawgrass, maidencane, whitetop sedge, and willow (Figure 6). The area of wetlands on this site is approximately 0.4 ha (1.3 acres). Approximately 0.8 ha (2.0 acres) of Brazilian pepper (*Schinus terebinthifolius*) also exist at the site.

The wetland communities at the site of Alternative 2 include freshwater marshes, wetland scrub, and wet prairies. Vegetation included in these wetlands are sawgrass, cattail, arrowhead, wax myrtle, widgeon grass, leatherfern, willow, and maidencane (Figure 7). The area of wetlands on this site is approximately 2.7 ha (6.6 acres). Approximately 1.1 ha (2.7 acres) of Brazilian pepper also exist at the site.

Wetland community types located at the site of Alternative 3 include stream and lake swamps. Vegetation included in these wetlands are cabbage palm, red maple, ludwigia, willow and wax myrtle (Figure 8). The area of wetlands on this site is approximately 3.9 ha (9.7 acres). Approximately 0.5 ha (1.3 acres) of Brazilian pepper also exist at the site as well as 0.5 ha (1.3 acres) of Australian pine (*Casuarina sp.*).

Wetland community types at the No Action alternative include saw palmetto (*Serenoa repens*), Cabbage Palm (*Sabal palmetto*), red maple (*Acer rubrum*), and live oak (*Quercus virginiana*) (Figure 9). There are also small clusters of Andropogon spp. The approximate area of wetlands on this site is 1.2 ha (3 acres).

In accordance with EO 11988 "Floodplain Management", NASA has implemented NMI 8800.10 "Floodplain and Wetland

Management" to regulate activities within flood prone and wetland areas. The 100-year flood plain at KSC is established at the +4 National Geodetic Vertical Datum (NGVD). Approximately 78% of the KSC land area is within this designation. Refer to Figure 10 for the 100-year and 500-year floodplain maps. The location of the Proposed Action, Alternative 3, and the No Action alternative are above both the 100 and 500-year flood plains. However, the location of Alternative 2 is within both the 100 and the 500-year floodplains.

Wildlife

The Indian River Lagoon system has nearly 150 species of fish. Lagoons and rivers support commercial fishery operations for both shellfish and fin fish, including blue crabs, shrimp, clams, and mullet. Offshore, the KSC area is one of the most productive fisheries along the east coast of Florida where commercial scallop fishery dominates (NPS 1986). A number of renewable oyster leases are also held in the waters near KSC.

KSC and the surrounding coastal areas provide habitat for over 300 bird species; nearly 90 species are resident breeders, over 100 species winter at KSC, and the remainder are migratory (Breininger 1985). Twenty-four species are on the protected species list (Breininger 1984). Uplands areas on KSC provide important habitat for many bird species, including the Pileated woodpecker, migratory warblers, and the threatened Florida scrub jay (*Aphelcoma coerulscens coerulscens*).

More than 31 species of mammals inhabit the area including white-tailed deer, gray squirrels, feral hogs, and bobcat. Two mammals are aquatic: the Atlantic bottlenose (river resident) dolphin and West Indian manatee (*Trichechus manatus*). Ten species of mammals are federally protected. Fifty-two species of reptiles (12 Federally protected) and 16 amphibian species (one is a Species of Special Concern) are known to inhabit the area (Breininger 1984).

Typical mammal species utilizing the locations chosen for the alternative sites include raccoon, feral hogs, Virginia opossum, and the nine-banded armadillo.

3.5 Threatened and Endangered Species

At present, there are over 19 Federal and state laws in effect which deal directly with the conservation and preservation of wildlife in Florida. The primary objectives

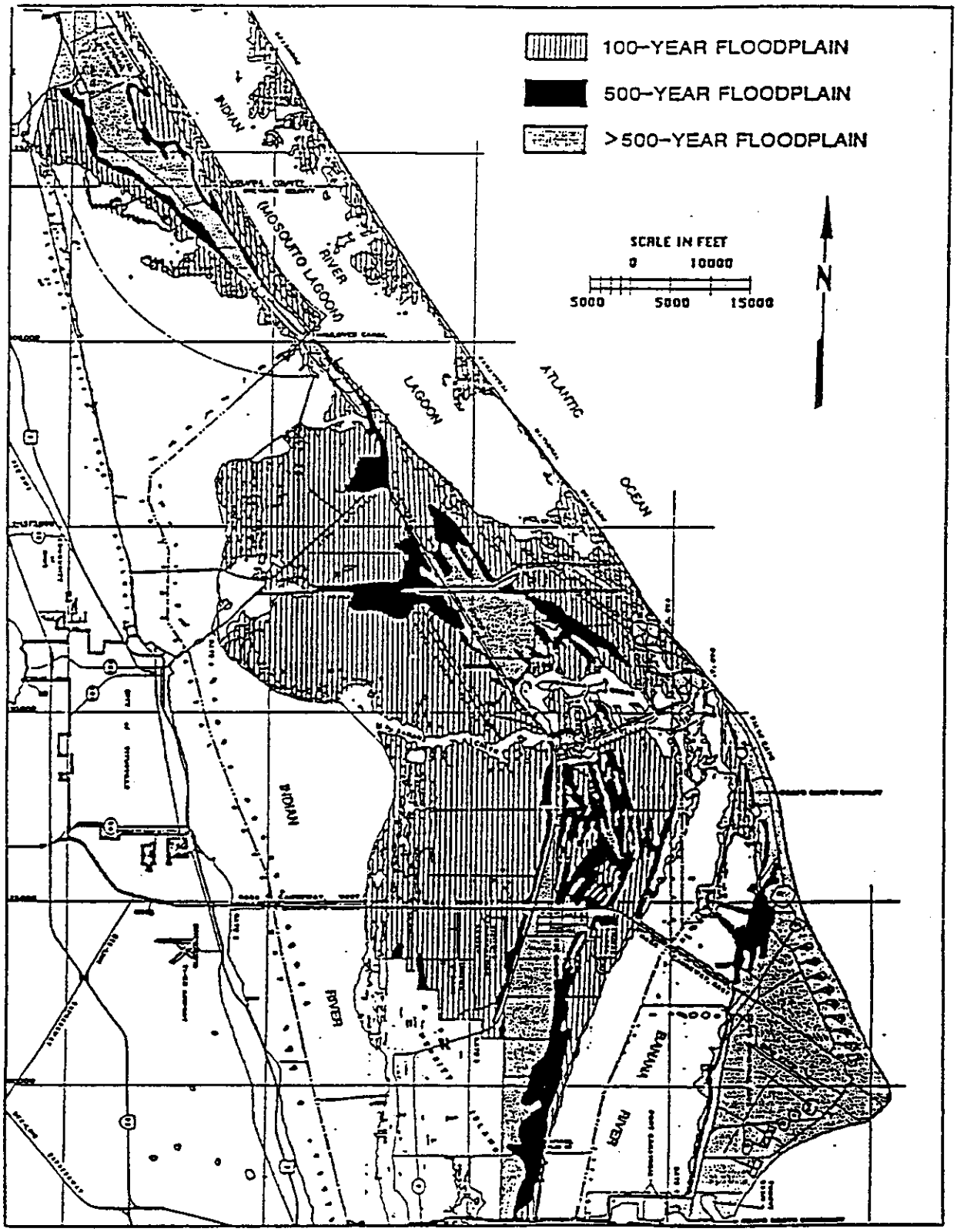

Figure 10: KSC Area Floodplain Map

of these laws are to establish the listing and delisting processes for endangered and threatened species, to maintain data on current populations of species, to identify and maintain critical habitat areas, and to protect those species which have been identified as endangered or threatened. The varied habitat types at KSC and its protection as a wildlife refuge has allowed for a diverse list of flora and fauna to flourish. Many of these plants and wildlife are listed as endangered or threatened and thrive in the undeveloped and pristine areas of KSC.

A field survey conducted at the site of the Proposed Action, at Alternative 2, and at Alternative 3 found that no threatened or endangered species were utilizing the area as habitat. However, the field survey performed at the site of the No Action alternative identified Scrub jays *(Aphelocoma coerulescens coerulescens)* which are endangered, as utilizing the site. The survey also identified gopher tortoise (*Gopherus polyphemus*), which are on the proposed list of endangered species, to be present in the area.

3.6 Cultural Resources

Sites containing potential archeological and/or historical resources on KSC are protected under the National Historical Preservation Act (NHPA) which requires that every Federal Agency "take into account" how each undertaking could affect historic sites. The areas proposed for alteration in this study have been previously mapped by NASA to indicate their potential for containing historical artifacts (AC 1992). Areas which have low potential for historical artifacts may not require additional Phase I or II archaeological surveys. The site of the proposed action and all alternatives have been classified as areas of low potential for containing items of historical or archaeological significance.

3.7 Geology and Soils

KSC is located on Peninsular Florida which gradually rose above a much larger feature called the Florida Plateau. Four distinct geologic units are characteristic of the coastal area of East-Central Florida and lie beneath KSC. In descending order these are Pleistocene and Recent age sands with interbedded shell layers; Upper Miocene and Pliocene silty or clayey sands; Central and Lower Miocene compacted silts and clays; and Eocene limestones. During the construction phase of facilities for the Manned Lunar Landing Program at Merritt Island and Cape Canaveral, Florida, the Army Corps of Engineers (COE) documented numerous geological reports with emphasis on general and

detailed foundation information. These reports can be found in the KSC Technical Documents Library. Soil borings collected during these investigations have established a geologic cross-section for KSC as shown in Figure 11, with the stratigraphy described in Table 1.

The soils in the area of the Proposed Action (see Figure 12) consist mainly of Wabasso sands and Copeland complex. Wabasso sand is a nearly level, poorly drained sandy soil on broad areas in the flatwoods and on low ridges on the flood plains. These soils formed in sandy marine sediments over loamy materials. The permeability of this soil is rapid to a depth of 28 inches and moderate between 28 and 62 inches. The Copeland complex consists of several nearly level, very poorly drained soils on low flats. These soils formed in moderately thick beds of sandy and loamy marine sediments over limestone. Permeability in this soil is rapid in the sandy layers and moderate in the loamy layer.

The soils in the area of Alternative 2 (see Figure 12) consist mainly of St. Johns sand, Turnbull and Riomar soils, Riviera and Winder soils, and Chobee mucky loamy fine sand. St. Johns sand is a nearly level, poorly drained sandy soil on broad areas on broad low ridges in the flatwoods. These soils formed in sandy marine sediments. The permeability of this soil is moderate in the weakly cemented layers and very rapid in all other layers. The Chobee sandy loam consist of nearly level, very poorly drained, loamy soil that has a thick black surface layer. These soils formed in loamy marine sediments. Permeability in this soil is moderately rapid to a depth of 14 inches and moderate below this depth.

The Felda and Winder soils are poorly drained soils in low, broad, grassy sloughs that have many slightly higher hammocks ranging from a few feet in diameter to a few acres. These soils formed in stratified, sandy, and loamy marine materials. Permeability in these soils is rapid in the sandy layers and moderate to moderately rapid in the loamy layers.

The soils in the area of Alternative 3 (Figure 12) consist mainly of Wabasso sands and Copeland complex. Wabasso sand is a nearly level, poorly drained sandy soil on broad areas in the flatwoods and on low ridges on the flood plains. These soils formed in sandy marine sediments over loamy materials. The permeability of this soil is rapid to a depth of 28 inches and moderate between 28 and 62 inches. The Copeland complex consists of several nearly level, very poorly drained soils on low flats. These soils formed in moderately thick beds of sandy and loamy marine sediments

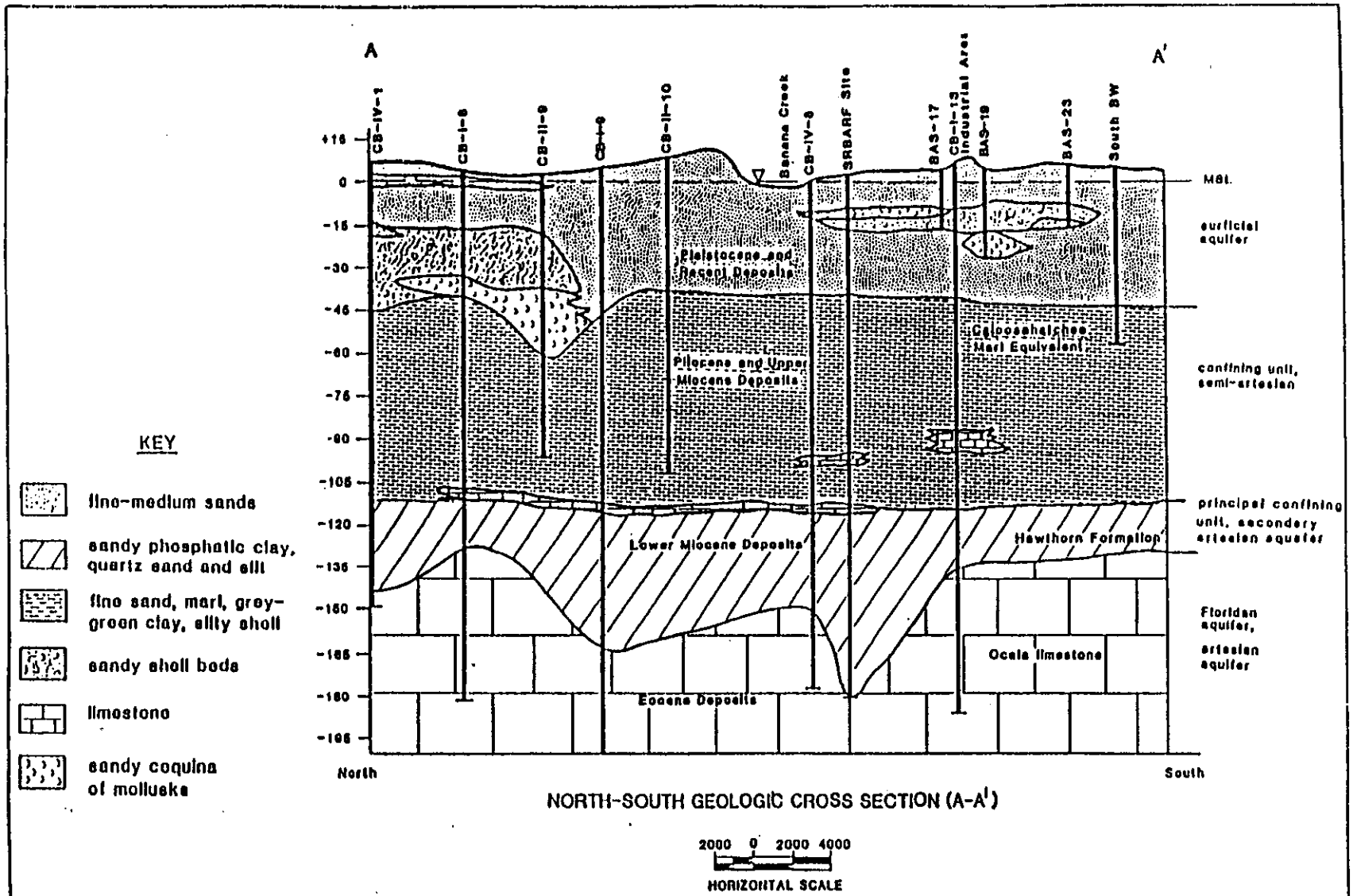

Figure 11: North-South Geologic Cross Section

TABLE 1

GENERALIZED STRATIGRAPHY AT KSC

Geologic Age	Formation Name	Aquifer	Physical and Water Bearing Characteristic
Holocene			Highly Variable and Undifferentiated Deposits.
Pleistocene	Anastasia Formation	Surficial Aquifer System	Sand, Shell, Clay, coquina, and mixtures. Yields moderate amounts of water, depending permeability of deposits.
Pliocene	Tamiami Formation		Interbedded limestone, coquina, sand and clay (eastern). Shell, sand, clay and cemented zones (western).
Miocene	Hawthorn Formation	Intermediate Confining Unit	Sandy clay, green and brown clays, and some limestones. Generally impermeable; poor water yield except for some thin shell and limestone beds.
Oligocene	Suwanee Limestone	Floridan Aquifer System	Gray to cream colored, clayey, granular limestone. Poor water yields.
Eocene	Ocala Limestone		Gray to cream colored, porus massive limestone, generally yields good quantity of water.
	Avon Park Limestone		Cream colored to tan, soft porus limestone.
	Lake City Limestone		Cream colored to tan, porous, chalky, and hard crystalline limestone and dense dolomite.
	Oldsmar Limestone		Not commonly tapped by wells.

Ref: KSC 1997-A

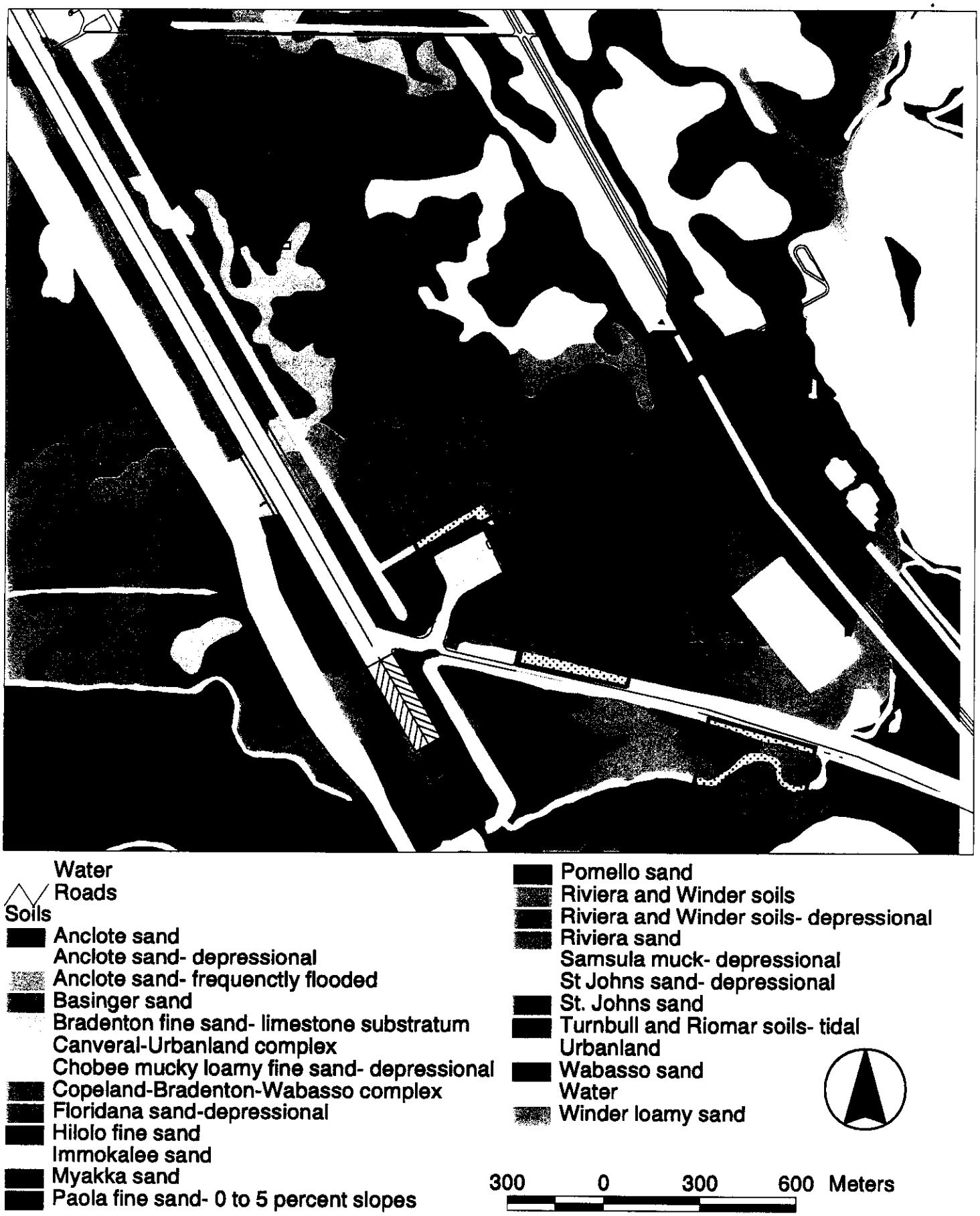

Figure 12: **Soil Types within the Alternative Sites.**

over limestone. Permeability in this soil is rapid in the sandy layers and moderate in the loamy layer.

The soils at the location of the No Action alternative (Figure 12) include Wabasso sand which is a nearly level, poorly drained sandy soil on broad areas in the flatwoods and on low ridges on the flood plains. These soils formed in sandy marine sediments over loamy materials. The permeability of this soil is rapid to a depth of 28 inches and moderate between 28 and 62 inches. Also at this location is Myakka sand. This is a nearly level, poorly drained sandy soil in broad areas in the flatwoods and in areas between sand ridges and sloughs and ponds. The water table depth in this soil is within a depth of 10 inches for 1 to 4 months and between 10 and 40 inches for more than 6 months.

3.8 Noise

Noise generated at KSC originates from six different sources: 1) Orbiter reentry sonic booms, 2) launches, 3) aircraft movements, 4) industrial operations, 5) construction, and 6) traffic noises. Noise generated by these sources above ambient levels have the potential to adversely affect both wildlife and humans. Some typical values for noise levels are shown on Table 2 and 3 for activities occurring at construction sites and for activities conducted routinely at KSC. The effects of noise on wildlife have been studied to an extent at KSC and at the CCAS during the launch of spacecraft (KSC 1981 and Breininger 1990). These studies have shown that besides an initial startle response to launches, birds and other wildlife return to their normal activities soon afterward and show no adverse affects. Other studies conducted on wading bird colonies subjected to military overflights (500 feet of altitude) with noise levels up to 100 decibels (dBA) observed no productivity limiting responses and only a short-term interruption of their daily routine (Black 1984). Permissible noise exposure limits for man are established by the Occupational Safety and Health Administration (OSHA). The 8-hour time weighted average noise level on KSC is appreciably lower than the OSHA recommended level of 85 decibels.

Noise levels at the SLF are generated primarily by aircraft movements. Sources of noise in this category consist of aircraft utilized for payload delivery, ferry support, NASA executives, security and astronaut training. Noise generated by arriving and departing planes are all brief periodic episodes of short duration. Sonic booms generated

TABLE 2

CONSTRUCTION AND VEHICULAR NOISE SOURCES, dBA

SOURCE	NOISE LEVEL (Peak)	DISTANCE FROM SOURCE [a] 50 ft	100 ft	200 ft	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	73-89
Dredging	89	79	73	66	60
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.
Ref: Golden 1980

TABLE 3
MEASURED NOISE LEVELS AT KSC, dBA

SOURCE	PEAK	REMARKS
Re-Entry Sonic Boom [1]		
Orbiter		101 N/m2 max. (2.1 psf)
SRB casing		96 to 144 N/m2 (2 to 3 psf)
External tank		96 to 192 N/m2 (2 to 4 psf)
Launch Noise		
Titan IIIC	94	21 Oct 1965 (9,388 m)
Saturn I	89	Avg. of 3 (9,034 m)
Saturn V	91	15 Apr 1969 (9,384 m)
Atlas	96	Comstar (4,816 m)
Space Shuttle [1]	90	1.4 dBA Down From Saturn V (9,384m)
Aircraft		
F4 Jet	107	18 km From Ground Zero
F4 Jet	158	Calculated at Ground Zero
NASA Gulfstream	109	Takeoff (Marker 14)
NASA Gulfstream	100	Landing (Marker 14)
Industrial Activities		
Complex 39A	78	Transformers
LETF	92	Hydraulic Charger Unit
Machine Shop	112	Base Support Building M6-486
Computer Room	88	VAB - Room 2K11
Snack Bar	60	CIF - Room 154
Laboratories	58	CIF - Rooms 139 and 282
Elevator	62	Central Instrumentation Fac.
VAB High Bay	108	Welding, Cutting, etc.
VAB High Bay	116	Chipping
Hangar AE	77	Room 125 During Test
Headquarters Office	75	Room 2637 and Printers
O & C Office	57	Room 2063
Mobile Launcher Platform	94	Main Pump Operating
Mobile Launcher Platform	100	2 Pumps Operating 5K Load
Industrial Area	66	15 m From Traffic Light
Undisturbed Areas		
Seashore	69	Medium Waves (Nice Day)
Riverbank	48	Light Gusts (No Traffic)
150 m Tower	64	Light Gusts of Wind

[1] Estimated
Ref: KSC 1978

by returning Space Shuttles also impact the site periodically. No adverse effects to humans or wildlife have been documented at the SLF due to these noise sources.

3.9 Surface Water Quality

The surface waters in and surrounding KSC may best be described as shallow estuarine lagoons and include portions of the Indian River Lagoon, the Banana River, Mosquito Lagoon, and Banana Creek. The area of Mosquito Lagoon within the KSC boundary and the northernmost portion of the Indian River Lagoon, north of the Jay Jay Railway spur crossing, 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 adjacent to and within the MINWR have the distinction of being designated as Outstanding Florida Waters (OFW) as required by Florida Statutes for waters within National Wildlife Refuges.

Several agencies including NASA, the USFWS, and Brevard County maintain water quality monitoring stations at surface water sites within and around KSC. The data collected is used for long-term trend analysis to support land use planning and resource management. Surface water quality at KSC is generally good, with the best areas of water quality being adjacent to undeveloped areas of the lagoon, such as the north Banana River, Mosquito Lagoon, and the northern most portion of the Indian River Lagoon. The water quality classification of the surface waters at KSC are shown on Figure 13.

The site of the Proposed Action is bordered on its southern edge by a large drainage ditch which drains to the SLF surface water management system and ultimately drains to Banana Creek which is considered an OFW. A portion of Alternative 2 is a ditch that is connected to the SLF stormwater system and is also drained by Banana Creek. Alternative 3 is directly connected to the SLF stormwater system by a swale. No surface water sites exist at the No Action alternative.

Water quality in Banana Creek is influenced by non-point source runoff from the SLF, the VAB area, the Kennedy Parkway, and undeveloped areas of the MINWR. These sources are relatively small and no impacts to water quality are apparent as evidenced by data collected in support of the NASA long-term water quality monitoring program as shown on Table 4. Currently, the surface water quality at the SLF is affected by vehicle traffic, aircraft maintenance and

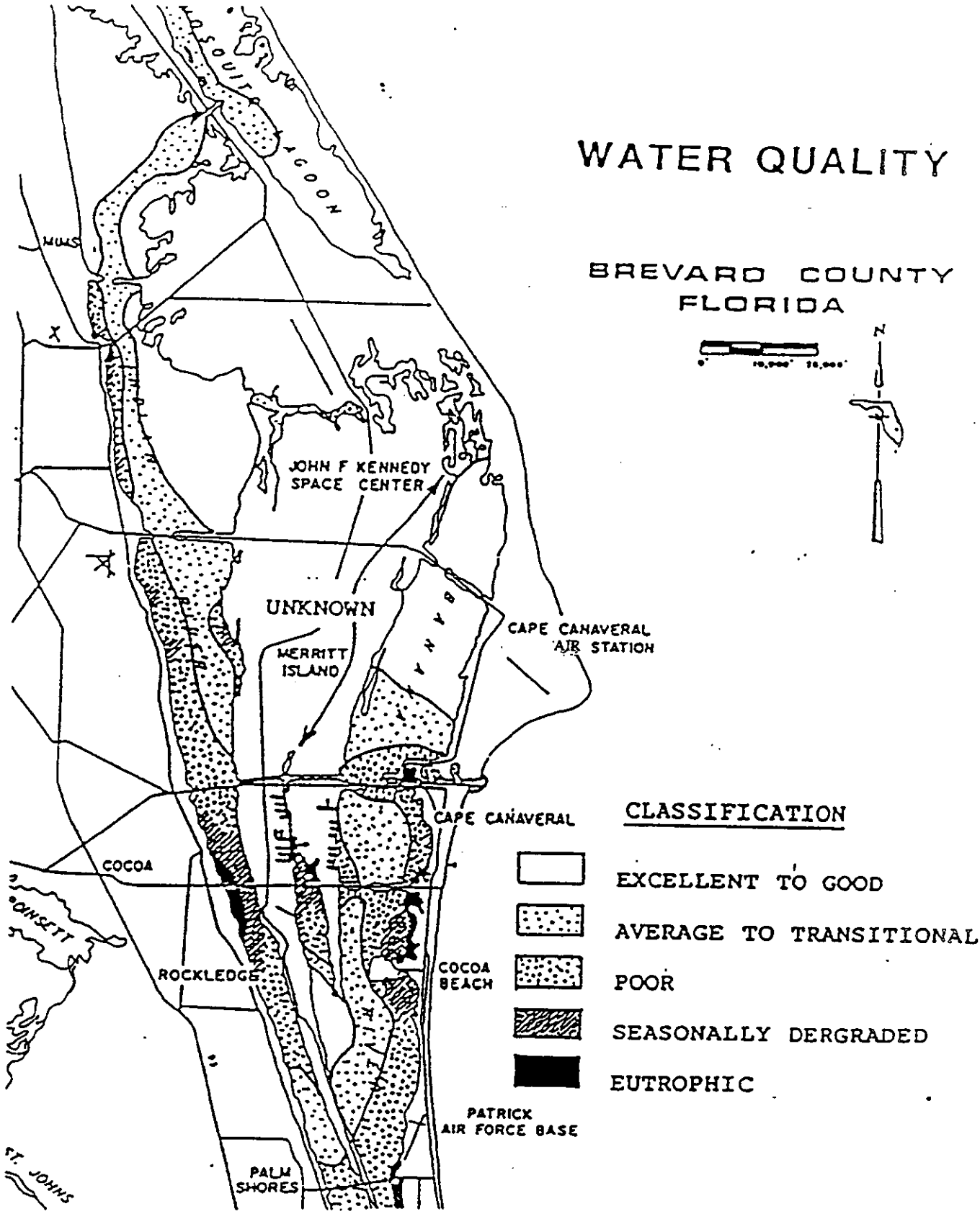

Figure 13: Surface Water Quality at KSC

flight operations, and general daily site operations. Surface water quality in the vicinity of the SLF is generally good.

3.10 Groundwater Quality

The State of Florida, through legislation, has created four categories to rate the quality of groundwater in a particular area. The criteria for these categories is based upon the degree of protection that should be afforded to that groundwater source, with Class G-I the more stringent and Class G-IV the lesser. The groundwater at KSC is classified as Class G-II, which means that the groundwater is a potential potable water source and generally has a total dissolved solids content of less than 10,000 mg/L. 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 surrounding lagoon systems. This is evident by the high mineral content, principally chlorides, that have been observed in groundwater samples collected during various KSC surveys. The groundwater quality for the Intermediate and Floridan aquifers at KSC are shown on Table 5.

The surficial aquifer in the area of the SLF is called the West Plain Subaquifer and is in a region considered to be fair to poor in terms of its ability to recharge the underlying aquifer systems (see Figure 14). The waters of this aquifer system are predominately fresh, however, due to intrusion from nearby saline waters, some areas may exhibit high chloride as well as high total dissolved solids concentrations. Overall, the surficial aquifer system in this area of KSC is of a good quality and does not demonstrate any adverse affects from operations at the SLF.

3.11 Socioeconomics

The KSC workforce is comprised of approximately 18,250 personnel, including contractor, construction, tenant, and permanent civil service employees (KSC 1997). Approximately 50% of the personnel have positions directly related to the Space Transportation System (STS) and payload processing operations. The remaining work force is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. Approximately 53% of the personnel at KSC are stationed in the VAB area,

TABLE 4

SUMMARY OF WATER QUALITY MONITORING DATA FOR BANANA CREEK

PARAMETER	AVERAGE	MINIMUM	MAXIMUM
Conductivity (umhos/cm)	28600.000	15.000	460.000
Turbidity NTU	14.700	4.000	91.000
Oil and Grease (mg/l)	3.100	<0.200	557.000
Phenols (ug/l)	143.000	21.000	1290.999
Alkalinity (mg/l)	175.000	132.000	403.999
pH	8.300	7.200	9.299
Total Kjeldahl Nitrogen (mg/)	2.990	0.368	0.800
Nitrate Nitrogen (mg/l)	0.030	<0.020	0.140
Ortho Phosphate (mg/l)	0.048	<0.025	0.162
Chlorophyll A (mg/m^3)	25.600	<0.500	512.900
Biological Oxygen Demand (mg/l)	8.200	1.000	81.000
Chemical Oxygen Demand (mg/l)	1596.000	236.000	5625.000
Dissolved Oxygen (mg/l)	4.900	0.800	13.800
Total Organic Carbons (mg/l)	10.850	4.140	61.070
Aluminum (mg/l)	1.190	<0.050	5.860
Cadmium (ug/l)	0.710	<0.100	2.600
Chromium (mg/l)	0.010	<0.001	0.051
Iron (mg/l)	0.570	0.300	1.780
Zinc (mg/l)	0.012	<0.010	0.025
Silver (ug/l)	7.440	<0.050	38.000

Ref: Hall 1991

TABLE 5
GROUNDWATER QUALITY FOR THE INTERMEDIATE AQUIFER SYSTEM AND
THE FLORIDAN AQUIFER SYSTEM AT THE KENNEDY SPACE CENTER

			INTERMEDIATE AQUIFER SYSTEM			FLORIDAN AQUIFER SYSTEM		
Parameter	Drinking Water Stds.		Mean Conc.	Minimum Conc.	Maximum Conc.	Mean Conc.	Minimum Conc.	Maximum Conc.
INORGANICS								
Chlorides	(S)	250.000	10134.000	1340.000	28400.00	1882.00	1189.00	3062.00
Manganese	(S)	0.050	<0.050	<0.050	<0.05			
Nitrate	(P)	10.000	0.020	<0.010	6.00			
Sodium	(P)	160.000	5360.000	550.000	10500.00	950.00	614.00	1531.00
Sulfate	(S)	250.000	695.000	10.000	1900	282.00	251.00	320.00
PHYSICAL PARAMETER								
TDS	(S)	250.000	15163.000	2870.000	2700.00	3778.00	2326.00	7823.00
pH	(S)	6.500	7.620	7.020	8.31	7.45	7.18	7.15
Alkalinity			189.000	70.000	200.00	810.00	133.00	381.00
TRACE METALS								
Arsenic	(P)	0.050	0.060	<0.050	0.100			
Barium	(P)	1.000	<1.000	<1.000	<1.000			
Cadmium	(P)	0.010	0.020	<0.010	<0.050			
Chromium	(P)	0.050	<0.050	<0.050	<0.050			
Copper	(S)	1.000	<1.000	<1.000	<1.000			
Iron	(S)	0.300	1.720	<0.030	4.060	0.11	0.10	0.13
Lead	(P)	0.050	<0.050	<0.050	<0.050			
Mercury	(P)	0.002	<0.002	<0.002	<0.002			
Selenium	(P)	0.010	0.060	0.200	<0.010			
Silver	(P)	0.050	<0.050	<0.050	<0.050			
Zinc	(S)	5.000	0.070	<0.020	0.330			
Gross Alpha(pCi/l)	(P)	15.000	11.500	2.60.000	21.000			
Fecal Coliform(n/.1l)	(P)	1.000	<12.000	<10.000	20.000			

ALL CONCENTRATIONS EXPRESSED IN mg/l UNLESS OTHERWISE SPECIFIED.

Ref: Hall 1991

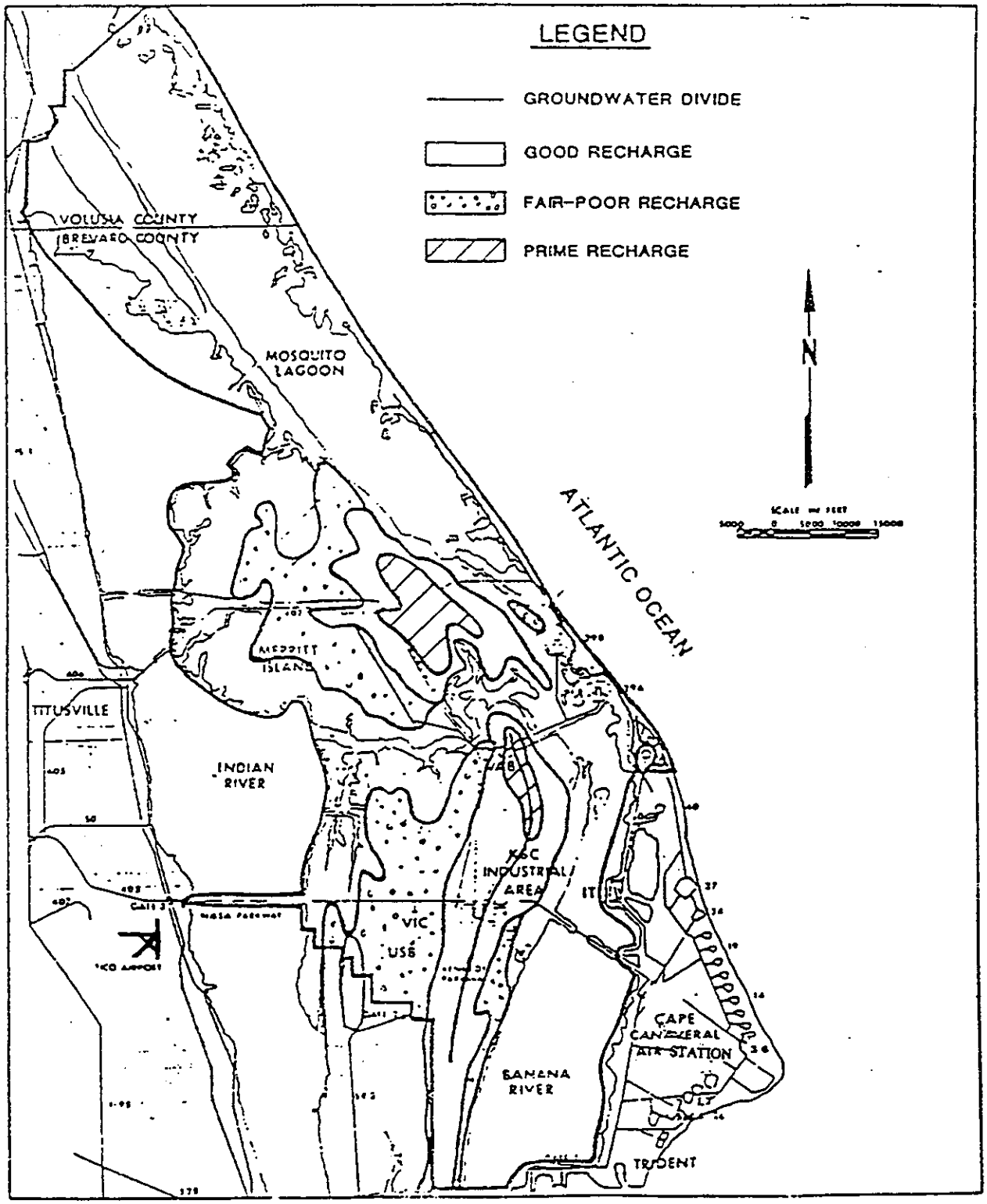

Figure 14: Potential Recharge for the Surficial Aquifer

while 39% are located in the Industrial Area. The remaining work force is stationed at various outlying facilities at KSC and at the CCAS.

The personnel and equipment to support the LAPS and COP are currently staged at various locations around the SLF and the VAB Area. There are approximately 25 positions associated with the LAPS and 32 permanent and 100 transient personnel associated with the COP. The X-34 Program is a new addition to KSC and, at present, no personnel are stationed here to support this program.

3.12 Land Use

KSC comprises approximately 56,600 ha (140,000 acres) of which nearly 95% is undeveloped area including uplands, wetlands, mosquito control impoundments, and open water areas. KSC is unique in that the MINWR and the CNS lie within its boundaries and are managed for NASA by the USFWS and the NPS respectively. These agencies exercise management control over agricultural, recreational, and environmental programs within the MINWR and the CNS.

The remaining approximately 2,630 ha (6,500 acres) of KSC comprise the NASA operational area. Currently, 62% of this operational area is developed as facility sites, roads, lawns, and maintained right-of-ways. The remaining undeveloped operational areas are dedicated safety zones around existing facilities or are held in reserve for planned and future expansion. The developed operational areas within KSC are dominated by the VAB Area, the Industrial Area, and the SLF. These facilities account for more than 70% of the NASA operational area.

The areas chosen for the alternative sites are currently undeveloped and are currently classified as Refuge land as part of the MINWR. Implementation of any of these alternatives will require the removal of the area occupied by the site from the refuge.

4.0 Environmental Consequences and Mitigation

4.1 Summary of Relevant Issues and Status of Issues

Impacts of the construction and operation at each of the alternative sites vary from none to minor upon the environmental issues evaluated. Results of the analyses are summarized in Table 6, which shows the impacts to each media for each alternative.

Impacts were classified in one of six categories:

- Not Applicable (N/A) - those activities not related to the site specific or global environment
- None - those areas in which no impacts are expected
- Minimal - those areas in which the impacts are not expected to be measurable or are too small to cause any degradation to the environment
- Minor - those impacts which will be measurable but are within the capacity of the impacted system to absorb the change or can be mitigated with little effort and resources so that the impact is not substantial
- Major - those environmental impacts which individually or cumulatively could be substantial

This matrix can be used to assess the overall impacts of implementation of this project for each site alternative. The following discussion provides the detail of these impacts. This section is organized by alternative so that the impacts of each alternative can be seen as a whole.

4.2 Proposed Action

4.2.1 Facilities and Infrastructure

Construction of the FVLSC along the north side of the Towway is expected to have a minimal impact to utility connections and the existing infrastructure at the SLF. The connection of the FVLSC to the existing utilities is within the capabilities of the current systems (sanitary sewer, potable water, power, etc.) for this alternative.

Table 6 Relevant Issues and Status of Issues Matrix

Issues	Proposed Action	Alt. 2	Alt. 3	No Action
Facilities and Infrastructure	Minimal	Minimal	Minimal	Minor
Air Quality	Minimal	Minimal	Minimal	Minimal
Biological Resources	Minimal	Minimal	Minimal	Minimal
Threatened & Endangered Species	None	None	None	Minor
Cultural Resources	None	None	None	None
Geology	None	None	None	None
Noise	Minimal	Minimal	Minimal	Minimal
Surface Water Quality	Minimal	Minimal	Minimal	Minimal
Groundwater Quality	None	None	None	None
Socioeconomics	Minimal	Minimal	Minimal	None
Land Use	Minimal	Minimal	Minimal	Minimal

Key to the Categories

N/A:	The issue has no relevance to the site environment.
None:	There are no impacts expected.
Minimal:	The impacts are not expected to be measurable or are too small to cause any degredation to the environment.
Minor:	Those impacts which are measurable, but are within the capacity of the impacted system to absorb the change, or the impacts can be compensated for with little effort and resources so that the impact is not substantial.
Major:	Those environmental impacts which individually or cumulatively could be substantial.

4.2.2 Air Quality

Impacts to air quality may result from two activities of constructing the hangar complex: site preparation activities, and increased mobile sources such as vehicular traffic. The clearing of land and other construction activities for the new facilities will generate airborne particulates from earth moving and hydrocarbon exhaust from heavy equipment. Such activities are expected to be minimal in scope and of short duration. Best Management Practices (BMPs) can also be employed to mitigate for emissions from earth moving and include water spraying, placement of hay bales, and other forms of dust control.

The number of commercial vehicles (<25) required for the operations is relatively small. This does not represent a major increase in traffic other than that already experienced by the site. The increase in vehicle loading is not expected to be measurable; therefore, these sources are expected to produce only minimal impacts to air quality at the site.

4.2.3 Biological Resources

Vegetation

The quality of the uplands that exist at the site can be considered poor due to the disjointed nature of the site. The grouping of several types of upland areas over such a small area limits the types of wildlife that can utilize this environment. The loss of this habitat, 7.9 ha (19.6 acres), is negligible when compared to the overall similar habitat on KSC, 11,909 ha (29,426 acres).

Wetlands and Floodplains

The quality of the wetlands found at the site are rather poor due to their disconnection from larger and more diverse wetland systems. Management of these wetlands to sustain their natural ecology and hydrologic function are made difficult due to this disconnection. Due to the small size, 0.5 ha (1.3 acres), of these wetland areas and their relatively poor quality, the loss of these habitats is not expected to produce a measurable impact on the overall wetlands functions on KSC.

Another issue at this site is the removal of Brazilian pepper. The removal of the Brazilian pepper, 0.8 ha (1.9 acres), would be an advantage to constructing the FVLSC at this site as this vegetation is considered an exotic. Its

removal would therefore reduce its ability to reproduce and spread to other areas of KSC and MINWR. The removal of these species would be considered mitigation for impacts to wetlands since its removal would benefit these habitats. The potential impacts from the construction and operation of the FVLSC are considered minimal for this alternative.

Wildlife

This site is utilized mostly by wildlife considered non-indigenous to KSC. Due to the disturbed nature of the habitat, indigenous species do not appear to utilize the site extensively. Therefore, direct impacts to these species is not expected by the removal of this habitat.

The non-indigenous species using the site would be forced to move into adjacent areas, thereby potentially impacting the native wildlife through competition. However, given the relatively large amount of available habitat elsewhere on KSC, such impacts are not expected to be measurable and are therefore considered minimal. Appendix B is a listing of wildlife species typically found in these habitats.

4.2.4 Threatened and Endangered Species

The Biological Assessment (Appendix A) performed at the site of this alternative identified none of the plants or wildlife listed as threatened or endangered. Therefore, development of the FVLSC at this site is expected to produce no impacts to threatened or endangered species.

4.2.5 Cultural Resources

The area proposed for this alternative site has been previously mapped by NASA to indicate its potential for containing historical artifacts. As a result of this study, this area has been classified as having a low potential for containing items of historical or archaeological significance. The construction and operation of the FVLSC at this site will pose no impact to these resources and no additional Phase I or II archaeological surveys will need to be conducted.

4.2.6 Geology and Soils

The only potential impacts to the geology at this site are due to site preparation activities. Land clearing and excavation for building foundations and stormwater systems will require that the upper layers of the soil strata be removed. This alteration of the topography of the site may

effect the flow patterns of surface runoff from rainfall events, but will be compensated for with the site grading and connection to the existing SLF stormwater management system. None of the construction or operation activities scheduled for the FVLSC will impact the larger geologic formations and aquifer. There are no potential impacts to geology expected for this alternative.

4.2.7 Noise

Ambient noise levels are expected to increase during construction activities and daily operations as a result of the FVLSC being built at the SLF. The noise generated by construction vehicles is expected to be below all noise thresholds and will occur for a brief period. EPA recommended upper level noise threshold is 70 dBA, for a 24 hour timeframe (KSC 1997-A 1997). In addition, there are no known noise receptors (e.g. wildlife) in or around the site which are especially sensitive to the expected noise levels. Noise levels for operations are expected to result from increased vehicle traffic, facility equipment (air conditioners, etc.), and increased aircraft traffic. The first two sources are expected to be similar to existing noise sources and therefore will not produce measurable impacts to noise receptors. The latter sources will be determined by the program(s) using the facility. As the scope of these programs are not completely defined at this time, their impacts are not addressed here. They will be the subject of the programmatic evaluations being performed separately. The potential impacts from the construction and operation of the FVLSC for this alternative are therefore considered minimal.

4.2.8 Surface Water Quality

Currently, the surface water quality at the SLF is affected by vehicle traffic, aircraft maintenance and flight operations, and general daily site operations. The construction of the FVLSC will increase the volume of traffic and number of operations conducted in the area, but is not expected to result in an increase in the runoff amount or loading entering Banana Creek or its tributaries. This is because the existing surface water management system will be used to attenuate runoff from the site and reduce pollutant loadings entering Banana Creek. During actual construction activities, impacts to surface waters in the area would be minimized by ensuring BMPs to control erosion and sedimentation are initiated and maintained. The effects to surface water quality are expected to be minimal for this alternative.

4.2.9 Groundwater Quality

The groundwater quality at the SLF is affected by runoff from roadways, parking lots and the landing strip and associated apron areas, that percolates into the surficial aquifer. Operations at the SLF generate the types of pollutants typically created by vehicle traffic, aircraft maintenance and flight operations, and other day to day site operations. Although the amount of runoff will increase, the loadings of these pollutants are not expected to increase significantly with the creation of the new facilities at the SLF. The poor recharge ability in the area inhibits the migration of contaminants downward into the surficial aquifer and promotes their transport into the existing surface water management system at the SLF. This allows the stormwater system to perform one of its primary functions in filtering contaminants and preventing their introduction into the area's groundwater supply. There are no effects to groundwater quality expected for this alternative.

4.2.10 Socioeconomics

This alternative is expected to have a minimal impact to the workforce at KSC. The introduction of the X-34 program would provide approximately 25 new positions at KSC. This amounts to a 0.1% increase in the workforce at KSC. The other programs to be located at the FVLSC already exist at KSC and only involve centralizing personnel in one location. The 100 construction workers would be drawn from the local workforce with an expected positive impact to the local economy.

4.2.11 Land Use

Only a very small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. Of the 56,600 ha (140,000 acres) of total KSC area, less than 5% is designated for KSC operational area and only 62% of this area has been developed. The approximately 8.1 ha (20 acre) site for the hangar complex would increase this area from approximately 62% to 62.3%. The impacts to land use at KSC as a result of the construction of this facility are expected to be minimal.

KSC is within the Coastal Zone as defined by Florida Statutes (15 CFR 930.30-44). As such, a Coastal Zone Consistency Determination is required (FDER 1984). The results indicate that the proposed action can be implemented within existing environmental regulations and has been

determined to be consistent with the Florida Coastal Zone Management Plan.

4.3 Alternative 2

4.3.1 Facilities and Infrastructure

Construction south of the Towway is expected to present minor impacts to utilities in these areas. Constructing the complex south of the Towway will require routing of some utilities beneath the Towway which will require logistical considerations and higher construction costs.

4.3.2 Air Quality

Impacts to air quality may result from two activities of constructing the FVLSC: site preparation activities, and increased mobile sources such as vehicular traffic. The clearing of land and other construction activities for the new facilities will generate airborne particulates from earth moving and hydrocarbon exhaust from heavy equipment. Such activities are expected to be minimal in scope and of short duration. BMPs can also be employed to mitigate for emissions from earth moving. These include water spraying, placement of hay bales, and other forms of dust control.

The number of commercial vehicles (<25) required for the operations is relatively small. This does not represent a major increase in traffic other than that already experienced by the site. The increase in vehicle loading is not expected to be measurable; therefore, these sources are expected to produce only minimal impacts to air quality at this site.

4.3.3 Biological Resources

Vegetation

The quality of the uplands that exist at this alternative site can be considered poor due to the disjointed nature of the site. The grouping of several types of upland areas over such a small area limits the types of wildlife that can utilize this environment. The loss of this habitat, 6.5 ha (16.1 acres) is negligible when compared to the overall amount of similar habitat on KSC, 11,909 ha (29,426 acres).

Wetlands and Floodplains

The quality of the wetlands found at this alternative site are rather poor due to their disconnection from larger and more diverse wetland systems. Management of these wetlands to sustain their natural ecology and hydrologic function are made difficult due to this disconnection. Due to the small size of these wetland areas, 3.9 ha (9.7 acres), and their relatively poor quality, the loss of these habitats is not expected to produce a measurable impact on overall wetlands functions on KSC. This alternative, does however, have more wetlands on the site than the proposed action location.

Another issue is the removal of exotic vegetation. The removal of the Brazilian pepper, 1.1 ha (2.7 acres) in connection with constructing the FVLSC would be an advantage at this site due to the fact that this vegetation is considered an exotic. Its removal would limit its ability to reproduce and spread to other areas of KSC and MINWR. The removal of this species would be considered mitigation for impacts to wetlands since its removal would benefit the environment. The potential impacts from the construction and operation of the FVLSC are minimal for this alternative.

Wildlife

This site is utilized mostly by wildlife considered non-indigenous to KSC. Due to the disturbed nature of the habitat, indigenous species do not appear to utilize the site extensively. Therefore direct impacts to these species is not expected by the removal of this habitat.

The non-indigenous species using the site would be forced to move into adjacent areas, thereby potentially impacting the native wildlife through competition. However, given the relatively large amount of available habitat elsewhere on KSC, such impacts are not expected to be measurable and are therefore considered minimal. Appendix B is a listing of wildlife species typically found in these habitats.

4.3.4 Threatened and Endangered Species

The Biological Assessment (Appendix A) performed at the site identified no plants or wildlife listed as threatened or endangered. Therefore, development of the FVLSC at this site is expected to produce no impacts to threatened or endangered species.

4.3.5 Cultural Resources

The area proposed for this alternative has been previously mapped by NASA to indicate its potential for containing historical artifacts. As a result of this study, this area has been classified as having a low potential for containing items of historical or archaeological significance. The construction and operation of the FVLSC at this site will pose no impact to these resources and no additional Phase I or II archaeological surveys will need to be conducted.

4.3.6 Geology and Soils

The only potential impacts to the geology at this site are due to site preparation activities. Land clearing and excavation for building foundations and stormwater systems will require that the upper layers of the soil strata be removed. This alteration of the topography of the site may effect the flow patterns of surface runoff from rainfall events, but will be compensated for with the site grading and connection to the existing SLF stormwater management system. None of the construction or operation activities scheduled for the FVLSC will impact the larger geologic formations and aquifer. There are no potential impacts to geology expected for this alternative.

4.3.7 Noise

Ambient noise levels are expected to increase during construction activities and daily operations as a result of the FVLSC being built at the SLF. The noise generated by construction vehicles is expected to be below all noise thresholds and will occur for a brief period. EPA recommended upper level noise threshold is 70 dBA for a 24 hour timeframe (KSC 1997-A). In addition, there are no known noise receptors (e.g. wildlife) in or around the site which are especially sensitive to the expected noise levels. Noise levels for operations are expected to result from increased vehicle traffic, facility equipment (air conditioners, etc.), and increased aircraft traffic. The first two sources are expected to be similar to existing noise sources and therefore will not produce measurable impacts to noise receptors. The latter sources will be determined by the program(s) using the facility. As the scope of these programs are not completely defined at this time, their impacts are not addressed here. They will be the subject of the programmatic evaluations being performed separately. The potential impacts from the construction and operation of the FVLSC for this alternative are therefore considered minimal.

4.3.8 Surface Water Quality

Currently, the surface water quality at the SLF is affected by vehicle traffic, aircraft maintenance and flight operations, and general daily site operations. The construction of the FVLSC will increase the volume of traffic and number of operations conducted in the area, but is not expected to result in an increase in the runoff amount or loading entering Banana Creek or its tributaries. This is because the existing surface water management system will be used to attenuate runoff from the site and reduce pollutant loadings entering Banana Creek. During actual construction activities, impacts to surface waters in the area will be minimized by ensuring that BMPs to control erosion and sedimentation are initiated and maintained.

The implementation of this alternative would use the existing stormwater system for treatment of runoff. However, due to the closer proximity to Banana Creek and the greater amount of wetland area impacted, this alternative is expected to effect the surface water quality to a greater degree than the other alternatives. The potential water quality impacts from the construction and operation of the FVLSC are considered minor for this alternative.

4.3.9 Groundwater Quality

The groundwater quality at the SLF is affected by runoff from roadways, parking lots and the landing strip and associated apron areas, that percolates into the surficial aquifer. Operations at the SLF generate the types of pollutants typically created by vehicle traffic, aircraft maintenance and flight operations, and other day to day site operations. Although the amount of runoff will increase, the loadings of these pollutants are not expected to increase significantly with the creation of the new facilities at the SLF. The poor recharge ability in the area inhibits the migration of contaminants downward into the surficial aquifer and promotes their transport into the existing surface water management system at the SLF. This allows the stormwater system to perform one of its primary functions in filtering contaminants and preventing their introduction into the area's groundwater supply. There are no effects to groundwater quality expected for this alternative.

4.3.10 Socioeconomics

This alternative is expected to have a minimal impact to the workforce at KSC. The introduction of the X-34 program

would provide approximately 25 new positions at KSC. This amounts to a 0.1% increase in the workforce at KSC. The other programs to be located at the FVLSC already exist at KSC and only involve centralizing personnel in one location. The 100 construction workers would be drawn from the local workforce with an expected positive impact to the local economy.

4.3.11 Land Use

Only a very small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. Of the 56,600 ha (140,000 acres) of total KSC area, less than 5% is designated for KSC operational area and only 62% of this area has been developed. The approximately 8.1 ha (20 acre) site for the FVLSC would increase this area from approximately 62% to 62.3%. The impacts to land use at KSC as a result of the construction of this facility are expected to be minimal.

KSC is within the Coastal Zone as defined by Florida Statutes (FDER 1984). As such, a Coastal Zone Consistency Determination is required. The results indicate that this alternative can be implemented within existing environmental regulations. It has been determined to be consistent with the Florida Coastal Zone Management Plan.

4.4 Alternative 3

4.4.1 Facilities and Infrastructure

Construction of the FVLSC northwest of the MDD is expected to have a minimal impact to utility connections and the existing infrastructure at the SLF. The connection of the FVLSC to the existing utilities is within the capabilities of the current systems (sanitary sewer, potable water, power, etc.) for this alternative.

4.4.2 Air Quality

Impacts to air quality may result from two activities of constructing the hangar complex: site preparation activities, and increased mobile sources such as vehicular traffic. The clearing of land and other construction activities for the new facilities will generate airborne particulates from earth moving and hydrocarbon exhaust from heavy equipment. Such activities are expected to be minimal in scope and of short duration. BMPs can also be employed to mitigate for emissions from earth moving. These include

water spraying, placement of hay bales, and other forms of dust control.

The number of commercial vehicles (<25) required for the operations is relatively small. These do not represent a major increase in traffic other than that already experienced by the site. The increase in vehicle loading is not expected to be measurable; therefore, these sources are expected to produce only minimal impacts to air quality at the site.

4.4.3 Biological Resources

Vegetation

The quality of the uplands that exist at this alternative site can be considered poor due to the disjointed nature of the site. The grouping of several types of upland areas over such a small area limits the types of wildlife that can utilize this environment. The loss of this habitat, 5.2 ha (12.8 acres) is negligible when compared to the overall amount of similar habitat on KSC, 11,909 ha (29,426 acres).

Wetlands and Floodplains

The quality of the wetlands found at this alternative site are rather poor due to their disconnection from larger and more diverse wetland systems. This disconnection makes the management of these wetlands difficult and so it is infeasible to sustain the ecology and hydrologic function of the wetland. Due to the small size of these wetland areas, 2.7 ha (6.6 acres), and their relatively poor quality, the loss of these habitats is not expected to produce a measurable impact on the overall wetlands functions on KSC.

Another issue at this site is the removal of exotic vegetation. The removal of the Brazilian pepper, 0.5 ha (1.3 acres), and the Australian pines, 0.5 ha (1.3 acres) in connection with the FVLSC construction would be an advantage to the site as this vegetation is considered an exotic. Its removal would therefore reduce its ability to reproduce and spread to other areas of KSC and MINWR. The removal of these species would be considered mitigation for impacts to wetlands since its removal would benefit these habitats. The potential impacts from the construction and operation of the FVLSC are minimal for this alternative.

Wildlife

This site is utilized mostly by wildlife considered non-indigenous to KSC. Due to the disturbed nature of the habitat, indigenous species do not appear to utilize the site extensively. Therefore direct impacts to these species is not expected by the removal of this habitat.

The non-indigenous species using the site would be forced to move into adjacent areas, thereby potentially impacting the native wildlife through competition. However, given the relatively large amount of available habitat elsewhere on KSC, such impacts are not expected to be measurable and are therefore considered minimal. Appendix B lists out wildlife species typically found in these habitats.

4.4.4 Threatened and Endangered Species

The Biological Assessment (Appendix A) performed at the site of this alternative identified no plants or wildlife listed as threatened or endangered. Therefore, development of the FVLSC at this site is expected to produce no impacts to threatened or endangered species.

4.4.5 Cultural Resources

The area proposed for this alternative has been previously mapped by NASA to indicate its potential for containing historical artifacts. As a result of this study, this area has been classified as having a low potential for containing items of historical or archaeological significance. The construction and operation of the FVLSC at this site will pose no impact to these resources and no additional Phase I or II archaeological surveys will need to be conducted.

4.4.6 Geology and Soils

The only potential impacts to the geology at this site are due to site preparation activities. Land clearing and excavation for building foundations and stormwater systems will require that the upper layers of the soil strata be removed. This alteration of the topography of the site may effect the flow patterns of surface runoff from rainfall events, but will be compensated for with the site grading and connection to the existing SLF stormwater management system for the site. None of the construction or operation activities scheduled for the FVLSC will impact the larger geologic formations and aquifer. There are no potential impacts to geology expected for this alternative.

4.4.7 Noise

Ambient noise levels are expected to increase during construction activities and daily operations as a result of the FVLSC being built at the SLF. The noise generated by construction vehicles is expected to be below all noise thresholds and will occur for a brief period. EPA recommended upper level noise threshold is 70 dBA, for a 24 hour timeframe (KSC 1997-A 1997). In addition, there are no known noise receptors (e.g. wildlife) in or around the site which are especially sensitive to the expected noise levels. Noise levels for operations are expected to result from increased vehicle traffic, facility equipment (air conditioners, etc.), and increased aircraft traffic. The first two sources are expected to be similar to existing noise sources and therefore will not produce measurable impacts to noise receptors. The latter sources will be determined by the program(s) using the facility. As the scope of these programs are not completely defined at this time, their impacts are not addressed here. They will be the subject of the programmatic evaluations being performed separately. The potential impacts from the construction and operation of the FVLSC for this alternative are therefore considered minimal.

4.4.8 Surface Water Quality

Currently, the surface water quality at the SLF is affected by vehicle traffic, aircraft maintenance and flight operations, and general daily site operations. The construction of the FVLSC will increase the volume of traffic and number of operations conducted in the area, but is not expected to result in an increase in the runoff amount or loading entering Banana Creek or its tributaries. This is because the existing surface water management system will be used to attenuate runoff from the site and reduce pollutant loadings entering Banana Creek. During actual construction activities, impacts to surface waters in the area would be minimized by ensuring BMPs to control erosion and sedimentation are initiated and maintained. The effects to surface water quality are expected to be minimal for this alternative.

4.4.9 Groundwater Quality

The groundwater quality at the SLF is affected by runoff from roadways, parking lots and the landing strip and associated apron areas, that percolates into the surficial aquifer. Operations at the SLF generate the types of pollutants typically created by vehicle traffic, aircraft

maintenance and flight operations, and other day to day site operations. Although the amount of runoff will increase, the loadings of these pollutants are not expected to increase significantly with the creation of the new facilities at the SLF. The poor recharge ability in the area inhibits the migration of contaminants downward into the surficial aquifer and promotes their transport into the existing surface water management system at the SLF. This allows the stormwater system to perform one of its primary functions in filtering contaminants and preventing their introduction into the area's groundwater supply. There are no effects to groundwater quality expected for this alternative.

4.4.10 Socioeconomics

This alternative is expected to have a minimal impact to the workforce at KSC. The introduction of the X-34 program would provide approximately 25 new positions at KSC. This amounts to a 0.1% increase in the workforce at KSC. The other programs to be located at the FVLSC already exist at KSC and only involve centralizing personnel in one location. The 100 construction workers would be drawn from the local workforce with an expected positive impact to the local economy.

4.4.11 Land Use

Only a very small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. Of the 56,600 ha (140,000 acres) of total KSC area, less than 5% is designated for KSC operational area and only 62% of this area has been developed. The approximately 8.1 ha (20 acre) site for the hangar complex would increase this area from approximately 62% to 62.3%. The impacts to land use at KSC as a result of the construction of this facility are expected to be minimal.

KSC is within the Coastal Zone as defined by Florida Statutes (FDER 1984). As such, a Coastal Zone Consistency Determination is required. The results indicate that this alternative can be implemented within existing environmental regulations. The action has been determined to be consistent with the Florida Coastal Zone Management Plan.

4.5 No Action

4.5.1 Facilities and Infrastructure

Construction at this site is expected to present minor impacts to utilities in the areas. These impacts are due to the added cost of routing and connecting utilities since no utility connections presently exist at the Mid-field Parksite. As this alternative has fewer facility structures than the other alternatives, the increased load on existing utilities would be less, and within the existing capacities for all utilities.

4.5.2 Air Quality

Impacts to air quality may result from two activities of constructing the Convoy Support Facility: site preparation activities, and increased mobile sources such as vehicular traffic. The clearing of land and other construction activities for the new facilities would generate airborne particulates from earth moving and hydrocarbon exhaust from heavy equipment. Such activities are expected to be minimal in scope and of short duration. BMPs would also be employed to mitigate for emissions from earth moving. These include water spraying, placement of hay bales, and other forms of dust control.

The number of commercial vehicles (<25) required for the operations already exist on the center. They would merely be relocated to this site. These do not represent a major increase in traffic other than that already experienced at the SLF. The increase in vehicle loading to this site is not expected to be measurable; therefore, these sources are expected to produce only minimal impacts to air quality at the site.

4.5.3 Biological Resources

Vegetation

The quality of the uplands that exist at this alternative site can be considered poor due to the disjointed nature of the site. The grouping of several types of upland areas over such a small area limits the types of wildlife that can utilize this environment. The loss of this habitat, 1 ha (2.5 acres) is negligible when compared to the overall amount of similar habitat on KSC, 11,909 ha (29,426 acres).

Wetlands and Floodplains

The quality of the wetlands found at the site are rather poor due to their disconnection from larger and more diverse wetland systems. This disconnection makes the management of these wetlands, so as to sustain the natural ecology and hydrologic function of the wetland, difficult. Approximately 1.21 ha (3 acres) of live oak/cabbage palm hammock would be removed for the construction of this alternative. Due to the small size of these wetland areas and their relatively poor quality, the loss of these habitats is not expected to produce a measurable impact on overall wetlands functions on KSC.

Wildlife

This site is utilized mostly by wildlife considered non-indigenous to KSC. Due to the disturbed nature of the habitat, indigenous species do not appear to utilize the site extensively. Therefore direct impacts to these species is not expected by the removal of this habitat.

The non-indigenous species using the site would be forced to move into adjacent areas, thereby potentially impacting the native wildlife through competition. However, given the relatively large amount of available habitat elsewhere on KSC, such impacts are not expected to be measurable and are therefore considered minimal. Appendix B lists wildlife species typically found in these habitats.

4.5.4 Threatened and Endangered Species

The Biological Assessment performed at the site for this alternative identified Scrub jays (Aphelocoma coerulescens coerulescens), which are endangered, and gopher tortoises (Gopherus polyphemus) which are proposed as being listed as endangered, were present. Development of the LAPS and COP at this site would produce minor impacts to threatened or endangered species. Implementation of this alternative would require mitigation for these impacts. This would be accomplished by providing resources and support to MINWR for their Scrub restoration activities, through the KSC Scrub Compensation Plan.

4.5.5 Cultural Resources

The area proposed for this alternative site has been previously mapped by NASA to indicate its potential for containing historical artifacts. As a result of this study, this area has been classified as having a low potential for

containing items of historical or archaeological significance. The construction and operation of the FVLSC at this site will pose no impact to these resources and no additional Phase I or II archaeological surveys will need to be conducted.

4.5.6 Geology and Soils

The only potential impacts to the geology at this site is due to site preparation activities. Land clearing and excavation for building foundations and stormwater systems will require that the upper layers of the soil strata be removed. This alteration of the topography of the site may effect the flow patterns of surface runoff from rainfall events, but will be compensated for with the site grading and design of a new stormwater management system for the site. None of the construction or operation activities scheduled for the FVLSC will impact the larger geologic formations and aquifer. There are no potential impacts to geology expected for this alternative.

4.5.7 Noise

Ambient noise levels are expected to increase during construction activities and daily operations as a result of the FVLSC being built at the SLF. The noise generated by construction vehicles is expected to be below all noise thresholds and will occur for a brief period. EPA recommended upper level noise threshold is 70 dBA, for a 24 hour timeframe (KSC 1997-A 1997). In addition, there are no known noise receptors (e.g. wildlife) in or around the site which are especially sensitive to the expected noise levels. Noise levels for operations are expected to result from increased vehicle traffic and facility equipment (air conditioners, etc.). These two sources are expected to be similar to existing noise sources and therefore will not produce measurable impacts to noise receptors. The potential impacts from noise generators and the construction and operation of the Convoy Support Facility for this alternative are therefore considered minimal.

4.5.8 Surface Water Quality

Currently, the surface water quality at the SLF is affected by vehicle traffic, aircraft maintenance and flight operations, and general daily site operations. The construction of the Convoy Support Facility will increase the volume of traffic and number of operations conducted in the area, but is not expected to result in an increase in the runoff amount or loading entering Banana Creek or its

tributaries. During actual construction activities, impacts to surface waters in the area would be minimized by ensuring that BMPs to control erosion and sedimentation are initiated and maintained. During operations, the new stormwater management system constructed would be used to collect and treat runoff from the facility. This would ensure minimal impacts to surface waters.

4.5.9 Groundwater Quality

The groundwater quality at the SLF is affected by runoff from roadways, parking lots and the landing strip and associated apron areas, that percolates into the surficial aquifer. Operations at the SLF generate the types of pollutants typically created by vehicle traffic, aircraft maintenance and flight operations, and other day to day site operations. Although the amount of runoff will increase, the loadings of these pollutants are not expected to increase significantly with the creation of the new stormwater management system for this facility. The poor recharge ability in the area inhibits the migration of contaminants downward into the surficial aquifer and promotes their transport into the storm water ponds created as part of the surface water management system for the site. This allows the stormwater system to perform one of its primary functions in filtering contaminants and preventing their introduction into the area's groundwater supply. There are no impacts to groundwater quality expected for this alternative.

4.5.10 Socioeconomics

The workforce at KSC would be temporarily impacted due to the additional workforce during activities associated with the construction of the facility. The 100 construction workers would be drawn from the local workforce with an expected positive impact to the local economy. The No Action alternative is expected to have no impacts to the workforce at KSC since it would only involve relocation of existing personnel at the center.

4.5.11 Land Use

Only a very small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. Of the 56,600 ha (140,000 acres) of total KSC area, less than 5% is designated for KSC operational area and only 62% of this area has been developed. The approximately 1.0 ha (2.5 acre) site for this project would not increase the percent of developed operational area above

62%. The impacts to land use at KSC as a result of the construction of this facility are expected to be minimal.

KSC is within the Coastal Zone as defined by Florida Statutes (FDER 1984). As such, a Coastal Zone Consistency Determination is required. The results indicate that this alternative can be implemented within existing environmental regulations. The action has been determined to be consistent with the Florida Coastal Zone Management Plan.

5.0 ENVIRONMENTAL JUSTICE

On February 11, 1994, the President of the United States 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 communities 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 communities 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 by identifying and addressing, as appropriate, disproportionately high adverse human health or environmental effects on minority or low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.

In accordance with EO 12898, 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 center; 4) make each center responsible for developing its own Environmental Justice Plan; and, 5) consider both normal operations and accidents.

In turn, KSC has developed a plan to comply with the EO and NASA's agency-wide strategy. As part of that plan, the impacts to low-income and minority populations in the KSC area were addressed as part of this EA. This project, for all alternatives addressed, would be implemented within the boundaries of KSC. The closest residential areas are 13 km (9.5 mi) to the south on Merritt Island and 12 km (7.6 mi) to the west in Titusville. No groups of either low-income or minority populations have been identified in either location. In addition, the distances of these areas from the proposed site alternative preclude any direct impacts from construction or operations. Economic impacts are not

expected to adversely affect any particular group. Construction personnel would be drawn from the local workforce and provide a short-term economic benefit to the local area. Operational personnel would be increased only for the X-34 program portion and these numbers are relatively small (25).

6 PREPARERS, CONTRIBUTORS, AND CONTACTs

The individuals from KSC who provided detailed data or analyses and who prepared this document are listed in Table 7. The table provides information concerning which section(s) each person was involved in writing or assembling.

Table 7 Preparers and Contributors to the EA

Responsible Person	Executive Summary	Section							Appendix	
		1	2	3	4	5	6	7	A	B
NASA/KSC Mario Busacca Environmental Program Office	X	X	X	X	X	X	X	X		
EG&G Florida, Inc. Robin Cosker Natural Resources Group			X	X	X		X	X		
Doug Durham Natural Resources Group	X	X	X	X	X	X	X	X		
John Shaffer Natural Resources Group		X	X	X						
Dynamac Corp. Vickie Larson									X	
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APPENDIX A
BIOLOGICAL ASSESSMENT

1. INTRODUCTION

Biological assessments (BA) are required from NASA by the Endangered Species Office of the U.S. Fish and Wildlife Service in order to evaluate the potential for adverse impacts to federally protected plants and wildlife. This BA has been prepared to evaluate potential impacts which may result from installation of a hangar complex for the Reusable Launch Vehicle program. Three areas in the vicinity of the Shuttle Landing Facility (SLF) were selected as potential sites, and were designated "Preferred Alternative", "Alternative 1", and "Alternative 2".

2. PROJECT DESCRIPTION

The Preferred Alternative site is located west of the Landing Aids Control building (#J6-2313) near the south end of the runway (Figure 1). Site Alternative 3 is adjacent to the northwest side of the Mate/Demate Device. Site Alternative 2 is approximately 800 m southeast of the SLF security fence where it crosses the Tow-way, and is south of the Tow-way adjacent to Banana Creek. The proposed complex will consist of 3 main facilities: 1) a hangar for the X-34 vehicle, 2) a multi-use facility with offices, workshops, and laboratories for the X-34 program, landing aids personnel, and convoy operations personnel, and 3) a convoy operations support staging and maintenance hangar. The facility design also includes one asphalt parking lot, three stabilized parking lots, an access road, and X-34 hangar apron. Two stormwater retention ponds are proposed, but will only be constructed if existing stormwater retention capabilities are not sufficient. The entire facility, including the potential stormwater retention ponds, will be contained within a 346 m x 264 m area.

3. BIOLOGICAL ASSESSMENT

Laboratory Analyses

Initial habitat evaluations were conducted using aerial photograph interpretation of 1994 digital orthographic images. Land cover types were delineated as polygon Arc/Info GIS coverages using the Florida Land Use Cover and Form Classification System (FLUCCS, 1985). The minimum mapping unit was 0.2 ha (0.5 ac).

Field Surveys

A field survey was done on 6 February 1998. All three sites were visited in order to validate the presence of the cover types that had been designated on the land cover maps. Unlabeled orthographic photographs were carried and marked in the field. These were used to edit the final land cover maps.

The Preferred Alternative consists primarily of pine flatwoods and palmetto prairie (Fig. 2). There are 0.4 ha (0.98 ac) of wet prairie in three separate parcels (Table 1). A 0.33 ha (0.81 ac) patch of xeric oak occurs on the site. Because of its small size and isolation from other patches of scrub, it is probably not being used by Florida scrub-jays (*Aphelocoma coerulescens*), and none were seen or heard during the field survey. The south and west edges of the site are extremely disturbed and dominated by exotic and invasive vegetation.

Alternative 3 is dominated by cabbage palm (*Sabal palmetto*) hammock and swamps consisting mostly of willow (*Salix caroliniana*) and red maple (*Acer rubrum*) (Fig. 3, Table 1). There is a line of exotic vegetation, Australian pine (*Casuarina* sp.) and Brazilian pepper (*Schinus terebenthifolius*), extending along a firebreak on the north end of the site. The south edge is disturbed and dominated by exotic and invasive species.

Alternative 2 is bordered on the north side by the SLF Towway and is bisected from east to west by an impoundment dike road and ditch (Fig. 4). Much of the vegetation cover along the dike road and Towway edges consists of exotic and invasive species (Table 1). The mixed

hardwoods are dominated by large live oaks (*Quercus virginiana*). There are two small areas of freshwater marsh at the site totaling 0.41 ha (1.02 ac), and there are 0.23 ha (0.57 ac) of wet prairie in the southwest corner of the site.

Impacts

No impacts to federally or state-protected plant or wildlife species are expected from development of this facility, regardless of the site chosen. A large portion of the vegetation at all three sites is exotic and/or invasive, and does not support any species of concern. The natural fire and hydrological regimes have been interrupted, so the uplands vegetation is too overgrown to support typical scrub species such as Florida scrub-jays and gopher tortoises (*Gopherus polyphemus*). Habitats used by the federally listed eastern indigo snake (*Drymarchon corais couperi*) occur at all three sites, but the amounts are small in comparison with the home range size of a single adult snake. Loss of this habitat would not constitute a detrimental impact to the species.

4. RECOMMENDATIONS

All three of the alternative sites have been degraded by human disturbance. Exotic and invasive plants are common, and even dominant in some areas. The natural fire and hydrological regimes have been interrupted, and it is unlikely that these areas could be ever be returned to a natural state. The ecological advantages of using the Preferred Alternative site over the other alternatives are 1) power, water, and communication lines that could service the facility are already in place. No additional construction for those services would be necessary; 2) The Preferred Alternative is adjacent to an existing facility, thereby consolidating development impacts into specific areas; and 3) The Preferred Alternative already has an existing access road on its west side.

Table 1. Land cover types and areas for three proposed RLV Hangar Facility site alternatives located near the Shuttle Landing Facility (SLF). February 1998.

Preferred Alternative

FLUCCS*	Area (ha)	Area (ac)	Area (sq. ft.)
Brazilian Pepper	0.80	1.98	86,259
Disturbed Shrub and Brush	0.03	0.07	2,884
Palmetto Prairie	0.77	1.89	82,413
Pine Flatwoods	3.44	8.50	370,146
Roads and Highways	1.06	2.62	114,283
Streams and Waterways	0.62	1.54	67,005
Temperate/Tropical Hardwood	0.83	2.04	88,858
Wax Myrtle	0.09	0.21	9,354
Wet Prairie	0.40	0.98	42,617
Wetland Scrub	0.12	0.29	12,678
Xeric Oak	0.33	0.81	35,187
TOTAL	**8.47**	**20.93**	**911,682**

Alternative 1

FLUCCS*	Area (ha)	Area (ac)	Area (sq. ft.)
Airport (SLF)	0.77	1.90	82,636
Australian Pine	0.52	1.28	55,899
Brazilian Pepper	0.51	1.27	55,178
Cabbage Palm	2.64	6.53	284,671
Roads and Highways	0.09	0.22	9,497
Stream and Lake Swamps (Bottomland)	3.45	8.53	371,715
Streams and Waterways	0.48	1.18	51,287
Temperate/Tropical Hardwood	0.66	1.63	71,097
TOTAL	**9.12**	**22.54**	**981,980**

Alternative 2

FLUCCS*	Area (ha)	Area (ac)	Area (sq. ft.)
Brazilian Pepper	1.11	2.74	119,567
Disturbed Shrub and Brush	0.00	0.01	221
Freshwater Marsh	0.41	1.02	44,530
Governmental	0.06	0.16	6,937
Mixed Hardwoods	2.28	5.62	244,970
Palmetto Prairie	1.33	3.28	142,838
Rural Land in Transition	0.51	1.26	54,929
Spoil Areas	0.44	1.09	47,375
Streams and Waterways	0.64	1.58	68,973
Temperate/Tropical Hardwood	0.11	0.27	11,951
Wax Myrtle	0.70	1.73	75,426
Wet Prairie	0.23	0.57	24,924
Wetland Scrub	1.40	3.46	150,696
TOTAL	**9.23**	**22.80**	**993,337**

* FLUCCS = Florida Land Use, Cover and Forms Classification System

APPENDIX B
TYPICAL WILDLIFE SPECIES

Wildlife species that might be found in the habitat types that occur at the three potential sites for the RLV Hangar Facility near the SLF. This list is based on species/habitat relationships, not site-specific surveys. Therefore, it should not be considered a complete account of all species present at the sites, or that all of the species listed are, in fact, present.

	Common name	Scientific name
Amphibians	Southern toad	*Bufo terrestris*
	Southern cricket frog	*Acris gryllus*
	Green tree frog	*Hyla cinerea*
	Squirrel tree frog	*Hyla squirella*
	Southern chorus frog	*Pseudacris nigrita*
	Eastern narrowmouth toad	*Gastrophryne carolinensis*
	Bullfrog	*Rana catesbeiana*
	Pig frog	*Rana grylio*
	Southern leopard frog	*Rana utricularia*
Reptiles	American alligator	*Alligator mississippiensis*
	Florida east coast terrapin	*Malaclemys terrapin tequesta*
	Florida cooter	*Chrysemys floridana*
	Florida box turtle	*Terrapene carolina*
	Green anole	*Anolis carolinensis*
	Southeastern five-lined skink	*Eumeces inexpectatus*
	Six-lined racerunner	*Cnemidophorus sexlineatus*
	Black racer	*Coluber constrictor*
	Corn snake	*Elaphe guttata*
	Yellow rat snake	*Elaphe obsoleta*
	Kingsnake	*Lampropeltis getulus*
	Eastern coachwhip	*Masticophis flagellum flagellum*
	Banded water snake	*Nerodia fasciata*
	Florida pine snake	*Pituophis melanoleucus mugitus*
	Ribbon snake	*Thamnophis sauritis*
	Garter snake	*Thamnophis sirtalis*
	Eastern diamondback rattlesnake	*Crotalus adamanteus*
	Dusky pygmy rattlesnake	*Sistrurus miliaris barbouri*

Birds	Cooper's hawk	*Accipiter cooperi*
	Red-shouldered hawk	*Buteo lineatus*
	Red-tailed hawk	*Buteo jamaicensus*
	American kestrel	*Falco sparverius*
	Merlin	*Falco columbarius columbarius*
	Northern bobwhite	*Colinus virginianus*
	Common ground dove	*Columbina passerina*
	Great horned owl	*Bubo virginianus*
	Barred owl	*Strix varia*
	Red-bellied woodpecker	*Melanerpes carolinus*
	Southern hairy woodpecker	*Picoides villosus*
	Pileated woodpecker	*Dryocopus pileatus pileatus*
	Carolina wren	*Thryothorus ludovicianus*
	Gray catbird	*Dumetella carolinensis*
	Loggerhead shrike	*Lanius ludovicianus*
	White-eyed vireo	*Vireo griseus*
	Yellow-rumped warbler	*Dendroica coronata*
	Pine warbler	*Dendroica pinus*
	American redstart	*Setophaga ruticilla*
	Worm-eating warbler	*Helmitheros vermivorus*
	Northern cardinal	*Cardinalis cardinalis*
Mammals	Southeastern shrew	*Sorex longirostris*
	Eastern cottontail	*Sylvilagus floridanus*
	Gray squirrel	*Sciurus carolinensis*
	Florida mouse	*Podomys floridanus*
	Florida long-tailed weasel	*Mustela frenata*
	Gray fox	*Urocyon cinereoargenteus*
	Bobcat	*Lynx rufus*
	White-tailed deer	*Odocoileus virginianus*