3.8 AIR QUALITY

3.8.1 Introduction

This section presents air quality conditions in the vicinity of former Homestead AFB compared to federal and state air quality standards, provides current and baseline air emissions inventories, and addresses areas of special concern.

3.8.1.1 Resource Definition

Air quality in a given location is generally described by the concentration of pollutants in the atmosphere expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Meteorological conditions have a significant impact on the pollutant concentrations because they control the dispersion or mixing of pollutants in the atmosphere through the influences of wind speed, wind direction, atmospheric stability, and other variables.

Air emissions considered in the evaluation of air quality include pollutants regulated under the Clean Air Act (see Section 3.8.1.2) and unregulated pollutants, including volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs).

VOCs are composed of a large group of diverse organic molecules. These molecules are gases or liquids at ambient conditions and tend to vaporize readily. Thus they are present in the atmosphere in the vapor state. VOCs include benzene, commonly found in gasoline, and xylenes, commonly found in paints. VOCs contribute to the formation of ozone, a pollutant regulated under the Clean Air Act.

PAHs are a class of relatively large organic molecules that are generally toxic and carcinogenic. These compounds can form in a combustion chamber of an automobile or aircraft engine through incomplete combustion, but usually comprise a very small portion of aircraft engine exhaust.

Automobile and aircraft engines also emit unburned hydrocarbons. These are fuels that have passed through the combustion chambers of an engine but have not been completely burned. Other terms sometimes used to describe unburned hydrocarbons include "oily gunk" and "soot." Unburned hydrocarbons can be deposited on windows, cars, and other surfaces.

Fuel venting emissions are defined by FAA as "raw fuel, exclusive of hydrocarbons in the exhaust emissions, discharged from aircraft gas turbine engines during all normal ground and flight operations." FAA Advisory Circular 34-1, "Fuel Venting and Exhaust Emissions Requirements from Turbine Engine Powered Aircraft" (July 27, 2000), prohibits the discharge of fuel venting emissions into the atmosphere from all new and in-use gas turbine engines manufactured after January 1, 1975.

Air emissions inventories identify sources of regulated pollutants from both stationary sources (e.g., industrial plants, gasoline stations) and mobile sources (e.g., motor vehicles, aircraft, construction equipment).

Areas of special concern include certain national parks, wilderness areas, and other areas afforded additional protection from air quality impacts.

3.8.1.2 Applicable Laws and Regulations

Clean Air Act (42 U.S.C. 7401–7671q). The Clean Air Act (CAA) provides the authority to USEPA to establish nationwide air quality standards to protect public health and welfare, with an adequate margin of safety. These federal standards, known as the National Ambient Air Quality Standards (NAAQS) (40 CFR 50), were developed for six "criteria" pollutants: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter less than 10 micrometers in diameter (PM_{10}), sulfur dioxide (SO_2), and lead (Pb). The standards are defined in terms of concentration (e.g., ppm) determined over various periods of time (averaging periods). Short-term standards (1 hour, 8 hour, or 24 hour) were established for pollutants with acute health effects, while long-term standards (annual) were established for pollutants with chronic health effects. These standards are shown in **Table 3.8-1**. The CAA Amendments of 1990 established a framework to achieve attainment and maintenance of the health-protective NAAQS. Title I of the amendments sets provisions for the attainment and maintenance of the NAAQS.

Table 3.8-1. Federal, State, and Local Ambient Air Quality Standards

Air Pollutant	Averaging Time	Federal Standards[a]		Florida Standards[a]	Miami-Dade Standards[a]
		Primary[b]	Secondary[b]		
CO	8 hour 1 hour	9 ppm 35 ppm	— —	9 ppm 35 ppm	9 ppm 35 ppm
NO_2	AAM 24 hour	0.053 ppm —	0.053 ppm —	0.053 ppm —	0.053 ppm —
SO_2	AAM 24 hour 3 hour	0.03 ppm 0.14 ppm —	— — 0.5 ppm	0.02 ppm 0.10 ppm 0.5 ppm	0.01 ppm 0.042 ppm 0.13 ppm
PM_{10}[c]	AAM 24 hr	50 µg/m^3 150 µg/m^3	50 µg/m^3 150 µg/m^3	50 µg/m^3 150 µg/m^3	50 µg/m^3 150 µg/m^3
O_3[d]	1 hour 8 hour	0.12 ppm 0.08 ppm	0.12 ppm —	0.12 ppm 0.08 ppm	0.12 ppm 0.08 ppm
Pb and Pb Compounds	Calendar Quarter	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3

Source: 40 CFR Part 50; Florida Title 62, Chapter 62-204.240.

Notes:
[a] Federal, state, and county standards, other than ozone and those based on an annual/quarterly arithmetic mean, are not to be exceeded more than once per year.
[b] Primary standards are the levels of air quality required to protect the public health, including an adequate margin of safety. Secondary standards are the levels of air quality required to protect the public welfare.
[c] USEPA has revised the form of the 24 hour PM_{10} standard from one expected exceedance to a 99th percentile form, averaged over 3 years.
[d] USEPA is phasing out the 1 hour primary ozone standard with a new 8 hour standard to protect against longer exposure periods. The new standard is defined as a "concentration-based" form, specifically the 3 year average of the annual fourth highest daily maximum 8 hour ozone concentration.

AAM annual arithmetic mean
µg/m^3 micrograms per cubic meter
ppm parts per million

USEPA has classified all areas of the United States as in attainment (meeting NAAQS), in nonattainment (not meeting NAAQS), or unclassified (insufficient ambient air monitoring data to determine attainment status) for each individual criteria pollutant. For regulatory purposes, unclassified areas are treated in a

similar manner to attainment areas. Areas that have been designated as nonattainment for ozone are categorized (ranging from extreme to marginal) based upon the severity of the air pollution.

Individual states are required to establish a USEPA-approved State Implementation Plan (SIP). A SIP is a plan for maintaining existing air quality in attainment areas and programmatically eliminating or reducing the severity and number of NAAQS violations in nonattainment areas. The underlying goal is to bring state air quality conditions into compliance with NAAQS.

Two NAAQS were newly promulgated by USEPA in 1997: a new 8 hour O_3 standard (which may eventually replace the existing 1 hour standard) and a new standard for $PM_{2.5}$, a previously unregulated, smaller size of particulate matter. Both of these standards have been remanded to USEPA by District Court for additional information and justification. In addition, USEPA has made a change in the form of the PM_{10} standard (which is not expected to affect attainment status in Florida). USEPA has stated that it plans to implement both of the new standards over an extended period of time.

For the new 8 hour ozone standard, USEPA planned to designate areas as attainment or nonattainment between 1999 and 2000, but the timing is now uncertain. Under the CAA, states are required to revise and update their SIPs as needed within 3 years after USEPA revises NAAQS. If Miami-Dade County were to be redesignated as nonattainment for ozone, Florida would be required to revise and submit its SIP to USEPA for approval.

For the new $PM_{2.5}$ standard, USEPA currently plans to make initial designations of "unclassifiable" due to a lack of data. From a regulatory perspective, an unclassifiable area is treated the same as an attainment area. Redesignations from unclassifiable to attainment or nonattainment would occur after 3 years of quality-assured monitoring data become available.

Under CAA, state and local agencies may establish air quality standards and regulations of their own, provided they are at least as stringent as the NAAQS. The Division of Air Resources Management of the FDEP is responsible for regulating air quality sources in Florida. Miami-Dade County DERM is responsible for administering the program in Miami-Dade County. As shown in Table 3.8-1, both the State of Florida and Miami-Dade County have adopted the federal NAAQS, except SO_2. Both agencies have promulgated more stringent standards for this pollutant.

The principal method of maintaining or improving ambient air quality is by controlling emissions from the sources. SIPs establish regulations to control stationary and mobile emission sources. In attainment areas, Prevention of Significant Deterioration (PSD) (*40 CFR 51.166*) regulations apply; in nonattainment areas, New Source Review (NSR) (*40 CFR 51.160–164*) regulations apply.

PSD regulations provide additional air quality protection from stationary source emissions in areas that are currently in attainment by setting a maximum incremental increase in the ambient concentrations of certain criteria pollutants (SO_2, NO_2, and PM_{10}). PSD regulations apply only to new construction for permanent sources.

Certain national parks and wilderness areas established before August 1977 were designated as PSD Class I areas. All other attainment areas in the United States have been designated as PSD Class II areas. Class I increments are very restrictive, allowing only minor increases in pollutants, while Class II increments allow moderate increases in pollutants. (There is a third category, Class III increments, but to date no area has been designated as Class III.) Everglades NP is designated as a Class I area, and Biscayne NP is designated as a Class II area. The PSD Class I and Class II increments are presented in **Table 3.8-2.**

Table 3.8-2. Federal and State PSD Increments for Areas in Attainment of the NAAQS

Pollutant	Averaging Time	PSD Increment ($\mu g/m^3$)	
		Class I	Class II
NO_2	Annual arithmetic mean	2.5	25
SO_2	Annual arithmetic mean	2	20
	24 hour maximum	5	91
	3 hour maximum	25	512
PM_{10}	Annual arithmetic mean	4	17
	24 hour maximum	8	30

Source: Florida Title 62, Chapter 62-212.400.
$\mu g/m^3$ micrograms per cubic meter
PSD Prevention of Significant Deterioration

PSD and NSR regulations apply to stationary sources. The majority of emissions associated with the civil reuse of Homestead AFB are expected to be from mobile sources. Visibility is singled out in the PSD regulations for protection and enhancement in accordance with the national goal of preventing any future impairment and remedying any existing impairment of visibility in Class I areas caused by industrial air pollution. A visibility impact analysis focuses on major new stationary sources or major modifications of existing stationary sources that have the potential to impair visibility in any Class I area. Because the majority of emissions associated with reuse of former Homestead AFB are expected to be from mobile sources, PSD and NSR regulations will have limited applicability.

General Conformity Rule (40 CFR Part 51, Subpart W). Under the CAA's General Conformity Rule, federal agencies contemplating an action must determine whether the action will conform to the applicable SIP. SIPs include plans for eliminating or reducing the severity and number of NAAQS violations in nonattainment areas, and the Florida SIP references the federal procedures for general conformity determinations. Federal agencies must ensure their actions do not:

- Cause or contribute to any new violation of NAAQS;
- Increase the frequency or severity of any existing violation; or
- Delay timely attainment of any standard, interim emission reduction, or milestone.

The General Conformity Rule only applies to nonattainment areas and maintenance areas. Former Homestead AFB is in an ozone maintenance area. The General Conformity Rule applies to all federal actions in nonattainment and maintenance areas except those covered by the Transportation Conformity Rule (see below), exempted from the regulation (including base realignment and closure property disposal actions), or found to be presumed to conform. The General Conformity Rule provides the procedures to be used in evaluating general conformity actions. Most FAA actions at airports are general conformity actions.

A conformity evaluation is conducted in three steps: applicability determination, conformity analysis, and conformity determination. The applicability determination establishes whether the General Conformity Rule applies to an action, compares the project's estimated net direct and indirect emissions with conformity threshold levels (emissions greater than 100 tons/year of nitrogen oxide [NO_x] or VOCs in ozone maintenance areas), and determines the regional significance of the project in the context of the General Conformity Rule (emissions greater than 10 percent of the regional emissions inventory for NO_x

and VOCs). The results of the conformity analysis provide the input for making a conformity determination if one is required. The determination requires certain documentation to be provided to USEPA, the State of Florida, and Miami-Dade County, as well as notification to the general public.

Transportation Conformity Rule (40 CFR Part 51, Subpart T). The Transportation Conformity Rule applies to federal actions related to highway or transit projects in nonattainment or maintenance areas which are proposed to receive funding and approval through the Federal-Aid Highway program, require Federal Highway Administration approval, or are "regionally significant." A project is of regional significance when it serves regional transportation needs and would normally be included in the modeling of a metropolitan planning organization.

3.8.1.3 Region of Influence

Federal regulations (40 CFR 81) define air quality control regions (AQCR) which were originally designated based on population and topographic criteria closely approximating each air basin. Air quality impacts from a given project are generally expected to be confined to the air basin or AQCR. Former Homestead AFB is located in the Southeast Florida Intrastate AQCR (AQCR #50), which consists of the following eight counties: Broward, Miami-Dade, Indian River, Martin, Monroe, Okeechobee, Palm Beach, and St. Lucie. In this SEIS, the ROI (**Figure 3.8-1**) for air quality includes all of Miami-Dade County and those parts of Everglades and Biscayne NPs that would be overflown at altitudes less than 3,000 feet by aircraft arriving at or departing from former Homestead AFB.

3.8.2 Regional Air Quality

This section presents air quality conditions in the ROI and compares them to the federal, state, and local air quality standards.

3.8.2.1 Existing Environment

Regional Climate

A brief summary of the regional climate is presented because of the influence of meteorology on air quality. The area surrounding former Homestead AFB is classified as having a subtropical maritime climate. The climate is dominated by the region's proximity to the warm waters of the Atlantic Ocean and the Gulf of Mexico. These water bodies are a major source of water vapor, particularly when the water is warm during the summer, resulting in high precipitation and high relative humidity. The proximity of the ocean also provides a stabilizing and moderating influence on temperatures in the region.

There are essentially two seasons in the region: a summer wet season from May through October, in which approximately 75 percent of the annual precipitation falls, and a winter dry season from November through April. Total annual rainfall is approximately 56 inches, with average monthly totals of 7.0 inches during the summer and 2.3 inches during the winter. Measurable precipitation with thunderstorms occurs about one out of every two days in the summer.

On an annual basis, prevailing winds in the area are primarily from the east and southeast, as shown on the wind rose for the area (**Figure 3.8-2**). A wind rose is a figure that depicts wind speeds and wind direction frequencies by compass direction. Although the prevailing winds are primarily easterly on an annual basis (wind directions are traditionally given as the direction from which the wind is blowing), they vary significantly throughout the year. Between December and February, the prevailing winds are from the northwest; between March and August, winds are predominantly from the southeast; and between September and November, prevailing winds are easterly.

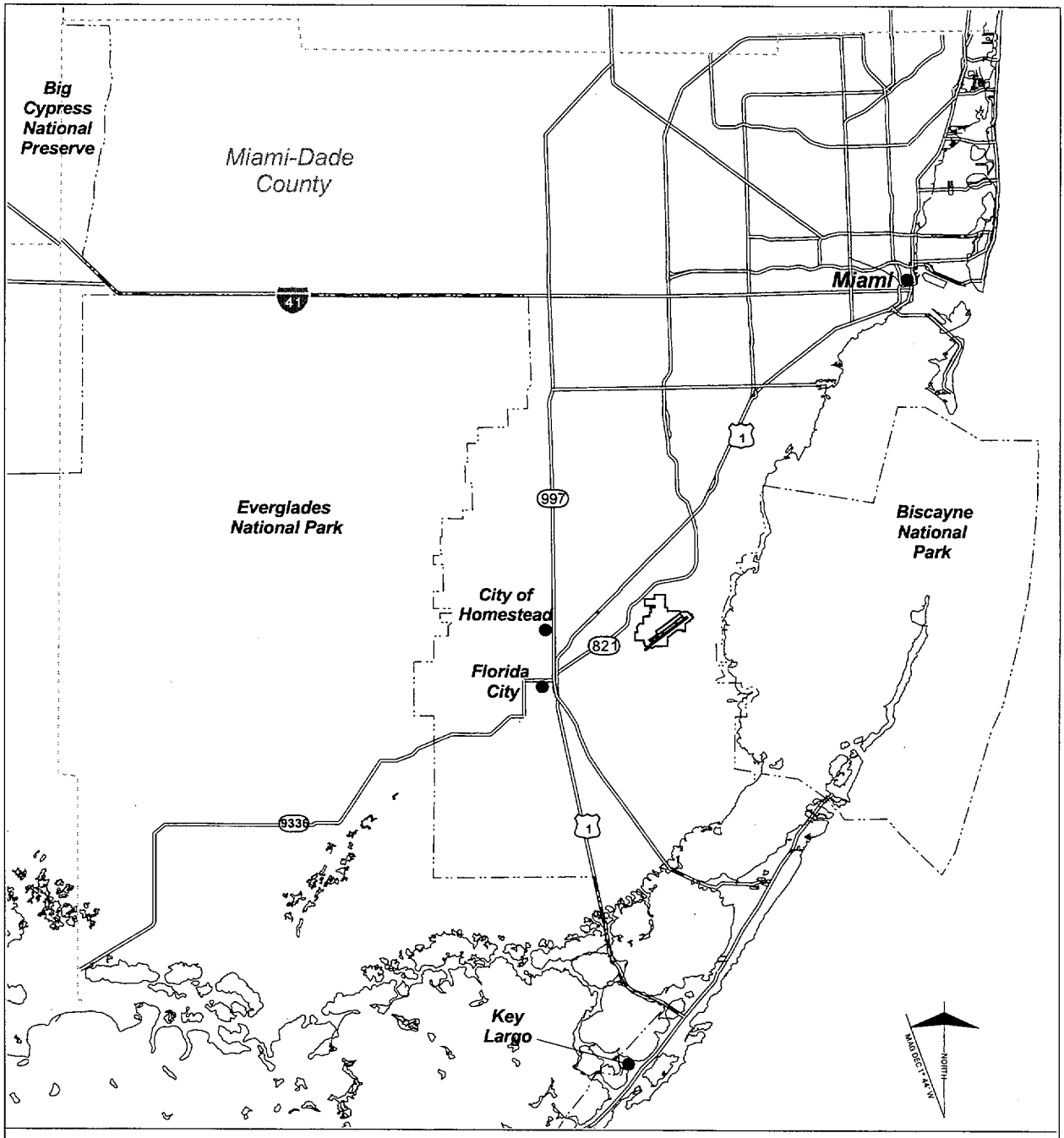
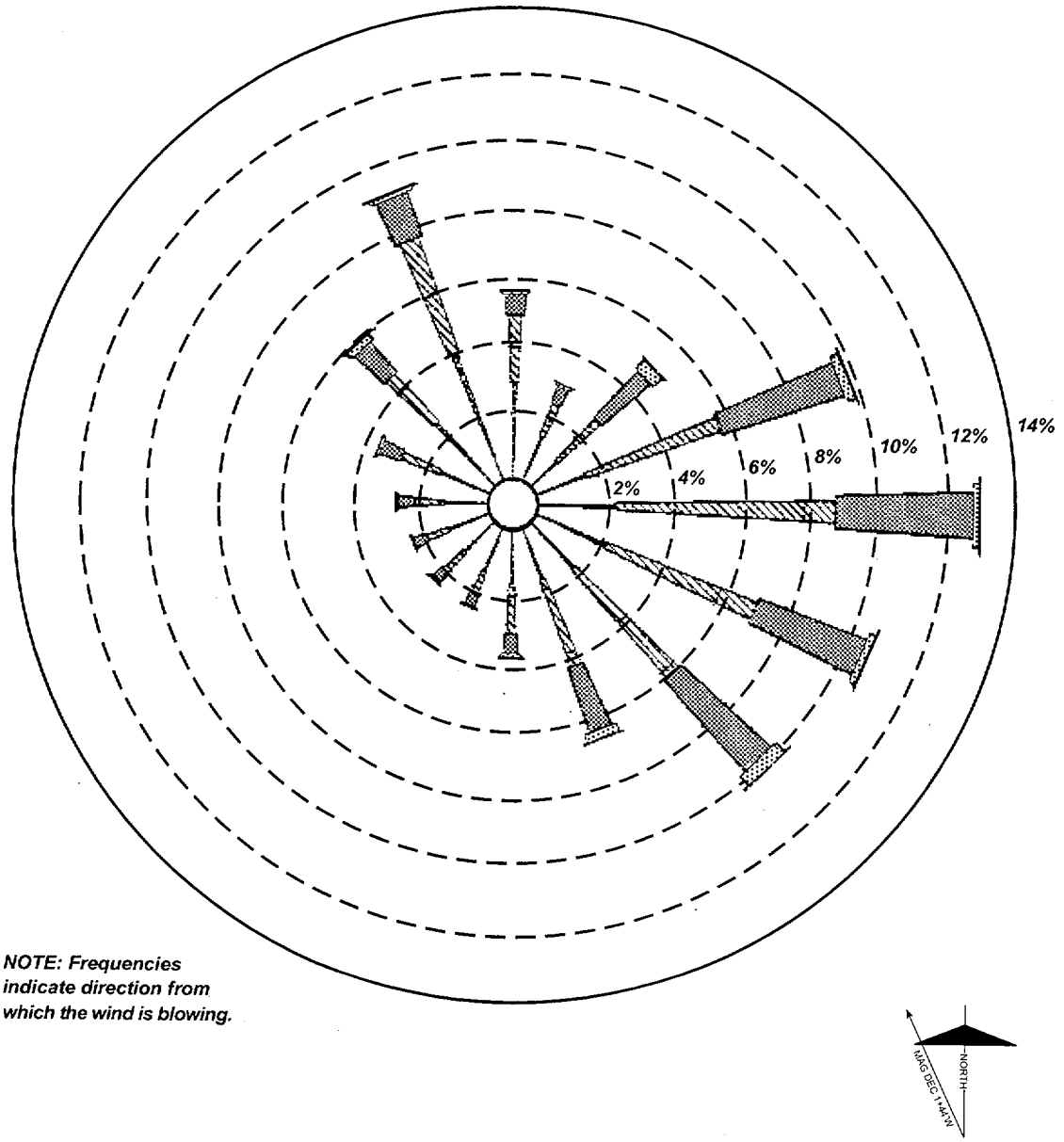


Figure 3.8-1
Region of Influence
for Air Quality



Source: USAF 1994a

Figure 3.8-2
Wind Rose for
Former Homestead AFB Area

Temperatures in the region are warm, but are moderated by the maritime influence of the Atlantic Ocean and Gulf of Mexico. Summer temperatures at Homestead AFB averaged 78 to 83°F, and winter temperatures average 67 to 75°F (**USAF 1990a**). Extreme temperatures are rare in the area; in over 50 years of record at the National Weather Service station at Miami International Airport, the temperature has ranged from 30 to 98°F.

Attainment Status

In general, air quality conditions in Miami-Dade County are good, and the county is currently designated as in attainment for all NAAQS (CO, NO_2, SO_2, PM_{10}, O_3, and lead). Miami-Dade County was reclassified in 1995 from an ozone nonattainment area to an ozone maintenance area.

As part of that reclassification process, Florida and Miami-Dade County developed an air quality maintenance plan that has become part of Florida's SIP. The maintenance plan includes individual emission "budgets" for ozone precursors (VOC and NO_x). Compliance with the ozone maintenance plan is determined on a county-by-county basis in southeastern Florida. USEPA will be classifying areas with respect to the new ozone and $PM_{2.5}$ NAAQS as monitoring data are collected and evaluated.

Air Quality Measurements

Miami-Dade County DERM operated a total of 19 monitors at 15 sites in 1991. The locations of the monitors are presented in **Figure 3.8-3**. As the figure shows, the monitors are sited at various locations to obtain representative air quality measurements in Miami-Dade County. The data collected between 1988 and 1991 are summarized in **Table 3.8-3**. The table shows that official exceedances of NAAQS were recorded for only one pollutant (ozone) during two of the four years (1988 and 1990). Further, the data show that Miami-Dade County was in compliance with all of the NAAQS during this period, including ozone[1]. Between 1989 and 1991, only one exceedance of the ozone standard was measured.

Recent air quality data (1995–1997) are summarized in **Table 3.8-4**. Miami-Dade County was in attainment for all NAAQS between 1995 and 1997. There were no exceedances of the ozone standard in those years.

There is also an air quality monitoring site in Everglades NP, which is shown on Figure 3.8-3. It does not collect the same type of data as the DERM sites. Certain information on ozone exposure was collected at the site between 1988 and 1991. The site primarily collects data on acid deposition. Data collected at the site on atmospheric deposition of nitrates are discussed in Section 3.8.4.

3.8.2.2 Projected Baseline Environment

Ambient air quality is expected to decline with the population growth forecast for the future. Air emissions, discussed in the following section, provide the most realistic projections of expected air quality through 2015.

[1] The ozone standard is met when there are no more than three exceedances of the ozone standard at a specific site over a consecutive 3 year period.

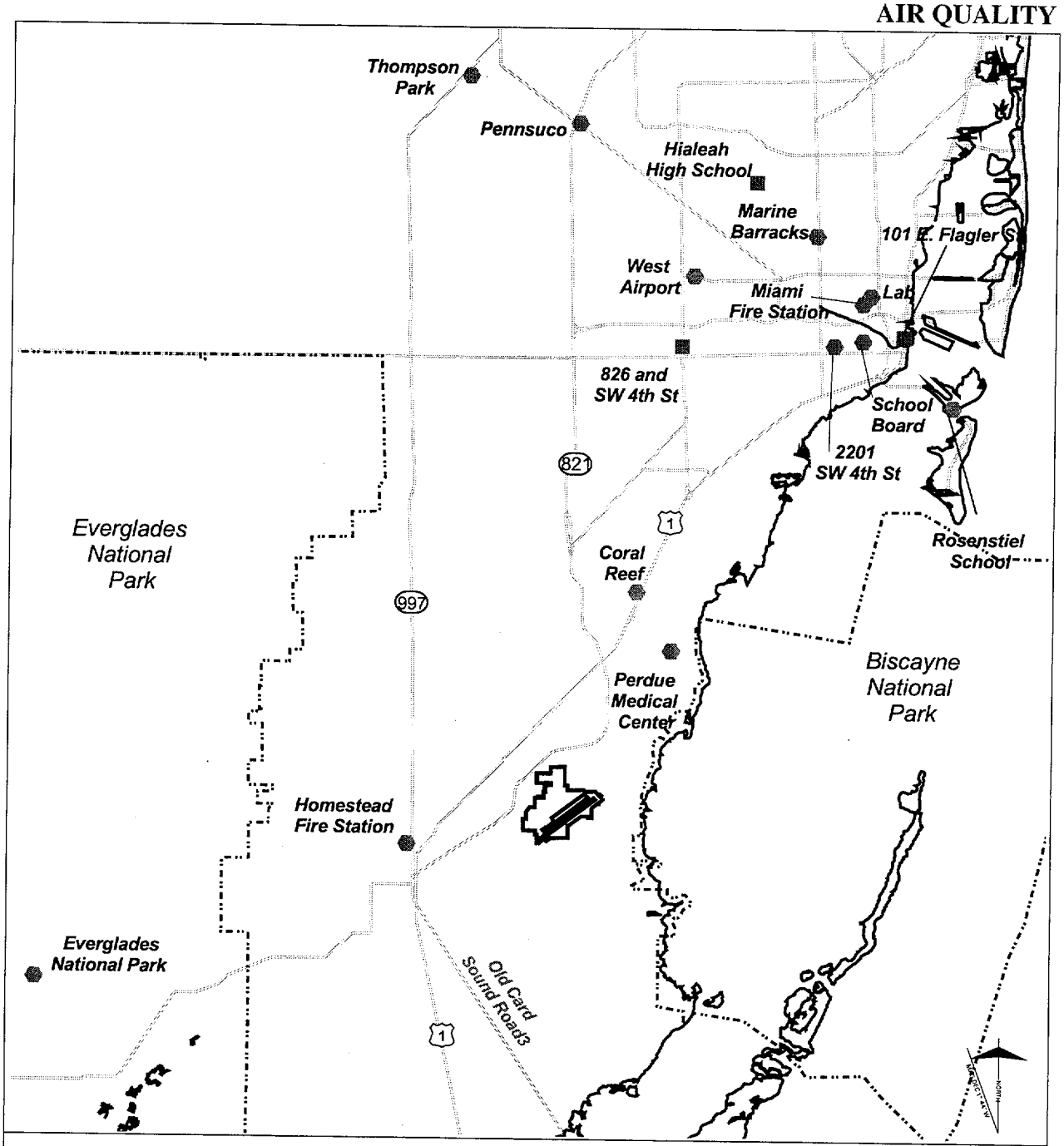


Figure 3.8-3
Ambient Air Quality Monitoring Network

Table 3.8-3. Ambient Air Quality in Miami-Dade County, 1988–1991

Pollutant	NAAQS	Florida Standards	Miami-Dade Standards	1988	1989	1990	1991
SO_2 Average annual reading	0.003 ppm[a] (80 µg/m^3)	0.02 ppm[a] (60 µg/m^3)	0.007 ppm[a] (25 µg/m^3)	0.0003 ppm	—[b]	0.00033 ppm	0.00089 ppm
CO Maximum 8 hour average	9 ppm[c] (10,000 µg/m^3)	9 ppm[c] (10,000 µg/m^3)	9 ppm[c] (10,000 µg/m^3)	9.0 ppm[d]	9.4 ppm[d]	9.3 ppm[d]	8.8 ppm
O_3 Number of days exceeding standard[g]	0.12 ppm (235 µg/m^3)	0.12 ppm (235 µg/m^3)	0.12 ppm (235 µg/m^3)	2	0	1	0
NO_2 Average annual reading	0.053 ppm[e] (100 µg/m^3)	0.053 ppm[a] (100 µg/m^3)	0.053 ppm[a] (100 µg/m^3)	0.0167 ppm	0.0178 ppm	0.0161 ppm	0.0150 ppm
Pb Maximum concentration Highest quarterly average	1.5 µg/m^3 [e]	1.5 µg/m^3 [e]	1.5 µg/m^3 [e]	0.1 µg/m^3	0.1 µg/m^3	0.00 µg/m^3	0.09 µg/m^3 0.00 µg/m^3
PM_{10} Annual arithmetic mean Maximum daily reading	50 µg/m^3 [a] 150 µg/m^3 [f]	50 µg/m^3 [a] 150 µg/m^3 [f]	50 µg/m^3 [a] 150 µg/m^3 [f]	32.1 µg/m^3 66 µg/m^3	30.3 µg/m^3 49 µg/m^3	30.6 µg/m^3 58 µg/m^3	29 µg/m^3 65 µg/m^3

Source: **USAF 1994a**.

Notes:
[a] Annual arithmetic average.
[b] Monitoring site not operational pending Florida Department of Environmental Protection decision.
[c] 8 hour arithmetic mean.
[d] Although 9.0 ppm is the official exceedance value, until a value equals or exceeds 9.5 ppm, it is not considered an official exceedance.
[e] Quarterly arithmetic mean.
[f] 24 hour arithmetic average.
[g] Number of days with exceedances greater than 0.124 ppm.

µg/m^3 micrograms per cubic meter
NAAQS National Ambient Air Quality Standards
ppm parts per million

Table 3.8-4. Ambient Air Quality in Miami-Dade County, 1995–1997

Pollutant	NAAQS	Florida Standards	Miami-Dade Standards	1995	1996	1997
SO_2 Average annual reading	0.003 ppm[a] (80 µg/m^3)	0.02 ppm[a] (60 µg/m^3)	0.007 ppm[a] (25 µg/m^3)	0.0016 ppm	0.00099 ppm	0.00107 ppm
CO Maximum 8 hour average	9 ppm[b] (10,000 µg/m^3)	9 ppm[b] (10,000 µg/m^3)	9 ppm[b] (10,000 µg/m^3)	7.0 ppm	8.7 ppm	4.4 ppm
O_3 Maximum annual reading Number of days exceeding standard[c]	0.12 ppm (235 µg/m^3)	0.12 ppm (235 µg/m^3)	0.12 ppm (235 µg/m^3)	0.111 ppm 0	0.123 ppm 0	0.117 ppm 0
NO_2 Average annual reading	0.053 ppm[d] (100 µg/m^3)	0.053 ppm[a] (100 µg/m^3)	0.053 ppm[a] 100 µg/m^3)	0.015 ppm	0.016 ppm	0.016 ppm
Pb Highest quarterly average	1.5 µg/m^3 [d]	1.5 µg/m^3 [d]	1.5 µg/m^3 [d]	0.0 µg/m^3	0.0 µg/m^3	[e]
PM_{10} Annual arithmetic mean Maximum daily reading	50 µg/m^3 [a] 150 µg/m^3 [f]	50 µg/m^3 [a] 150 µg/m^3 [f]	50 µg/m^3 [a] 150 µg/m^3 [f]	29.1 µg/m^3 86 µg/m^3	28.4 µg/m^3 88 µg/m^3	26.2 µg/m^3 71 µg/m^3

Source: **Dade County 1996, 1997, 1998.**

Notes:
[a] Annual arithmetic average.
[b] 8 hour arithmetic mean.
[c] Number of days with exceedances greater than 0.124 ppm.
[d] Quarterly arithmetic mean.
[e] Lead monitoring sites were closed on October 31, 1996.
[f] 24 hour arithmetic average.

µg/m^3 micrograms per cubic meter
NAAQS National Ambient Air Quality Standards
ppm parts per million

3.8.3 Air Emissions

Available data on air emissions are generally limited to criteria pollutants that have NAAQS. This section focuses on those pollutants. NPS has expressed concern about the generation of polycyclic aromatic hydrocarbons, and these compounds are also discussed in this section.

3.8.3.1 Existing Environment

Criteria Pollutants

FDEP developed a 1990 emissions inventory for Miami-Dade County as part of the air quality maintenance plan for Southeast Florida in the Florida SIP (**Table 3.8-5**). This emissions inventory is closest in time to the 1988 emissions inventory for Homestead AFB (**Table 3.8-6**). The air quality focus in Miami-Dade County has largely been on ozone (since the county was classified as nonattainment for ozone until 1995); therefore, the emissions inventory presented in Table 3.8-5 is only available for VOCs and NO_x emissions.

Table 3.8-5. Air Emissions Inventory for Miami-Dade County, 1990

Emissions Source	VOC (tons/year)	NO_x (tons/year)
Stationary Point	5,198	17,250
Stationary Area	57,889	2,179
Non-Road Mobile	23,758	17,491
Biogenic[1]	56,535	0
On-Road Mobile	57,159	42,961
Total Emissions	**200,539**	**79,881**

Source: Florida Title 62, Chapter 62-204.
Note: [1] Biogenic emissions are emissions from natural sources.

Table 3.8-5 shows that there are three source groups that contribute most of the VOC emissions in Miami-Dade County in nearly equal amounts: stationary area sources, on-road mobile sources, and biogenic sources. The majority of the NO_x emissions are due to on-road mobile sources.

Table 3.8-6. Air Emissions Inventory for Homestead AFB, 1988

Emissions Source	VOC (tons/year)	NO_x (tons/year)	CO (tons/year)	SO_2 (tons/year)	PM_{10} (tons/year)
Stationary Sources	150	58	29	4	7
Mobile sources	332	580	1,489	58	55
Total Emissions	**482**	**638**	**1,518**	**62**	**62**

Source: **USAF 1994a.**

A comparison of the emissions from Homestead AFB (1988) and Miami-Dade County (1990) shows that Homestead AFB contributed less than 1 percent of the VOC and NO_x emissions in Miami-Dade County in the late 1980s and early 1990s. This inventory shows that the overall level of air emissions from

Homestead AFB were low, and that mobile sources contributed most of the VOC, NO_x, and CO emissions.

FDEP has also calculated the 1997 emissions inventory for Miami-Dade County in the Florida SIP. This emissions inventory again focused on VOC and NO_x emissions. The 1997 emissions inventory for Miami-Dade County, derived from the Florida SIP, is presented in **Table 3.8-7**.

Table 3.8-7. Air Emissions Inventory and Emission Budgets for Miami-Dade County, 1997

Emissions Source	VOC (tons/year)	NO_x (tons/year)
Stationary Point	4,077	11,669
Stationary Area	40,515	2,292
Non-Road Mobile	25,543	18,575
Biogenic	56,535	0
On-Road Mobile	32,445	39,059
Total Emissions	**159,115**	**71,595**
***On-Road Mobile Emissions Budget*[1]**	***54,301***	***40,814***

Source: Florida Title 62, Chapter 62-204.
Note: [1] Applies to on-road mobile emissions only.

Two elements have been added to the 1997 emissions inventory in Table 3.8-7: "Motor Vehicles Emissions Budget" and "Total with Motor Vehicles Emissions Budget." The motor vehicles emissions budget is the emissions cap on VOC and NO_x emissions in Miami-Dade County, set at 95 percent of the 1990 VOC and NO_x on-road mobile emissions in the county. This emissions budget was developed as part of the redesignation of Miami-Dade County to an ozone maintenance area. The approach taken to ensure that Miami-Dade County would continue to meet the ozone NAAQS was to limit future VOC and NO_x emissions to the 1990 level (when there were no ozone violations), with a further 5 percent reduction as a safety factor.

The reason that emission budgets were assigned to motor vehicle emissions was twofold. First, motor vehicles contribute a significant part of the VOC and NO_x emissions in Miami-Dade County (more than 50 percent for NO_x, as shown in Table 3.8-7). Second, they are the source with the greatest potential for future emissions growth, due to increased population, increased number of vehicles, and increased vehicle miles traveled. Table 3.8-7 also provides a budget for total emissions, but the control emphasis is on the motor vehicles emission budget.

The 1997 on-road mobile VOC emissions dropped by 43 percent from the 1990 level and were well below the motor vehicle emissions budget for VOCs shown in Table 3.8-7. However, the 1997 on-road mobile NO_x emissions decreased from 1990 levels by only 9 percent, and because of the 5 percent safety factor, were only slightly below the corresponding NO_x motor vehicles emissions budget.

The basic problem in reducing the total emissions from motor vehicles is that the reduction in emissions per mile from cleaner-running individual vehicles is at least partly offset by an increase in total vehicle miles traveled in the area. Motor vehicle emission control systems have made significant gains during the 1990s in controlling VOC emissions but have made less progress in controlling NO_x emissions.

A 1997 air emissions inventory developed for Homestead ARS (**AFRC 1998a**) is summarized in **Table 3.8-8.** The mobile sources emissions for this inventory are based on an analysis of aircraft operation plus other mobile emissions determined by the ratio of aircraft emissions to other mobile sources emissions derived from 1988 emission inventory at Homestead AFB.

Table 3.8-8. Air Emissions Inventory for Homestead ARS, 1997

Emissions Source	VOC (tons/year)	NO_x (tons/year)	CO (tons/year)	SO_2 (tons/year)	PM_{10} (tons/year)
Stationary Sources	4	11	11	4	4
Mobile Sources	47	135	358	7	4
Total Emissions	**51**	**146**	**369**	**11**	**8**

Source: **AFRC 1998a**.

Air emissions from stationary sources at Homestead ARS decreased between 1988 and 1997 due to the closure of Homestead AFB and reduction in military aircraft operations. Homestead ARS contributed an extremely small part of the air emissions in Miami-Dade County during 1997.

Polycyclic Aromatic Hydrocarbons

PAHs are organic compounds that are contained in certain petroleum products and are generated by the combustion of petroleum products. They occur in airborne emissions as very small particles from mobile sources (aircraft, automobiles, and trucks) and industrial processes that use petroleum products as fuels. Even though they are toxic to biota at very low concentrations, there is little quantitative information about their generation rates by vehicles and their dispersal, especially in atmospheric environments.

It is reasonable to assume that operations at former Homestead AFB over a number of years has contributed to the deposition of PAHs on nearby soils and in drainage canals. While the source of these materials may include base operations, the relative contribution of various sources of PAHs to concentrations in soils and sediments is not known.

3.8.3.2 Projected Baseline Environment

FDEP has projected emissions rates for 2000, 2005, and 2015 (motor vehicles only). These emissions projections are presented in **Table 3.8-9**. Table 3.8-9 shows that the projected mobile source emissions of VOCs in 2000, 2005, and 2015 are well below the emissions budget (approximately 28,000 tons/year compared to a budget of 54,000 tons/year). However, projected mobile source emissions of NO_x are relatively close to the emissions budget. This is particularly true in 2015, when the estimated emissions are projected to be less than 3,000 tons/year below the mobile source emissions budget.

These emissions are based on vehicle miles traveled, and it appears that the increases in vehicle miles traveled are more consistent with Miami-Dade County's high population growth forecasts than with the moderate growth forecasts used for estimating projected baselines in this SEIS. Therefore, the projected baseline increases in emissions are probably overstated.

Table 3.8-9. Projected Air Emissions Inventory and Emissions Budget for Miami-Dade County

Emissions Source	2000 (tons/year)		2005 (tons/year)		2015 (tons/year)	
	VOCs	NO_x	VOCs	NO_x	VOCs	NO_x
Stationary Point	2,953	11,673	3,135	11,680	NA	NA
Stationary Area	40,851	2,347	39,121	2,427	NA	NA
Non-Road Mobile	26,630	19,341	28,419	20,630	NA	NA
Biogenic	56,535	0	56,535	0	NA	NA
On-Road Mobile	28,127	39,654	27,280	37,712	30,021	37,588
Total Emissions	**155,096**	**73,015**	**154,490**	**72,449**	**NA**	**NA**
***On-Road Mobile Emissions Budget*[1]**	***54,301***	***40,814***	***54,301***	***40,814***	***54,301***	***40,814***

Source: Florida Title 62, Chapter 62-204; Florida Department of Environmental Protection.
Note: [1] Applies to on-road mobile emissions only.
NA not available

Conversations with FDEP staff (**McElveen 1998, Offord 1998**) indicate that there are two areas in which future NO_x emissions from mobile sources may be reduced. These areas include USEPA-mandated NO_x controls on the heavy-duty diesel engines used on trucks, scheduled for implementation in 2004, and low-sulfur gasoline, which reduces the contamination of catalytic converters in motor vehicles and allows them to control NO_x emissions more efficiently. FDEP is currently evaluating these options and their effect on future projections of NO_x emissions from mobile sources.

3.8.4 Areas of Special Concern

3.8.4.1 Existing Environment

There are two areas which have special air quality concerns near former Homestead AFB: Everglades NP, a Class I area, and Biscayne NP, a Class II area.

Everglades National Park

The nearest Class I area to former Homestead AFB is Everglades NP, the eastern boundary of which is about 10 miles west of the former base. Everglades NP was designated a Class I area in the 1977 CAA Amendments. The CAA provides additional air quality protection for Class I areas such as Everglades NP from major new stationary emission sources, as well as from existing stationary sources undergoing major modifications. One of these provisions is the Class I increments that allow only minor increases of pollutants in Class I areas from stationary sources. In addition, the CAA charges federal land managers (i.e., NPS) of Class I areas with an affirmative responsibility to protect air quality related values (AQRV) of these areas and to evaluate whether stationary sources from a proposed major emitting facility will have an adverse impact on such values. According to NPS, AQRVs are "values including visibility, flora, fauna, cultural and historical resources, odor, soil, water, and virtually all resources dependent upon and affected by air quality" (**NPS 1996a**). The NPS Organic Act requires NPS to protect resources at all NPS areas, regardless of AQRV status.

NPS has conducted an AQRV analysis for Everglades NP (**NPS 1993**). The principal AQRV concerns listed by NPS were visibility and two sensitive plant species. Two "integral vistas" (scenic views) were identified in the park (along the Main Park Road and at the Shark Valley Tower).

NPS monitors a number of air quality parameters in Everglades NP, including visibility, acid deposition, and ozone, and has defined the 90th percentile site-specific standard visual range and average ozone concentrations on a seasonal basis for the park for use in conducting a visibility analysis (**Table 3.8-10**). Those values are used to protect the most sensitive visual resources (those days with the best visibility).

Table 3.8-10. Seasonal Ozone Concentrations and Standard Visual Range for Everglades NP

Season	Ozone Concentration (ppm)	90th Percentile Standard Visual Range (km)
Winter	0.045	43
Spring	0.061	47
Summer	0.040	59
Fall	0.047	63

Source: **Florida Administration Commission 1998.**
km kilometers
ppm parts per million

NPS has preliminarily identified two plants in the park reported to be sensitive to specific air pollutants: South Florida Slash Pine (sensitive to SO_2) and Carolina Ash (sensitive to O_3). In addition to the direct effects on AQRVs, NPS is concerned about potential indirect effects on plants and animals due to pollution, such as habitat alteration and changes in food supply.

NPS operates a National Atmospheric Deposition Program acid deposition monitoring station at Everglades NP, one of five stations in the state of Florida. The annual average measured atmospheric deposition rate of nitrates at Everglades NP over the 1994–1998 period was 7.08 kilograms/hectare (**NADP 1998**).

Biscayne National Park

Regulatory protection of AQRVs is less for Class II areas such as Biscayne NP, which is located about 1.5 miles east of former Homestead AFB. However, NPS has identified nitrogen loading into Biscayne Bay from all sources (surface water, groundwater, and air) as an ecological concern for the park. The measurements collected by the National Atmospheric Deposition Program in Everglades NP provide an estimate of current levels of nitrate deposition rates in the area. Although there may be localized variations in deposition, these data are the best information available and are assumed to be generally representative of nitrogen deposition rates in Biscayne NP.

3.8.4.2 Projected Baseline Environment

The limit on increased air emissions in Miami-Dade County imposed by the air emissions budget (part of the ozone air maintenance plan) means that the projected baseline air quality in these areas of special concern is not expected to change significantly from current conditions.

3.9 EARTH RESOURCES

This section describes earth resources, including geology and soils.

3.9.1 Introduction

3.9.1.1 Resource Definition

Geologic resources include mineral deposits, significant landforms, tectonic features, and paleontologic remains, all of which can have scientific, historical, economic, and recreational value. Geology refers to the natural physiographic and geologic features that characterize, and are unique to, the geologic setting of southern Florida, with an emphasis on the top 200 feet of the earth's surface. Soils are the unconsolidated material and organic material at the ground surface in which plants grow.

3.9.1.2 Applicable Laws and Regulations

The following are summaries of federal and state laws and regulations that apply to earth resources.

Federal Agriculture Improvement and Reform Act of 1996 (P.L. 104-494). This act includes the Farmland Protection Program, which provides funds in some locations to purchase development rights to keep productive farmland in use. It includes the Everglades program to purchase land as a means of improving the Everglades. It also includes the Environmental Quality Incentives Program, the Conservation of Private Grazing Land Initiative, Conservation Reserve Program, Wetlands Reserve Program, and the Wildlife Habitat Incentives Program, all of which deal with conservation and erosion control.

Farmland Protection Policy Act (7 U.S.C. 73). Under this act, federal agencies are required to identify effects of federal programs on conversion of farmland to nonagricultural uses.

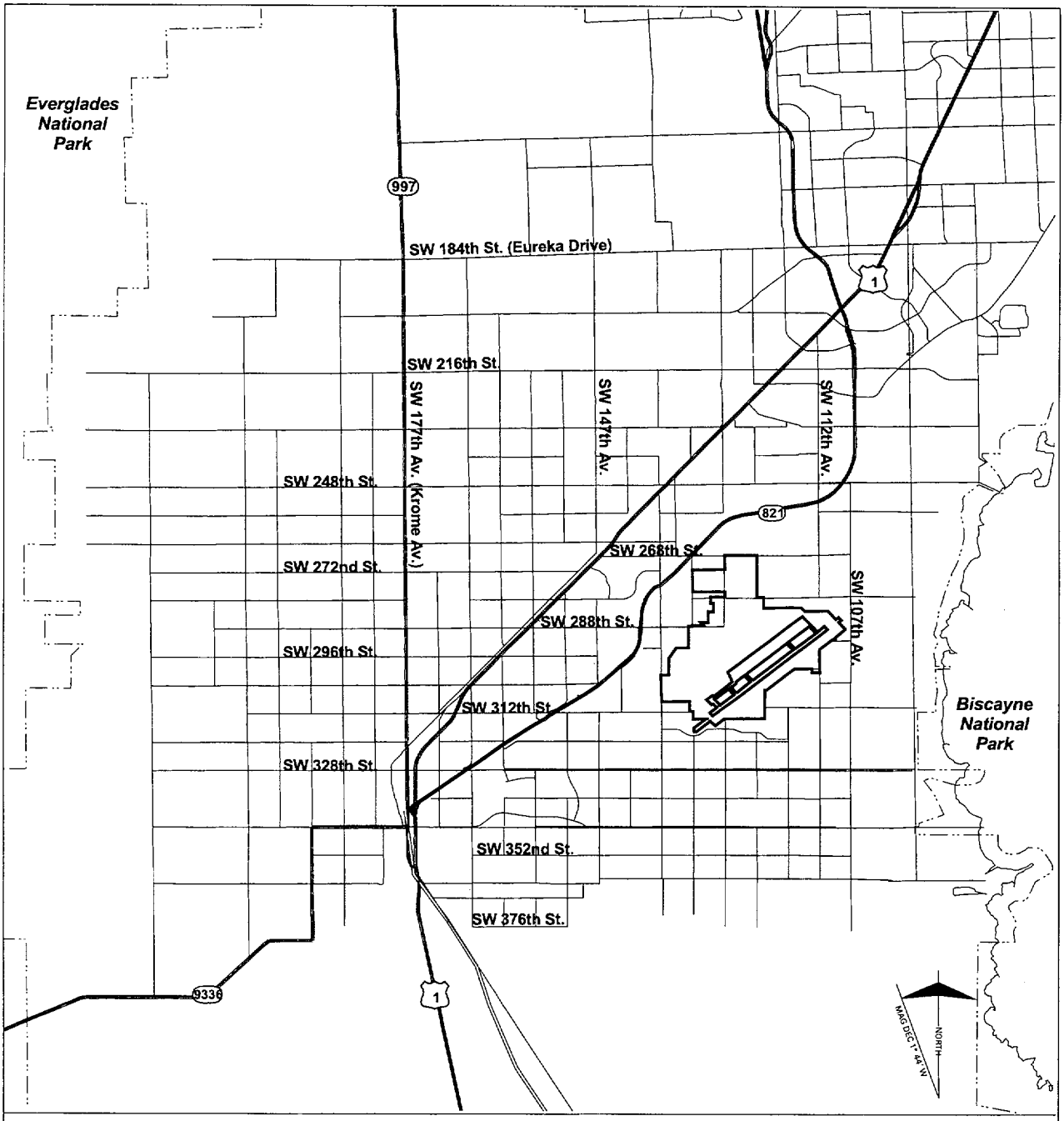
Soil Conservation Act (16 U.S.C. 3b). This act defines the policy of Congress to permanently provide for the control and prevention of soil erosion, thus preserving natural resources.

Mineral Lands and Mining (30 U.S.C.). This statute provides criteria for regulation and protection of mineral resources.

Part IV of Chapter 40E-1, Florida Administrative Code (FAC) covers Environmental Resource Permits as part of the Rules of the South Florida Water Management District. This regulation governs activities that have the potential to be detrimental to drainage, flood control, water conservation, erosion control, soil conservation, or fish and wildlife habitat preservation. It requires that people conducting earth disturbing activities implement measures for erosion and pollution control by using best management practices, and that all activities be conducted in a manner which does not cause violations of state water quality standards.

3.9.1.3 Region of Influence

The ROI for earth resources (**Figure 3.9-1**) includes former Homestead AFB and the surrounding lands that may be affected by the disposal and subsequent reuse of former Homestead AFB property, including secondary development. The ROI for geology and soils encompasses south Miami-Dade County, from Eureka Drive south to SW 376th Street, west to SW 177th Avenue, and east to Biscayne National Park.



LEGEND

- Former Homestead AFB
- National Park Boundary
- Street
- Major Road
- U.S. Highway
- State Highway

2 0 2
Scale in Miles

Source: SAIC

Figure 3.9-1
Region of Influence
for Earth Resources

3.9.2 Geology

3.9.2.1 Existing Environment

The ROI is located in the southern extension of the Atlantic Coastal Ridge (Miami Ridge) physiographic province. The Miami Ridge is bounded to the west by the Everglades Trough physiographic province and to the south and east by the Southern Slope physiographic province. The Silver Bluff Scarp, a wave-cut cliff directly east of the former base, has formed along the southeast edge of the ridge during periods of higher sea levels (**USDA 1996**).

Cycles of sediment deposition and erosion occurred in Florida in response to sea-level changes throughout the Cenozoic era (the last 65 million years). Florida's Cenozoic-aged sediments were deposited in two major periods: the Paleogene and Neogene. During these two periods, carbonate sediments, mostly made up of whole or broken shells, formed in southern Florida. Up to 11,800 feet of carbonate rock underlies much of southern Florida. These deposits include very little siliciclastic sediment (quartz sands, silts, and clays). Rock-forming sediments of southern Florida are dominated by limestone and dolostone (**Florida Geological Survey 1998**).

Stratigraphy

Figure 3.9-2 displays the stratigraphic units described in this section and is generally representative of the area. The lowest relevant rock formation is the Hawthorn Group, of Miocene age, that attains a thickness of more than 900 feet. This group consists of interbedded sand, silt, clay, dolostone, and limestone. The Tamiami Formation, of late Miocene to early Pliocene age, forms the top of this group. It consists of sand and clay and forms the base of the Biscayne (shallow) Aquifer. The upper part of the group acts as a confining unit for the Floridan (deep) Aquifer (**USDA 1996**).

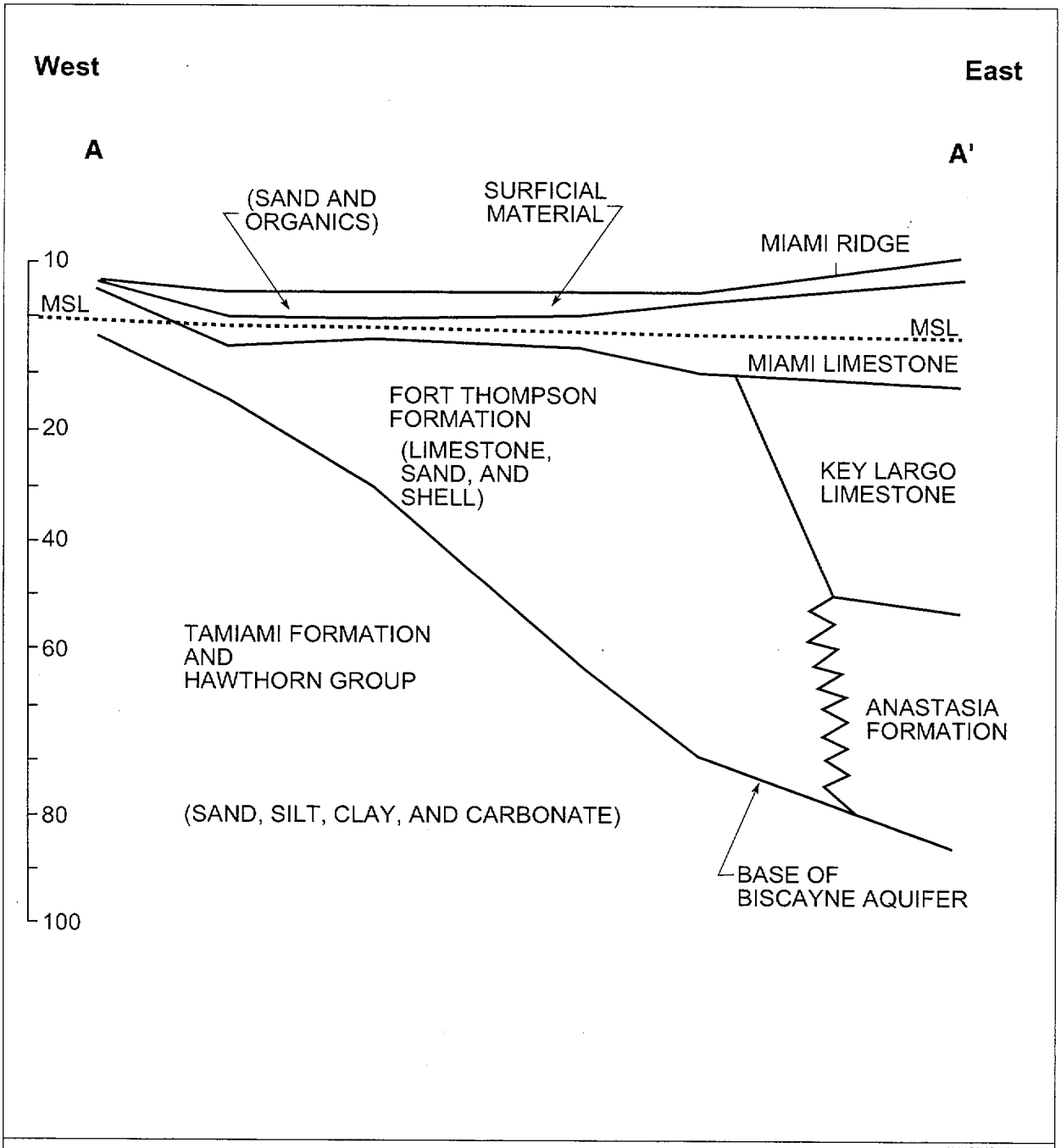
The Fort Thompson Formation, of Pleistocene age and approximately 40 to 70 feet thick, consists of interbedded limestone, sand, and shells. The Fort Thompson Formation is one of the most productive water units within the Biscayne Aquifer. To the east of the Fort Thompson Formation, along the Atlantic Coast, is the Anastasia Formation, also of Pleistocene age. This formation consists of a sandy, shelly limestone up to 120 feet thick and also forms a major part of the Biscayne Aquifer along the coastal areas (**USDA 1996**).

The Key Largo Limestone merges laterally with the Anastasia Formation. It consists of hard limestone and is derived from coral, algae, and shells, with a thickness as great as 60 feet. The Key Largo Limestone is exposed throughout the upper keys, but generally is below the surface in the vicinity of former Homestead AFB (**USDA 1996**).

Miami Limestone is the surface formation in south Miami-Dade County, generally overlain by a thin layer of soil. It is a soft, light cream to dark gray, oolitic limestone, generally less than 40 feet thick. It is of Pleistocene age and has become very porous and permeable through dissolution by recharging groundwater. The Miami Limestone is also considered a part of the Biscayne Aquifer (**USDA 1996**).

Mineral Resources

According to a recent map available from the Florida Geological Survey (**USGS 1998**), crushed stone is the primary geologic resource of economic value in the ROI. The major source is Miami limestone.



Source: USDA 1996

Figure 3.9-2
Cross Sectional Area,
South Miami-Dade County Stratigraphy

Significant Landforms

The Miami Ridge is the most significant landform in south Miami-Dade County. The ridge runs in a north-south direction parallel to the Atlantic coast. It is the highest structure in the area, with elevations of up to 10 feet above MSL.

Karst landforms are a common feature of Florida's landscape. They appear as sinkholes, caves, disappearing streams, springs, and underground drainage systems. However, based on the hydrogeologic setting of the area in and around former Homestead AFB, the potential for karst landforms is minimal. Only a few sinkholes are present in the area, and when they are present, they are generally shallow, wide, and develop slowly (**Florida Geological Survey 1998**).

Tectonic Features

The potential for seismic activity in the ROI is negligible. Based on studies published in the Florida Geological Survey (**Lane 1991**), former Homestead AFB is in an area with no reasonable expectation for seismic activity.

Paleontological Resources

The potential for paleontological resources is limited in the area around the former base. Fossil shells and shell fragments are an abundant feature associated with the limestone formations, but no significant paleontological findings have occurred in the ROI (**Rupert 1989**).

3.9.2.2 Projected Baseline Environment

Geological resources in the ROI will remain the same during the analysis periods for this SEIS.

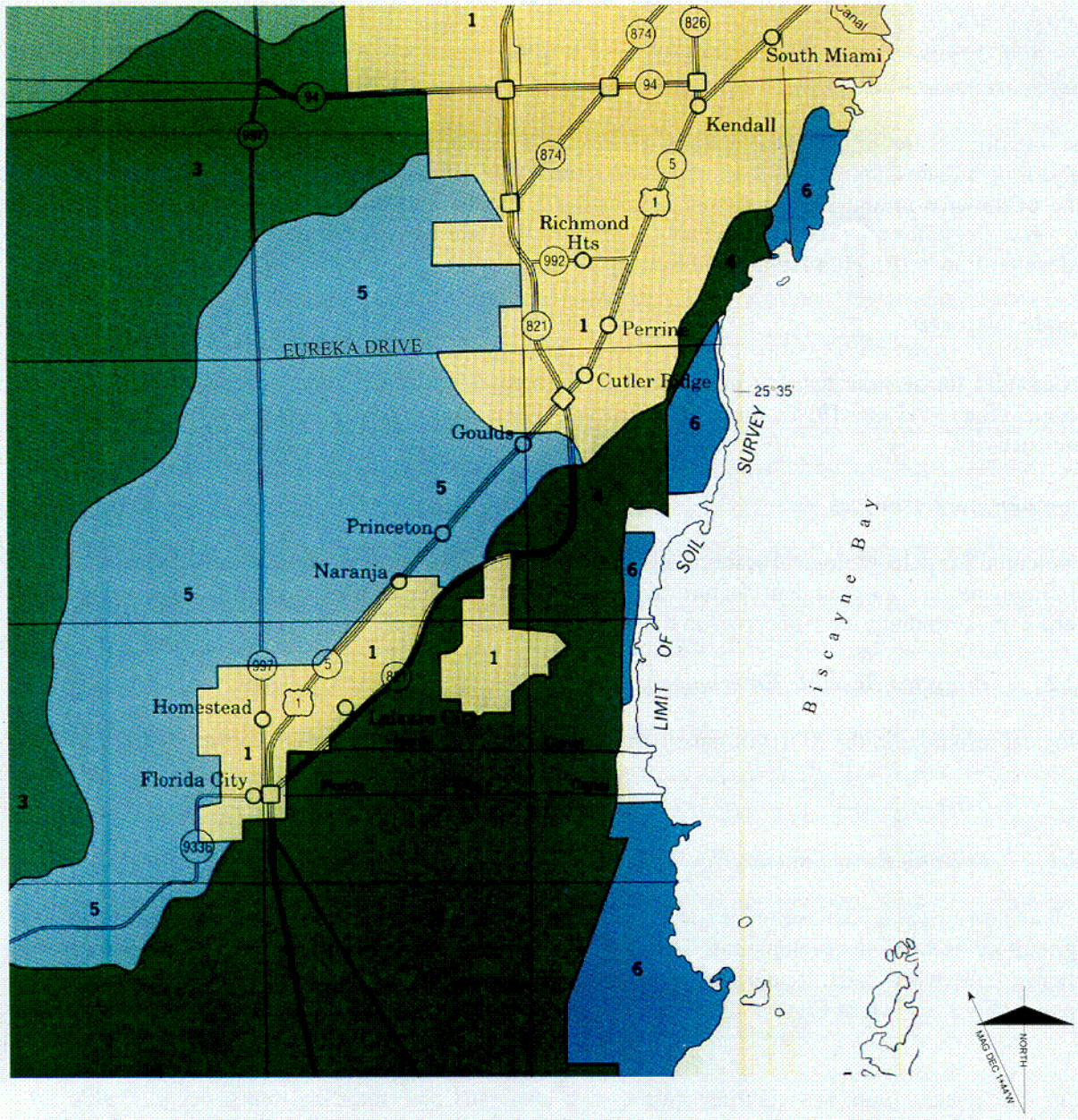
3.9.3 Soils

3.9.3.1 Existing Environment

The characteristics and distribution of soil types in the ROI affect the location of important land uses such as agriculture and urban development. There are five general soil associations in the ROI, each having distinctive patterns of soils, topography, and drainage, named for the dominant soils in the area. These soil associations, shown in **Figure 3.9-3**, can be used to compare the suitability of soils for different land uses.

Within the general soil associations, twenty-two different soil mapping units occur. **Table 3.9-1** summarizes some of the important characteristics of these soil mapping units existing within the general soil associations. **Figure 3.9-4** illustrates the detailed soil mapping units on and near former Homestead AFB.

The soil association for developed areas is Urban Land-Udorthents Association. This consists of soils that have been disturbed by construction and areas covered by streets, sidewalks, and structures that prevent classification of the underlying soils. It includes topography that ranges from nearly level to very steep, moderately well-drained to well-drained soils, often with stony fill material that is eight inches to over 80 inches thick above limestone bedrock. Soil mapping units, other than Udorthents and Urban land, that occur within this association include drained Biscayne gravelly marl and Biscayne marl, Krome very gravelly loam, and Cardsound-Rock outcrop complex (**USDA 1996**).



LEGEND

1 Urban Land—Udorthents Association
3 Rock Outcrop—Biscayne—Chekika Association
4 Perrine—Biscayne—Pennsuco Association
5 Krome Association
6 Perrine—Terra Ceia—Pennsuco Association

Figure 3.9-3
General Soil Map of the ROI

L-1

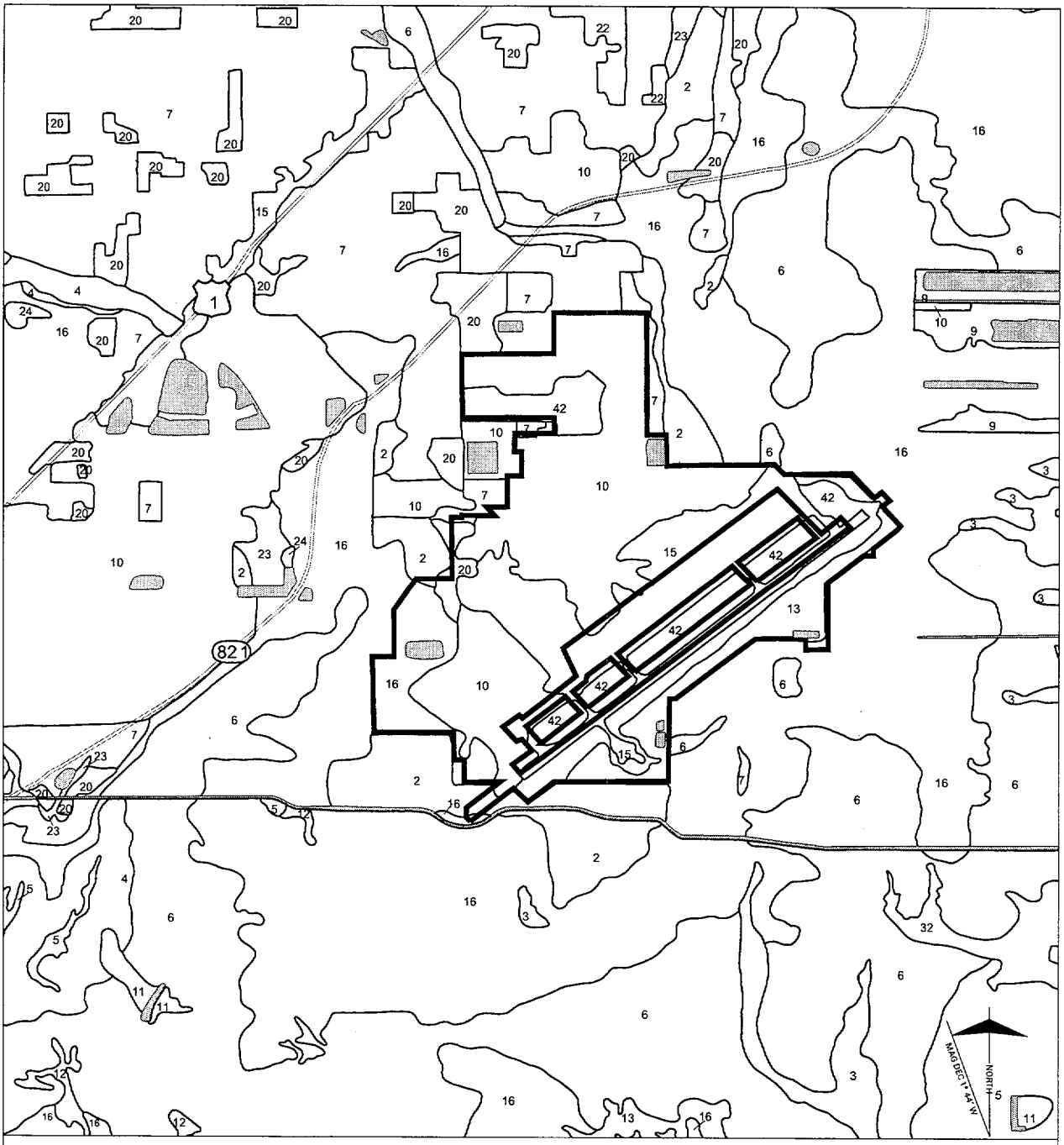
Table 3.9-1. Characteristics of Soils in the ROI

Soil Map Symbol[1]	Soil Mapping Unit	Permeability[2]	Depth to Apparent High Water Table (feet)[3]	Available Water Capacity[4]	Wind Erosion Potential[5]	Water Erosion Potential[6]	Land Capability Class[7]	Building Site Suitability[8]
2	Biscayne gravelly marl, drained	Moderate	0–1	Moderate to high	Very low	Moderate	3	Severe
3	Lauderhill muck, depressional	Rapid	+2–0	High	Very high	NA	7	Severe
4	Pennsuco marl, drained	Moderately slow	0–1	High	Moderate	Moderate	3	Severe
5	Pennsuco marl	Moderately slow	0–1	High	Moderate	Moderate	3	Severe
6	Perrine marl, drained	Moderately slow	1	High	Moderate	Moderate	3	Severe
7	Krome very gravelly loam	Moderate	4–5	Moderate	Very low	Low	5	Severe
9	Udorthents–Water complex	Moderate	NA	NA	NA	NA	NA	NA
10	Udorthents, limestone substratum–Urban land complex	Moderate	NA	NA	NA	NA	NA	NA
11	Udorthents, marl substratum–Urban land complex	Moderately slow	NA	NA	NA	NA	NA	NA
12	Perrine marl	Moderately slow	+1–1	High	Moderate	Moderate	7	Severe
13	Biscayne marl	Moderate	0–1	High	Moderate	Moderate	7	Severe
15	Urban land	NA	NA	NA	NA	NA	NA	NA
16	Biscayne marl, drained	Moderate	0–1	High	Moderate	Moderate	3	Severe
20	Cardsound-Rock outcrop complex	Moderately slow	5–6	High	Moderate	Moderate	4	Severe
22	Opalocka-Rock outcrop complex	Very Rapid	5–6	Very low	Extremely high	Low	6	Severe
23	Chekika very gravelly loam	Moderate	1–3	Moderate	Moderate	Low	3	Severe
24	Matecumbe muck	Rapid	1.5–3	High	Low	NA	7	Severe
25	Biscayne-Rock outcrop complex	Moderate	0–1	High	Moderate	Moderate	4	Severe
26	Perrine marl, tidal	Moderately slow	0–1	High	Moderate	Moderate	8	Severe
31	Pennsuco marl, tidal	Moderately slow	0–0.5	High	Moderate	Moderate	7	Severe
32	Terra Ceia muck, tidal	Rapid	0–0.5	High	Very high	NA	8	Severe
42	Udorthents, limestone substratum, 0 to 5 percent slopes	Rapid	NA	NA	NA	NA	NA	NA

Source: **USDA 1996**.

Notes:
[1] Soil Map Symbol refers to the number and soil type classification on Figure 3.9-4 and in the soil survey of Miami-Dade County Area, Florida.
[2] Rate of flow of water through saturated soil.
[3] Measured in feet from the surface to the seasonal highest level of a.saturated zone in the soil in most years.
[4] Capacity of soils to hold water.
[5] Susceptibility of soils to wind erosion.
[6] Susceptibility of soils to water erosion.
[7] An indicator of the suitability of soils for use as cropland, with 1 being the most suitable and 8 having the most limitations. Classes 1 through 5 can be used for crop production with increasing limitations to overcome.
[8] Indicates the limitations of the soil as a site for buildings, sanitary facilities, and roads.

NA Data not available or not applicable



LEGEND

Soil Types
2 Biscayne gravelly marl, drained
3 Lauderhill muck, depressional
4 Pennsuco marl, drained
5 Pennsuco marl
6 Perrine marl, drained
7 Krome very gravelly loam
9 Udorthents-water complex
10 Udorthents, limestone substratum-urban land complex
11 Udorthents, marl substratum-urban land complex
12 Perrine marl
13 Biscayne marl
15 Urban land
16 Biscayne marl, drained
20 Cardsound silty clay loam-rock outcrop complex
22 Opalocka sand-rock outcrop complex
23 Chekika very gravelly loam
32 Terra Ceia muck, tidal
42 Udorthents, limestone substratum, 2 to 5 % slopes

Former Homestead AFB
Water
U.S. Highway
State Highway

Area Shown

0.5 0 0.5
Scale in Miles

Derived from:
SFWMD n.d.

Figure 3.9-4
Soils Distribution in the Vicinity of Former Homestead AFB

North of the former base is the Krome Association, consisting of nearly level and gently sloping, moderately well-drained loamy soils. These soils are gravelly and very shallow, only 3 to 9 inches thick over limestone bedrock. There are solution cavities in the rock underlying this association, which consists of drained Biscayne gravelly marl, drained Biscayne marl, Biscayne marl-Rock outcrop complex, Cardsound-Rock outcrop complex, Chekika very gravelly loam, Krome very gravelly loam, Matecumbe muck, Opalocka sand-Rock outcrop complex, drained Pennsuco marl, drained Perrine marl, Udorthents, limestone substratum-Urban land complex, and Urban land. The majority of agricultural land in the ROI occurs in this association. Most of the vegetables and fruit trees are grown on Krome and Chekika soils. Potatoes, sweet corn and malanga are grown on Biscayne, Perrine, and Pennsuco soils (**USDA 1996**).

The Perrine-Biscayne-Pennsuco Association is located in an area primarily south of Route 821, on the low coastal plains south and southeast of former Homestead AFB. It consists of soils that are nearly level, poorly drained marls, which formed from unconsolidated fine-grained particles of calcium carbonate deposited in marine or fresh water. The soil depth ranges from very shallow to deep. There are several hydric soils within this association. Soil mapping units within this association include Biscayne marl, drained and undrained, Cardsound-Rock outcrop complex, depressional Lauderhill muck, Matecumbe muck, drained and undrained Pennsuco marl, drained and undrained Perrine marl, tidal Terra Ceia muck, and limestone substratum-Urban land complex Udorthents (**USDA 1996**). The agricultural land adjacent to former base occurs in this association.

In the mangrove swamps in the southeastern part of the ROI is the Perrine-Terra Ceia-Pennsuco Association. The soils are nearly level and poorly to very poorly drained. They are either marl that is 40 to 80 inches deep over limestone or organic material that is over 50 inches thick. Many of these soils are inundated by salt water during high tide, and most are hydric (**USDA 1996**). The soil mapping units within this association include depressional Lauderhill muck, Matecumbe muck, Pennsuco marl, tidal Pennsuco marl, tidal Perrine marl, and tidal Terra Ceia muck (**USDA 1996**).

Permeability as shown in Table 3.9-1 is a measure of the rate water moves through saturated soil and is an indicator of soil drainage and the potential for movement of soluble chemicals through the soil profile. Available water capacity is an estimate of how much water a soil can hold and release for plants. Depth to apparent high water table is the depth in feet to the seasonal highest level of a saturated zone in the soil in most years. Water and wind erosion potential ratings indicate how susceptible bare soil is to erosion caused by wind and surface water. Land capability class is an indicator, in a general way, of the suitability of soils for use as cropland. The ratings range from 1 to 8, with 1 identifying soils with few limitations that restrict agricultural use, 2 indicating moderate limitations, 3 indicating severe limitations that reduce the choices of crops, 4 identifying the most severe limitations for crops and also the need for additional management, and 5 indicating limitations that are impractical to overcome in most cases. Land capability classes 6 through 8 are unsuitable for cultivation. The ratings for building site suitability provide guidance on how difficult it is to overcome limitations for construction of buildings, utilities, and roads.

The Urban land soil mapping unit is used to describe areas that have been covered by pavements and structures. They also include lawns, vacant lots, and parks where the native soil has been replaced or disturbed. The natural soil types in these areas cannot be identified. Typically these lands are level, moderately permeable, and consist of fill material up to 55 inches thick. The fill material generally improves the suitability of these areas as building sites (**USDA 1996**).

Soils at former Homestead AFB consist primarily of Urban land with small amounts of Biscayne marls located on the south and east portions of the base. Much of the natural soil types have been altered or covered by fill for buildings, streets, parking lots, and the runway. Figure 3.9-4 displays soil type classifications on the former base. **Table 3.9-2** summarizes the distribution of the predominant soil type classifications.

Table 3.9-2. Distribution of Soil Mapping Units on Former Homestead AFB

Soil Map Symbol[1]	Soil Mapping Unit	Percentage of Land Surface[2]
2	Biscayne gravelly marl, drained	0.82
7	Krome very gravelly loam	0.14
10	Udorthents, limestone substratum, Urban land complex	39.45
13	Biscayne marl	7.91
15	Urban land	24.27
16	Biscayne marl, drained	7.97
20	Cardsound-Rock outcrop complex	1.17
42	Udorthents, limestone substratum, 0 to 5 percent slopes	17.25
99	Water	1.02

Source: **USDA 1996.**
Notes: [1] Soil map symbol and soil mapping unit refer to the information on Figure 3.9-4.
[2] Percentage of land surface is based on all acres on former Homestead AFB, including areas covered by water.

There are no areas of prime farmland or additional farmland of statewide or local importance in Miami-Dade County. All agricultural land in the ROI is identified as unique farmland (**Coffin 1999**), defined as areas with a special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality and high value crops such as citrus, avocado, mangos, papayas, strawberries, vegetables, and sugar cane. (**Florida Cooperative Extension Service 1982**). Unique farmlands have local value for agricultural production. Loss of these soils to uses that permanently preclude crop production, such as construction of buildings, would reduce the region's value for agriculture.

3.9.3.2 Projected Baseline Environment

Population growth and development will affect soil resources in the ROI. Some of the soils now used for agriculture, mainly in the Krome Association and some in the Perrine-Biscayne-Pennsuco Association, are expected to be converted to non-agricultural uses such as roads, buildings, and parks. Krome Association soils are suitable both for agriculture and urban development. It is estimated that about 4,000 acres of the soils suitable for agriculture in the ROI could be converted to urban uses between 1995 and 2015, and it is likely that the majority of the conversion will occur within the Krome Association.

3.10 WATER RESOURCES

This section describes water resources, including surface water quantity and quality and groundwater quantity and quality.

3.10.1 Introduction

3.10.1.1 Resource Definition

Water resources comprise the water on or beneath the ground surface, including marine bays, rivers, canals, lakes, ponds, and wetlands, and water percolating, standing, or flowing beneath the ground surface.

3.10.1.2 Applicable Laws and Regulations

Following is a summary of major laws and regulations that apply to the use and management of surface water and groundwater:

Clean Water Act (CWA) (33 U.S.C. 1251 et seq.). This statute specifies permitting requirements for discharges of wastewater and stormwater to waters of the United States under the National Pollutant Discharge Elimination System (delegated to the State of Florida), and for the protection of ambient water quality. It also specifies permitting requirements for dredging and filling wetlands (Section 404), a program administered by the USACE with USEPA oversight.

Safe Drinking Water Act (42 U.S.C. 300f et seq.). This act sets forth a classification system for groundwater used for potable water supply and specifies requirements for the quality of groundwater that can be used for water supply. The implementation of the Safe Drinking Water Act is delegated to the State of Florida. The Biscayne Aquifer, which lies beneath former Homestead AFB, is the principal aquifer in southeastern Florida and is the primary source of drinking water for Miami-Dade County. This aquifer is classified as a sole-source aquifer by USEPA pursuant to Section 1425 of the Safe Drinking Water Act (44 FR 58797). Under this act, federally financially assisted projects over designated sole source aquifers are subject to USEPA review to ensure that such projects do not contaminate the aquifer so as to create a significant hazard to public health.

State of Florida Water Resource Implementation Rule (Florida Statute 373.036). This statute sets forth goals, objectives, and guidance for the development and review of programs, rules, and plans relating to water resources, based on statutory policies and directives.

Florida Statute 62-302.700(9), This Statute establishes the "Outstanding Florida Waters" program to designate waters that are of exceptional recreational or ecological significance in which water quality should be maintained and protected under all circumstances, other than temporary degradation and the lowering allowed under Section 316 of the federal Clean Water Act. Waters within Biscayne NP and Everglades NP are classified as Outstanding Florida Waters under Chapter 62-302.700(9).

Florida Administrative Code (FAC), Chapter 62-520.410. This regulation defines classes of aquifers designated for potable water use and sets standards for water quality. The Biscayne Aquifer is a Class G-1 aquifer for potable water use, with a total dissolved solids (TDS) content of less than 3,000 milligrams per liter (mg/L) under Chapter 62-520.410, FAC. However, the aquifer is designated by FDEP as a Class G-2 aquifer (i.e., for potable water use with TDS content of less than 10,000 mg/L) under Chapter 62-520.410, FAC.

3.10.1.3 Region of Influence

The ROI for water resources (**Figure 3.10-1**) is primarily composed of the area most likely affected by development associated with activities on the former base. This area encompasses the land and water resources from Eureka Drive south to SW 376th Street and from the nearshore Biscayne Bay west to the eastern boundary of Everglades NP. In addition, water areas that could be subject to atmospheric deposition from aircraft operations are examined. This includes Biscayne NP and Everglades NP and the area between them (not shown on Figure 3.10-1).

3.10.2 Surface Water

3.10.2.1 Existing Environment

The following sections describe existing surface water network and flows and water quality in the area potentially affected by development on former Homestead AFB and vicinity. FDEP has classified all water bodies within the ROI as Class III Surface Waters designated for recreation and maintenance of a healthy, well-balanced fish and wildlife population (Chapter 62-302.400, FAC).

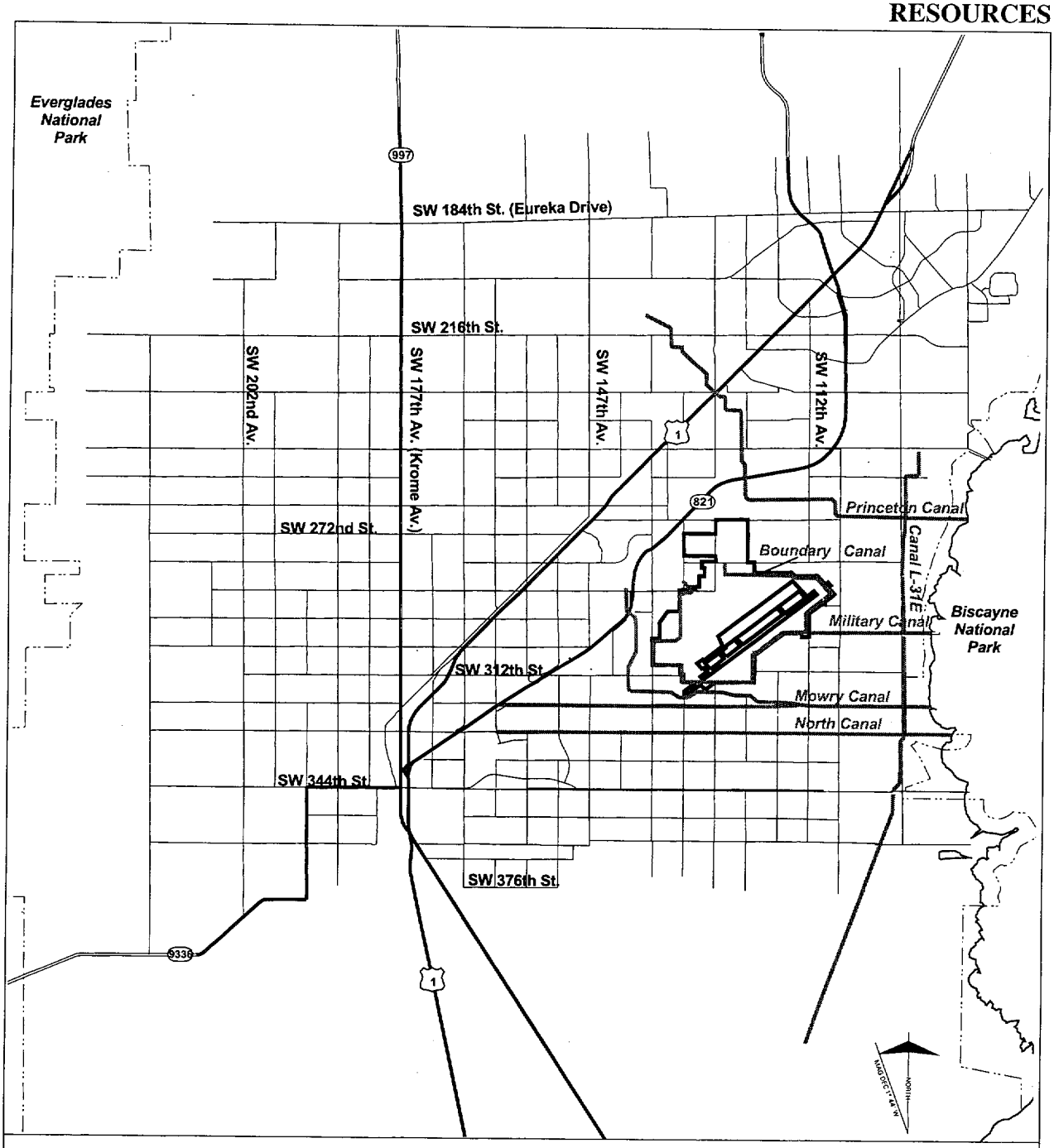
Surface Water Network and Flows

Historically, much of the surface water that flowed from the area around former Homestead AFB to Biscayne Bay was in poorly defined, small channels or overland sheet flow. Since about the 1950s, when canals were dug over most of southern Florida to promote drainage, the majority of the surface water features in the ROI are human-made. Now, much of the water that flows "to tide" (i.e., to the ocean or the bay) does so in human-made canals. With the exception of a few small sinkholes, essentially all of the lakes and ponds in the ROI are also human-made. They were created for limestone mines or borrow pits.

In general, surface water flows from areas around former Homestead AFB to either Princeton Canal or Mowry Canal and is discharged to Biscayne Bay through salinity control structures within a few hundred yards of the bay. Water flowing from the former base (with the exception of the former golf course) is collected in a series of canals, stored in a reservoir, and ultimately carried by Military Canal (also called Outfall Canal) to the bay (**Figure 3.10-2**). The following paragraphs describe the canal system that drains the ROI.

Military Canal. Military Canal runs approximately 2 miles eastward from former Homestead AFB to Biscayne Bay. The majority of its flow is derived from stormwater runoff from the former base, but some surface water drains from agricultural and unused land along the canal. There is also exchange of water in the canal with groundwater, and the extent and direction of the exchange depends on the relative heads of water in the surface and groundwater systems. The estimated average annual discharge from Military Canal to Biscayne Bay, using the Surface Water Management Model (SWMM), is 4,560 acre-feet. This represents about 1.1 percent of the freshwater input to southern Biscayne Bay (**Alleman 1995**).

Figure 3.10-2 shows the general surface drainage from former Homestead AFB. Stormwater on the base is collected by a system of 24 miles of canals, swales, ditches, and pipes. Runoff from former Homestead AFB is drained via a series of canals to Boundary Canal, which almost surrounds the former base. A 4 foot levee along the outside bank of Boundary Canal prevents most runoff from outside the property from entering the canal, but an unknown amount of runoff enters the cantonment from SW 288th Street. Flightline Canal and other drainage canals discharge water to Boundary Canal. Flightline Canal drains the runway and flows into the southwest segment of Boundary Canal. The Boundary Canal system



LEGEND

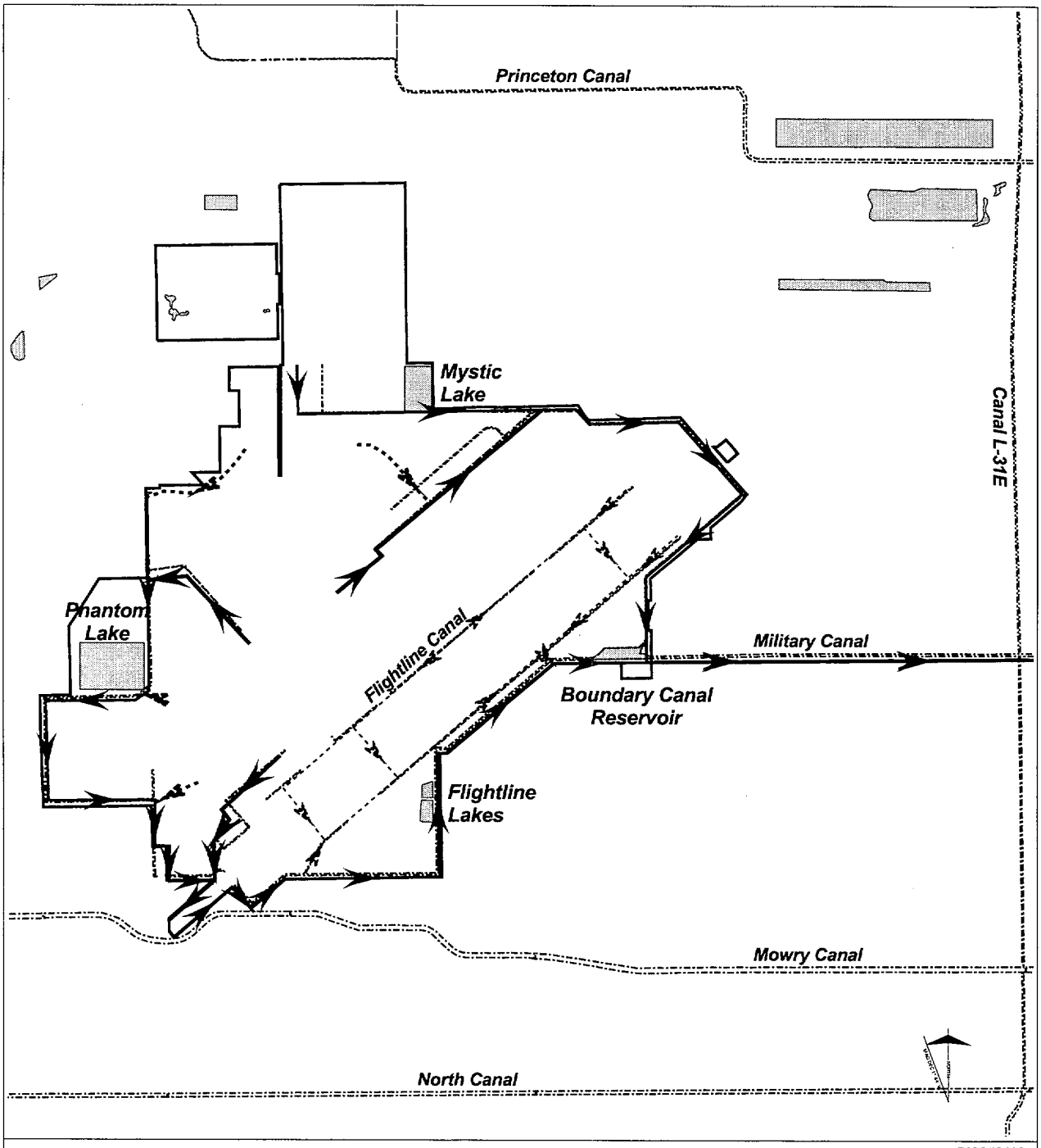
- Former Homestead AFB
- Major Canal
- National Park Boundary
- Street
- Major Road
- U.S. Highway
- State Highway

2 0 2

Scale in Miles

Source: SAIC

Figure 3.10-1
Region of Influence
for Water Resources



Source: PBS&J 1998a

Figure 3.10-2
Former Homestead AFB
Drainage Patterns

collects approximately 85 percent of the runoff from the former base and delivers the water to the reservoir on the eastern edge of the installation. The remaining site runoff is generated in part of the former base housing area and is discharged to Mystic Lake, an impoundment on the northeastern boundary of the former base.

Discharge from the reservoir receiving water from Boundary Canal is controlled by a pumping station at the east end of the reservoir. Three pumps, each with a maximum capacity of 100,000 gallons per minute (gpm), pump collected stormwater into Military Canal. The ultimate capacity of discharge is 300,000 gpm (668 cubic feet per second [cfs]). The pump station has space for a fourth pump, but discharge from former Homestead AFB is limited to 668 cfs by SFWMD permit (**PBS&J 1998a**).

The pumps operate at maximum discharge when reservoir elevation is 4.1 feet according to the 1927 National Geodetic Vertical Datum (NGVD). An interim discharge at 3 feet NGVD is currently allowed under an agreement between the Air Force Reserve Command and Miami-Dade County. This discharge is required to keep water elevations in Flightline Canal at acceptable operational levels. The pumps are operated until the water level in Flightline Canal is lowered to 2.5 feet NGVD. Without the pumps operation, flooding would occur along the flightline.

Surface water elevation and flow from Military Canal to Biscayne Bay is controlled by automated gate structure S20-G, operated by SFWMD. S20-G is a gated spillway 1.5 miles east of the former base that maintains adequate upstream water control stages in the canal, regulates discharges to tidewater, and prevents salinity intrusion during periods of high flood tides. Gates are opened when the water level in Military Canal is more than 0.3 feet above the tide elevation in Biscayne Bay. The highest surface water elevation of record behind S20-G was 3.05 feet.

According to revised 1987 maps developed by the Federal Emergency Management Agency (FEMA), the eastern end of former Homestead AFB would be flooded during the 100 year flood (**USAF 1994a**). The flood boundary runs north-south and extends through the middle of the runway. Most of the area west of this line would form part of an island, bounded on the west and south by the former base boundary and on the north by Princeton Canal. During this severe flooding, stormwater from the former base would be discharged directly into the surrounding flood waters. Runoff for the 10 year, 25 year, and 100 year floods were estimated using the Natural Resource Conservation Service curve number method. Peak flows for the 10 year, 24 hour storm range from 520 cfs to 710 cfs.

Runoff hydrographs were calculated for both 24 hour and 72 hour storms for each storm return period (10 year, 25 year, and 100 year). The precipitation magnitudes for each case, based on Natural Resources Conservation Service Type III storms, are shown in **Table 3.10-1**.

Table 3.10-1. Estimates of Former Homestead AFB Storms

Storm Return Period (years)	24 hour (inches)	72 hour (inches)
10	7.5	10.2
25	9.0	12.2
100	11.0	14.9

Source: **PBS&J 1998a**.

Table 3.10-2 shows the peak flows for former Homestead AFB. The storm return period (10, 25, and 100 years) and duration (24 and 72 hours) were selected based on a study performed by Post, Buckley, Schuh & Jernigan, Inc. (**PBS&J 1998a**). The criteria were developed in accordance with the SFWMD Permit Information Manual (Volume IV) and in close coordination with the Miami-Dade County Aviation Department and DERM.

Table 3.10-2. Estimates of Former Homestead AFB Peak Flows

Storm Return Period (years)	24 hour (cfs)	72 hour (cfs)
10	710	810
25	880	970
100	1,100	1,200

Source: **PBS&J 1998a.**
cfs cubic feet per second

Mowry Canal. Mowry Canal is located approximately 1,000 feet south of former Homestead AFB. This canal is approximately 14 miles long and begins at canal L-31N, located approximately 10 miles west of the former base. Before discharging into Biscayne Bay via Control Structure S-20F, this canal flows east parallel to and approximately 7,000 feet south of Military Canal. The average monthly flow from S-20F, based on measurements from 1980 to 1989 by SFWMD, varies from 4,028 acre-feet in May to 20,861 acre-feet in August (**Alleman et al. 1995**), with an estimated average annual discharge of 155,250 acre-feet, about 38 percent of the total freshwater input to southern Biscayne Bay.

Princeton Canal. Princeton Canal is located approximately 3,000 feet north of former Homestead AFB. The drainage basin for this canal is approximately 25.4 square miles (**Alleman et al. 1995**) and begins at canal L-31N. Before discharging into Biscayne Bay via Control Structure S-21A, this canal flows east parallel to and approximately 11,000 feet north of Military Canal. The average monthly flow from S-21A, based on measurements from 1980 to 1989 by SFWMD, varies from 1,673 acre-feet in May to 9,163 acre-feet in August (**Alleman et al. 1995**), with an estimated average annual discharge of 76,170 acre-feet, about 19 percent of the total freshwater input to southern Biscayne Bay.

Canal L-31E. L-31E is a north-south canal located between Princeton and Mowry Canals, 0.5 to 1 mile from Biscayne Bay. It was created to provide fill material for the levee that protects inland areas against storm surges. L-31E is hydraulically connected to Princeton and Mowry Canals. L-31E also has a culvert connection to Military Canal, but the culverts were intentionally blocked some time in the past to prevent surface water from L-31E mixing with Military Canal surface water. L-31E drains a sizable fraction of the area east of former Homestead AFB through a series of mosquito ditches and natural channels. Stormwater generated between Princeton and Mowry canals is collected in L-31E and discharged to Biscayne Bay via Princeton or Mowry Canal.

Lakes and Ponds. Other surface water features on the former base include seven lakes and ponds (see Figure 3.10-2). These lakes and ponds, like the Boundary Canal system, were excavated from limestone. Mystic Lake comprises approximately 9.8 acres on the northeastern boundary of the site and receives approximately 15 percent of the stormwater from the former base. Phantom Lake (14.5 acres) lies on the western site boundary. The North and South Flightline Lakes (7.7 and 8.0 acres, respectively) are located near the southern boundary of the former base and are remnant borrow pits. Two ponds on the western end of the former golf course cover 2.1 acres. None of these lakes and ponds on former Homestead AFB

have any apparent surface water connections to the Boundary Canal system. Two large ponds lie northeast of former Homestead AFB. These ponds were created by limestone mining. The ponds are not connected to other surface water features, and water balance is maintained primarily through percolation to groundwater and evaporation.

Biscayne Bay. Biscayne Bay is a large, semi-enclosed marine embayment that borders the east coast of south Florida from North Miami to Key Largo. Its eastern extent is defined by a series of keys between three and 10 miles offshore. The bay is generally shallow, with most areas having depths of 10 feet or less.

Historically, Biscayne Bay was fed by a number of small streams, overland sheet flow, and groundwater inputs that created a nearshore, low-salinity area. With the channelization of south Florida, however, groundwater inputs were reduced and the widely dispersed and more or less continuous surface water flow was replaced by periodic slugs of freshwater from the canals. The result was an increase in nearshore salinity, causing the area near the shore to be more marine in character.

Water Quality

The water quality of the canals in the ROI is generally within Florida water quality standards, although concentrations of several parameters are occasionally elevated. Few data are available to assess water quality in the lakes and ponds in the ROI. The following descriptions focus on the surface water quality and sediment quality of Military Canal and its tributaries, Mowry Canal, Princeton Canal, and Biscayne Bay.

The major issues associated with water (or sediment) quality in the ROI's canal systems are discharges of nutrients and toxics to the bay. The discharge of surges of freshwater whenever canal salinity control structures are opened is also of concern.

When present in excess, nutrients (nitrogen and phosphorus compounds) can stimulate plant growth to nuisance levels. In addition, un-ionized ammonia, a nitrogen compound, is toxic to animals. At the pHs and temperatures in the vicinity of the base, un-ionized ammonia would range from 1.8 percent of total ammonia at pH 7.5 and 25°C to 20.3 percent of total ammonia at pH 8.5 and 30°C. Most conditions are near the lower end of the range. The SWIM Plan for Biscayne Bay indicates that phosphorus is the limiting nutrient for the bay, and discharges of phosphorus could stimulate plant growth to nuisance levels if not carefully controlled. Because ammonia can also be toxic to animals, however, discharges of both nitrogen and phosphorus compounds should be limited to minimize adverse effects. Limited information on the biota of Biscayne Bay indicates that excess nutrients are stimulating the growth of epiphytes (attached plants) on seagrasses, reducing the viability of the seagrasses in the bay.

USEPA's water quality criteria (and Florida water quality standards) implicitly acknowledge the harm that is caused by a variety of toxic compounds when they are present at sufficiently high concentrations. Toxic compounds can be divided into two major groups: organics and metals. Organics include compounds that are designed to be toxic (e.g., pesticides), as well as compounds that have been generated by human activity and generally dispersed into the environment (e.g., polyaromatic hydrocarbons) or widely used and not carefully controlled (e.g., polychlorinated biphenyls).

Metals such as cadmium, lead, mercury, chromium, and others are widely used in industrial operations and were often purposefully disposed of in aquatic environments in the past. Once in the environment, they often remain for long periods of time (decades or more) and can cause toxic effects long into the future. While the release of significant quantities of metals is not now permitted under the National

Pollutant Discharge Elimination System, such was not the case prior to the mid-1970s when these compounds were of less concern.

The following paragraphs describe measured concentrations of some general indicators of water quality (e.g., pH, dissolved oxygen, total dissolved solids), nutrients, and toxics in Military Canal and its tributaries, Mowry Canal, Princeton Canal, and Biscayne Bay. In general, there are more data on nutrients than on toxics, and because of the expense of measuring organic compounds, there are more data on metals than organics. The measured concentrations are compared to applicable Florida and Miami-Dade County freshwater standards.

Military Canal. There are several sources of data on Military Canal; DERM, the Air Force, and USEPA have all monitored the canal at times. The results of the monitoring activities differ but show similar patterns.

DERM monitored water quality monthly at a number of stations in the canals of Miami-Dade County over a number of years. One monitoring station, MI03, is at the mouth of Military Canal, at the west side of the SW 107th Avenue bridge. Water quality data for this station are presented in **Table 3.10-3**.

The physical/chemical parameters measured at this station indicate that, between 1989 and 1997, the water at that location was essentially fresh water. All parameters except dissolved oxygen complied with applicable state and county standards. The minimum concentration of dissolved oxygen did not meet either Florida or Miami-Dade County water quality standards. The Florida standard for ammonia is for un-ionized ammonia only, while the measured results are for total ammonia. Un-ionized ammonia is less than 5 percent of total ammonia under common pH and temperature conditions. Five percent of the measured levels fall below the Florida standard.

A small number of surface water samples from Military Canal analyzed by the Air Force between 1993 and 1996 indicated all constituents except beryllium and cadmium complied with Florida water quality standards over this period (**Table 3.10-4**). Out of six samples, beryllium was detected twice, once slightly above the standard, and the other almost twice the standard.

The concentrations of various parameters in the sediments of Military Canal have been studied on a number of occasions. The results of the 1989 and 1990 sediment samples collected by DERM are summarized in **Table 3.10-5**.

The Air Force sampled Military Canal sediments as part of the remedial investigation of OU-11 between 1993 and 1996. The results of these analyses are presented in **Table 3.10-6**.

In late 1997, USEPA sampled sediments from 93 sampling stations along Military Canal. In an initial summary of results, USEPA identified nine compounds of potential concern. These compounds and their mean concentrations throughout the canal system are presented in **Table 3.10-7**.

There is concern that toxic chemicals are being transported from Military Canal to Biscayne Bay. Based on USEPA data, Military Canal sediments are toxic to standard freshwater test organisms in various locations, and a NOAA study (**NOAA 1998b**) also indicated that there is some toxicity in Biscayne Bay sediments just outside of the Military Canal control structure.

Table 3.10-3. Water Quality of Military Canal, DERM Station MI03, 1989–1997

	Units	Number of Samples	Number of Non-detects	Maxi-mum	Median[1]	Mean[1]	Florida Standard	Miami-Dade Standard	Notes
Dissolved Oxygen	mg/L	93	0	1.9	6.7	6.6	5	4	2, 3, 4
Salinity	ppt	74	0	1.0	0.3	0.3	ns	ns	5
Temperature	°C	93	0	32.6	26.8	26.5	nar	3°	6, 7, 8
Hardness	mg/L as $CaCO_3$	4	0	206	203	198	ns	ns	5
Nitrogen	mg/L					0.709	nar	nar	8
Nitrates and Nitrites	mg/L	90	0	1.900	0.580	0.655	nar	nar	8
Ammonia	mg/L	86	7	0.230	0.040	0.054	0.02	0.5	9
Total Phosphorus	mg/L	86	0	0.100	0.010	0.012	nar	nar	8
Cadmium	µg/L	44	40	0.90	0.02	0.23	1.94	nar	8, 10
Copper	µg/L	45	36	6.58	0.60	1.39	21.2	400	10
Lead	µg/L	45	38	1.79	0.10	0.33	7.58	950	10
Zinc	µg/L	40	28	14.40	4.60	6.11	189	1,000	10

Source: DERM; statistical analysis, SAIC.

Notes:
[1] Median and mean are calculated with detected values only. Nondetects have been eliminated, so actual medians and means would be lower than the values presented here.
[2] Dissolved oxygen lists minimum value in Maximum column.
[3] Florida criterion is not less than 5 mg/L, with normal daily and seasonal levels above this level to be maintained.
[4] County criterion is 5 ppm during at least 10 hours per 24-hour period, never less than 4, unless naturally caused.
[5] ns = no standard.
[6] The Florida thermal criterion varies with the situation and generally does not apply to canal discharges.
[7] Miami-Dade criterion: 3° above ambient.
[8] nar = narrative standard only, no numeric criterion. This generally requires concentrations that cause no adverse environmental effect.
[9] Measurements are for total ammonia. Florida standard is for un-ionized ammonia only. Un-ionized ammonia is less than 5 percent of total ammonia at pH 7.9 at 27°C.
[10] Florida criteria are calcium carbonate dependent.

µg/L micrograms per liter
mg/L milligrams per liter
ppt parts per thousand

When examining the nature of the contaminants in Military Canal, at least two of the compounds must have been deposited in canal sediments at least 20 years ago. DDT and PCB-1254 were both banned in the early 1970s, and no new sources of contamination for these compounds have been identified. Yet concentrations of DDE (a degradation product of DDT) and PCB-1254 in Military Canal remain at elevated levels, even after several major storms, including Hurricane Andrew. This suggests that the sediments are not easily transported out of Military Canal to Biscayne Bay. Nevertheless, elevated concentrations of some metals in the water column of Military Canal, probably caused by resuspension of sediments during high flows or wind-induced mixing, suggest that some transport of contaminants probably occurs over extended periods of time.

Table 3.10-4. Air Force Measurements of Military Canal Surface Water Quality, 1993–1996

Parameter	Units	Minimum Concentration	Maximum Concentration	Florida Standard
Organics				
Benzene	µg/L	<10	1 J	71.28 annual avg.
Chloroform	µg/L	<10	1.1 J	470.8 annual avg.
Ethylbenzene	µg/L	<10	3	605
Toluene	µg/L	<10	8	475
Xylenes (Total)	µg/L	<10	18	370
2-methylnaphthalene	µg/L	<10	1 J	30
Naphthalene	µg/L	<10	2 J	26
Heptachlor	µg/L	<0.05	0.016 J	0.0038
Metals				
Aluminum	µg/L	<22.0	29.1	ns
Antimony	µg/L	<22.2	25.6	4,300
Arsenic	µg/L	<3.2	1.6	50
Barium	µg/L	8.6	12.0	ns
Beryllium	µg/L	<0.20	0.24	0.13
Cadmium	µg/L	<2.7	3.5	1.94
Calcium	µg/L	57,500	230,000	ns
Copper	µg/L	<2.2	3.1	21.2
Iron	µg/L	<7.8	9.2	1,000
Lead	µg/L	<0.9	1.7	7.58
Magnesium	µg/L	3,970	664,000	ns
Manganese	µg/L	<0.4	5.6	ns
Nickel	µg/L	<5.7	10.7	281
Potassium	µg/L	7,610	196,000	ns
Selenium	µg/L	<2.0	0.4	5.0
Sodium	µg/L	19,800	5,160,000	ns
Vanadium	µg/L	<3.8	6.0	ns
Zinc	µg/L	6.0	9.4	189

Source: **Montgomery Watson 1997.**
< less than detection limit
J estimated concentration
µg/L micrograms per liter
ns no standard

Boundary Canal. In general, Boundary Canal has higher maximum concentrations of pollutants than Military Canal (**Table 3.10-8**). All measurements for beryllium and mercury exceeded their respective criteria. The maximum concentration of total ammonia exceeded Florida standard for un-ionized ammonia, if 5 percent of total ammonia is assumed to be un-ionized. All other parameters complied with both state and county water quality standards.

Table 3.10-5. DERM Measurements of Military Canal Sediment Quality, 1989–1990

Parameter	Units	Concentration[1]
Organics		
BHC-Alpha	µg/kg	11.1
Endosulfan I	µg/kg	4.9
Heptachlor	µg/kg	3.4
DDD	µg/kg	25.7
DDE	µg/kg	34.0
DDT	µg/kg	53.5
Kelthane	µg/kg	24.7
Lindane	µg/kg	1.4
Perthane	µg/kg	241
Trifluralin	µg/kg	11.4
Metals		
Aluminum	mg/kg	3,079
Cadmium	mg/kg	13.5
Copper	mg/kg	78.6
Lead	mg/kg	82.3
Zinc	mg/kg	304.2

Source: **Woodward-Clyde 1995.**
Note: [1] Concentration of organics represents maximum detected values.
µg/kg micrograms per kilogram
mg/kg milligrams per kilogram

Mowry Canal. Surface water data for Mowry Canal are summarized for 1991 through 1997 in **Table 3.10-9**. In general, concentrations of nutrients were higher than those in Military Canal, but metals were lower. All parameters complied with both state and county water quality criteria. Measured concentrations of total ammonia did not exceed Florida standard for un-ionized ammonia, assumed to be 5 percent of total ammonia under common conditions.

Princeton Canal. Surface water data for Princeton Canal for 1991 through 1997 are summarized in **Table 3.10-10**. In general, concentrations of nutrients were higher than those in Military Canal, but metals were lower. All parameters complied with both state and county water quality criteria. Measured concentrations of total ammonia did not exceed Florida standard for un-ionized ammonia, assumed to be 5 percent of total ammonia under common conditions.

Biscayne Bay. DERM has taken water quality samples at a number of stations in Biscayne Bay since 1988. Five stations in the bay were routinely sampled between 1988 and 1996. Data for these stations are summarized in **Table 3.10-11**. Freshwater water quality standards do not apply to Biscayne Bay.

The salinity data indicate that the bay is essentially seawater (salinity of seawater is approximately 35 parts per thousand). The stations most influenced by freshwater inputs from canals have slightly lower average salinities. Station BB41, approximately 3.5 miles off the mouth of Mowry Canal and 3.7 miles off the mouth of Military Canal, has the lowest salinity.

Table 3.10-6. Air Force Measurements of Military Canal Sediment Quality, 1993–1996

Parameter	Units	Concentration	
		Minimum	Maximum
Organics			
Acetone	µg/kg	180	9,700
4,4-DDE	µg/kg	<0.1J	20J
4,4-DDT	µg/kg	<21	21
Metals			
Aluminum	mg/kg	1,460	4,960
Antimony	mg/kg	<14.8	26.6
Arsenic	mg/kg	2.8	7.5
Barium	mg/kg	8.2	27.8
Beryllium	mg/kg	0.08	0.30
Cadmium	mg/kg	0.94	2.50
Chromium	mg/kg	10.5	18.3
Cobalt	mg/kg	<1.1	1.9
Copper	mg/kg	32.9J	66.3J
Cyanide[1]	mg/kg	4.7J	4.7J
Iron	mg/kg	2,140	5,640
Lead	mg/kg	17.1	38.8
Mercury	mg/kg	0.43	0.73
Magnesium	mg/kg	1,440	13,900
Manganese	mg/kg	16.7	65.1
Nickel	mg/kg	<2.3	4.3
Potassium	mg/kg	392	2,770
Selenium	mg/kg	15	3.9
Silver	mg/kg	<2.3	11.3
Vanadium	mg/kg	7.6	24.1
Zinc	mg/kg	45.7	188

Source: **Montgomery Watson 1997.**
Note: [1] Only one sample analyzed.
< less than detection limit
J estimated concentration
µg/kg micrograms per kilogram
mg/kg milligrams per kilogram

Total phosphorus and ammonia concentrations were similar for all stations measured, but nitrate plus nitrite varied by a factor of four. High nitrate plus nitrite concentrations reflect the input of nutrient-rich canal water. BB41 had the highest average concentration of nitrate plus nitrite. Dissolved oxygen concentrations also tended to be higher at stations with higher nutrient concentrations, probably because the higher nutrient waters lead to more plant growth, which causes a higher range in oxygen concentration over a 24 hour period. Because the samples reported were taken during the day when the plants are photosynthesizing, higher oxygen concentrations were observed.

Table 3.10-7. USEPA Measurements of Military Canal Sediment Quality, 1997

Parameter	Units	Mean Concentration
Organics		
P,P-DDE	µg/kg	118.51
Chlordane	µg/kg	18.07
Dibenzo(a,h)anthracene	µg/kg	98.66
PCB-1254	µg/kg	219.61
Metals		
Arsenic	mg/kg	8.18
Cadmium	mg/kg	3.6
Copper	mg/kg	91.46
Mercury	mg/kg	1.32
Silver	mg/kg	23.99

Source: **USEPA 1999.**
µg/kg micrograms per kilogram
mg/kg milligrams per kilogram

NOAA sampled the sediments of Biscayne Bay at 226 stations in 1995 and 1996 and tested their toxicity by four tests: (1) percent survival of marine amphipods in 10 day tests of bulk sediments (amphipod), (2) changes in bioluminescence of a marine bacterium in organic extracts (Microtox), (3) fertilization success of sea urchins in 1 hour tests of sediment porewater (fertilization), and (4) embryological development of sea urchin eggs in 48 hour porewater tests (development).

Three stations were sampled below the salinity control structures in each of three canals in the ROI: Princeton Canal, Military Canal, and Mowry Canal (**NOAA 1998b**). The results are summarized in **Table 3.10-12**. None of the canals had sediments that were toxic to amphipods, but all other tests showed some toxicity for all of the canals. The Microtox tests indicated that Princeton Canal had the most toxic sediments and Mowry Canal the least. The development tests indicated that Military Canal had the most toxic sediments, while Princeton and Mowry Canals had lower toxicities. In fertilization tests, Mowry Canal had the most toxic sediments and Princeton Canal the least. Chemical concentration data are also available for these stations, but they are not included here because toxicity and resulting biological effects are the principal concerns.

Nutrient and Toxicant Loads. The Draft SEIS included estimated concentrations of metal, organic, and nutrient loadings from former Homestead AFB in Military Canal, based on soil concentrations. Data from actual measurements of Military Canal water and sediment samples indicate that soil concentrations are not appropriate surrogates. Therefore, it is not possible to estimate loads for metals and organic chemicals that have not been measured during sampling.

Loads to Biscayne Bay from the three major canals in the ROI (**Table 3.10-13**) were estimated by multiplying mean concentrations at the canal mouths, times the average annual flow from each canal. Flows for Mowry and Princeton canals were obtained from the Biscayne Bay SWIM Plan. Flows for Military Canal were calculated using the SWMM model. Concentrations were obtained from DERM data on bay-wide canal monitoring.

Table 3.10-8. Boundary Canal Water Quality

Parameter	Units	Concentration		
		Minimum	Maximum	Florida Standard
Physical/Chemical				
TDS	mg/L	230	7,000	ns
TSS	mg/L	<5	38	ns
Nutrients				
Total Phosphorus (P)	mg/L	<0.05	0.29	nar
Total Ammonia (N)	mg/L	<0.05	0.78	0.02[1]
Nitrite + Nitrate (N)	mg/L	<0.10	4.11	nar
TKN	mg/L	<0.5	1.5	ns
Organics				
Chloroform	µg/L	<5	2	470.8[2]
Endosulfan II	µg/L	<0.1	0.03	0.056
Metals				
Aluminum	µg/L	22.4	108.0	ns
Antimony	µg/L	23.8	33.6	4,300
Arsenic	µg/L	0.6	6.0	50
Beryllium	µg/L	0.20	0.39	0.13[2]
Cadmium	µg/L	<2.7	3.4	1.94[3]
Chromium	µg/L	<4.1	4.5	362
Copper	µg/L	2.2	18.1	21.2
Iron	µg/L	8.1	120.0	1,000
Lead	µg/L	1.1	6.4	7.58
Mercury	µg/L	0.08	0.09	0.012
Nickel	µg/L	5.9	7.9	281
Selenium	µg/L	0.4	0.8	ns
Vanadium	µg/L	4.4	7.1	ns
Zinc	µg/L	5.1	40.9	189

Source: **Woodward-Clyde 1995.**

Notes:
[1] Applies to un-ionized ammonia only, which is less than 5 percent of total ammonia at pH 7.9 at 27°C.
[2] Annual average.
[3] Hardness dependent. Hardness taken from Table 3.10-3.

< less than detection limit
µg/L micrograms per liter
mg/L milligrams per liter
nar narrative criterion only, no numeric criterion.
ns no standard
TDS total dissolved solids
TKN total Kjeldahl nitrogen
TSS total suspended solids

Table 3.10-9. Water Quality of Mowry Canal, DERM Station MW04, 1991–1997

	Units	Number of Samples	Number of Non-detects	Maximum[1]	Median[1]	Mean[1]	Florida Standard	Miami-Dade Standard	Notes
Dissolved Oxygen	mg/L	78	0	0.6	6.5	6.6	5	4	2, 3, 4
Salinity	ppt	74	0	0.9	0.4	0.3	ns	ns	5
Temperature	°C	78	0	30.3	26.0	26.0	nar	3°	6, 7, 8
Hardness	mg/L as $CaCO_3$	4	0	316	293	280	ns	ns	5
Nitrogen	mg/L					2.162	nar	nar	8
Nitrates and Nitrites	mg/L	71	0	4.640	2.080	2.123	nar	nar	8
Ammonia	mg/L	58	8	0.150	0.030	0.040	0.02	0.5	9
Total Phosphorus	mg/L	51	0	0.040	0.004	0.006	nar	nar	8
Cadmium	µg/L	34	31	0.10	0.10	0.07	1.94	nar	8, 10
Copper	µg/L	36	33	2.10	0.54	1.00	21.2	400	10
Lead	µg/L	36	33	2.30	0.14	0.86	7.58	950	10
Zinc	µg/L	31	23	6.20	4.00	4.70	189	1,000	10

Source: DERM; statistical analysis, SAIC.

Notes:
[1] Median and mean are calculated with detected values only. Nondetects have been eliminated, so actual medians and means would be lower than the values presented here.
[2] Dissolved oxygen lists minimum value in Maximum column.
[3] Florida criterion is not less than 5 mg/L, with normal daily and seasonal levels above this level to be maintained.
[4] County criterion is 5 ppm during at least 10 hours per 24-hour period, never less than 4, unless naturally caused.
[5] ns = no standard.
[6] The Florida thermal criterion varies with the situation and generally does not apply to canal discharges.
[7] Miami-Dade criterion: 3° above ambient.
[8] nar = narrative standard only, no numeric criterion. This generally requires concentrations that cause no adverse environmental effect.
[9] Measurements are for total ammonia. Florida standard is for un-ionized ammonia only. Un-ionized ammonia is less than 5 percent of total ammonia at pH 7.9 at 27°C.
[10] Florida criteria are calcium carbonate dependent.

µg/L micrograms per liter
mg/L milligrams per liter
ppt parts per thousand

There are also atmospheric sources of pollutants entering Biscayne Bay and the Everglades. Nitrogen is added from the deposition of water-soluble and particulate nitrogen compounds which are generated, at least in part, from emissions from stationary and mobile sources. Polycyclic aromatic hydrocarbons from petroleum products and the combustion of petroleum products by vehicles, aircraft, and other equipment are also deposited as very small particles. There are no measurements of either nitrogen or PAH deposition in Biscayne Bay, but there are data for nitrogen deposition in Everglades NP. The measured annual nitrogen deposition rate over 1994–1998 was 7.08 kilogram/hectare, which is equivalent to 6.30 pounds per acre (see Section 3.8.4.1).

Table 3.10-10. Water Quality of Princeton Canal, DERM Station PR03, 1991–1997

	Units	Number of Samples	Number of Non-detects	Maximum[1]	Median[1]	Mean[1]	Florida Standard	Miami-Dade Standard	Notes
Dissolved Oxygen	mg/L	78	0	2.3	5.9	5.9	5	4	2, 3, 4
Salinity	ppt	74	0	0.7	0.3	0.3	ns	ns	5
Temperature	°C	78	0	29.9	26.0	25.8	nar	3°	6, 7, 8
Hardness	mg/L as $CaCO_3$	3	0	307	298	298	ns	ns	5
Nitrogen	mg/L					3.933	nar	nar	8
Nitrates and Nitrites	mg/L	72	0	4.860	4.060	3.873	nar	nar	8
Ammonia	mg/L	65	6	0.320	0.040	0.060	0.02	0.5	9
Total Phosphorus	mg/L	48	3	0.030	0.003	0.006	nar	nar	8
Cadmium	µg/L	35	34	0.10	0.10	0.10	1.94	nar	8, 10
Copper	µg/L	36	34	2.40	1.52	1.52	21.2	400	10
Lead	µg/L	36	35	0.04	0.04	0.04	7.58	950	10
Zinc	µg/L	31	23	8.90	6.05	6.31	189	1,000	10

Source: DERM; statistical analysis, SAIC.

Notes:
[1] Median and mean are calculated with detected values only. Nondetects have been eliminated, so actual medians and means would be lower than the values presented here.
[2] Dissolved oxygen lists minimum value in Maximum column.
[3] Florida criterion is not less than 5 mg/L, with normal daily and seasonal levels above this level to be maintained.
[4] County criterion is 5 ppm during at least 10 hours per 24-hour period, never less than 4, unless naturally caused.
[5] ns = no standard.
[6] The Florida thermal criterion varies with the situation and generally does not apply to canal discharges.
[7] Miami-Dade criterion: 3° above ambient.
[8] nar = narrative standard only, no numeric criterion. This generally requires concentrations that cause no adverse environmental effect.
[9] Measurements are for total ammonia. Florida standard is for un-ionized ammonia only. Un-ionized ammonia is less than 5 percent of total ammonia at pH 7.9 at 27°C.
[10] Florida criteria are calcium carbonate dependent.

µg/L micrograms per liter
mg/L milligrams per liter
ppt parts per thousand

3.10.2.2 Projected Baseline Environment

Although there will be growth in south Miami-Dade County over the next 15 years, it is not clear how and where that growth will occur. Future changes in surface water flows and loads were estimated based on land use changes estimated to occur in the projected baseline (see Section 2.1.3). The estimated acreage changes in residential, commercial, and industrial land uses in the ROI were multiplied by an assumed percent imperviousness (between 40 and 79 percent) for each land use category to obtain total new acres of impervious surface. The area of impervious surface was multiplied by average annual rainfall to obtain total increased runoff. The increased runoff was then multiplied by the weighted average concentration of pollutants in Princeton and Mowry Canals to obtain total increased loadings. The results of these calculations (**Table 3.10-14**) indicate that both flows and loads in the ROI would be expected to increase by about 8 percent by 2015 with moderate growth.

Table 3.10-11. Biscayne Bay Water Quality, 1988–1996

Station	Salinity (ppt)	Dissolved Oxygen (mg/L)	Total Phosphorus (mg/L)	Nitrate + Nitrite (mg/L)	Ammonia (mg/L)
BB36	34.8	6.12	0.0028	0.0146	0.065
BB37	35.3	5.94	ND	ND	ND
BB38	35.4	5.99	0.0030	0.0085	0.057
BB41	33.3	6.33	0.0031	0.0333	0.062
BB42	35.5	6.05	ND	ND	ND
Mean[1]	34.8	6.09	0.0029	0.0188	0.061

Source: DERM; statistical analysis, SAIC.
Note: [1] Mean is average of station means, not individual observations.
mg/L milligrams per liter
ND no data
ppt parts per thousand

Table 3.10-12. Sediment Toxicity at the Mouths of Three Canals Discharging to Biscayne Bay, 1995–1996

Location	Amphipod[1]	Microtox[2]	Development[3]	Fertilization[4]
Princeton Canal				
Landward station	Non-toxic	Highly toxic	Slightly toxic	Non-toxic
Intermed. station	Non-toxic	Moderately toxic	Non-toxic	Non-toxic
Seaward station	Non-toxic	Highly toxic	Slightly toxic	Slightly toxic
Military Canal				
Landward station	Non-toxic	Non-toxic	Moderately toxic	Moderately toxic
Intermed. station	Non-toxic	Non-toxic	Moderately toxic	Slightly toxic
Seaward station	Non-toxic	Moderately toxic	Slightly toxic	Slightly toxic
Mowry Canal				
Landward station	Non-toxic	Non-toxic	Non-toxic	Moderately toxic
Intermed. station	Non-toxic	Slightly toxic	Slightly toxic	Moderately toxic
Seaward station	Non-toxic	Slightly toxic	Slightly toxic	Highly toxic

Source: **NOAA 1998b.**
Notes: [1] Amphipod (crustacean) survival test.
[2] Bacterial bioluminescence test.
[3] Sea urchin embryological development test.
[4] Sea urchin egg fertilization test.

3.10.3 Groundwater

Groundwater in southeastern Florida is contained in two distinct aquifers: the Biscayne Aquifer, which is the surficial, unconfined aquifer system, and the lower, confined Floridan Aquifer. This section describes each of these aquifers and addresses groundwater quality.

Table 3.10-13. Total Estimated Flows and Loads from Military, Mowry, and Princeton Canals to Biscayne Bay, 1989–1997

	Units	Military	Mowry	Princeton	Total
Flows	acre-feet/year	5,133	155,250	76,170	236,553
Nitrogen	pounds/year	9,905	913,130	814,950	1,737,985
Phosphorus	pounds/year	174	2,484	1,188	3,846
Cadmium	pounds/year	3	29	21	53
Copper	pounds/year	19	424	315	758
Lead	pounds/year	5	362	8	375
Zinc	pounds/year	85	1,985	1,308	3,378

Source: SAIC.
Note: Loads in this table are calculated on detected values only, so loads of cadmium, copper, lead, and zinc are probably overestimated because the majority of samples for these elements were nondetects.

Table 3.10-14. Total Projected Baseline Surface Water Flows and Loads from Military, Mowry, and Princeton Canals

	Units	2000	2005	2015
Flow	acre-feet/year	241,251	245,945	255,338
Nitrogen	pounds/year	1,773,068	1,808,121	1,878,257
Phosphorus	pounds/year	3,920	3,995	4,144
Cadmium	pounds/year	54	55	57
Copper	pounds/year	773	788	818
Lead	pounds/year	382	390	405
Zinc	pounds/year	3,445	3,512	3,645

Source: SAIC.
Note: Loads in this table are estimated based on detected baseline values only. Loads of cadmium, copper, lead, and zinc are probably overestimated because the majority of samples for these elements were nondetects. Projected increases in surface water flows were based on the assumption that all rainfall falling on newly impervious surface would be discharged to Biscayne Bay. This is a conservative assumption that would also result in high estimates of chemical loads.

3.10.3.1 Existing Environment

Aquifers

Biscayne Aquifer. The Biscayne Aquifer (a sole-source aquifer, see Section 3.10.1.2) in the area of former Homestead AFB is composed mainly of highly permeable limestone and sandstone. The thickness of the aquifer at the former base ranges from approximately 80 to 120 feet (**Fish and Stewart 1991**) and is bounded to the east by saline water derived from the intrusion of seawater into aquifer formations. The groundwater table, the phreatic surface of the unconfined Biscayne Aquifer, is close to the land surface. Because of its shallow, unconfined condition, the aquifer is influenced by rainfall, channel flows, and ponded surface water in the area.

In the Homestead area, the Biscayne Aquifer is composed of the following stratigraphic units in ascending order: permeable limestone of the Tamiami Formation, the Fort Thompson Formation, and Miami Oolite (**Geraghty & Miller 1992**) (see Section 3.9). Due to the interfingering of aquifer materials, some permeable units (aquifers or small sections of aquifers) may exhibit confined characteristics. In general, the Biscayne Aquifer has hydraulically interconnected groundwater flow at all depths, and flows are closely related to the water table depth (**Sonntag 1987**).

The Biscayne Aquifer is characterized by interconnected zones of cavernous limestone and has reported transmissivities ranging from approximately 4 to 8 million gallons per day per foot (mgd/foot) (**Montgomery Watson 1997**). The transmissivity of the aquifer at the base has been estimated to range from 2.2 to 8 mgd/foot, and the permeability has been found to be greater than 1,000 feet per day (**Fish and Stewart 1991**). The average transmissivity has been estimated to be 5 mgd/foot, the average permeability has been estimated to be 8,640 feet per day, and the average flow velocity is estimated at 2.6 feet per day or 950 feet per year (**USAF 1994a**).

The general direction of groundwater flow within the Biscayne Aquifer is to the east toward Biscayne Bay, except in localized areas where it is influenced by canals or production well pumpage (**Figure 3.10-3**). The hydraulic gradient, calculated from the average configuration of the water table in Miami-Dade County in September between 1974 and 1982, was 0.3 feet per mile. The water table is generally within 1 to 5 feet of the land surface, but may occur at or near land surface during the wet season (summer). The seasonal variation in water level ranges from 0.5 to 1.0 foot. The extremely flat regional hydraulic gradient counteracts the very high transmissivity of the Biscayne Aquifer and results in slow net movement of groundwater.

Fluctuations in groundwater levels and local variations in the direction of groundwater flow are due to several factors: (1) differences in infiltration potential, (2) runoff from paved areas, (3) water-level drawdown near pumping wells, and (4) drainage effects of canals and water-level control structures.

Recharge to the Biscayne Aquifer is derived from rainfall, irrigation runoff, surface water imported by canals, urban runoff, and groundwater inflow. Due to the high permeability of the aquifer, surface runoff is slight, except over impervious areas. Recharge by rainfall is greatest during the wet season, from May through October, and recharge by canal seepage is greatest during the dry season, from November through April. Annual recharge to the aquifer is estimated to be as much as 38 inches per year, or 63 percent of total rainfall (**USAF 1994a**).

Infiltration is considered to be rapid through surfaces of Oolite outcrop and areas with a thin soil layer. Infiltration rates are accelerated by fractures within the Oolite, as well as by naturally occurring solution channels. Rain water percolates through the relatively thin vadose zone to locally recharge the unconfined aquifer. Discharge from the Biscayne Aquifer is mainly by evapotranspiration; groundwater flow to canals or Biscayne Bay; and municipal, industrial, domestic, and agricultural withdrawals.

The unconfined Biscayne Aquifer is influenced by the surface water bodies in the ROI. Available data indicate that the groundwater levels in the Biscayne Aquifer remain higher than the canal surface water levels during the dry (low rain) period, and it is likely that the Biscayne Aquifer discharges groundwater to the canals during those times. During storms, water levels in the canals rise with a rise in the groundwater table (i.e., there are rises in water levels in Military Canal without pumpage from the reservoir). The rise in the groundwater table is caused by vertical recharge from rainfall and lateral recharge from canals. Canal water levels return to pre-storm conditions within hours of rainfall.

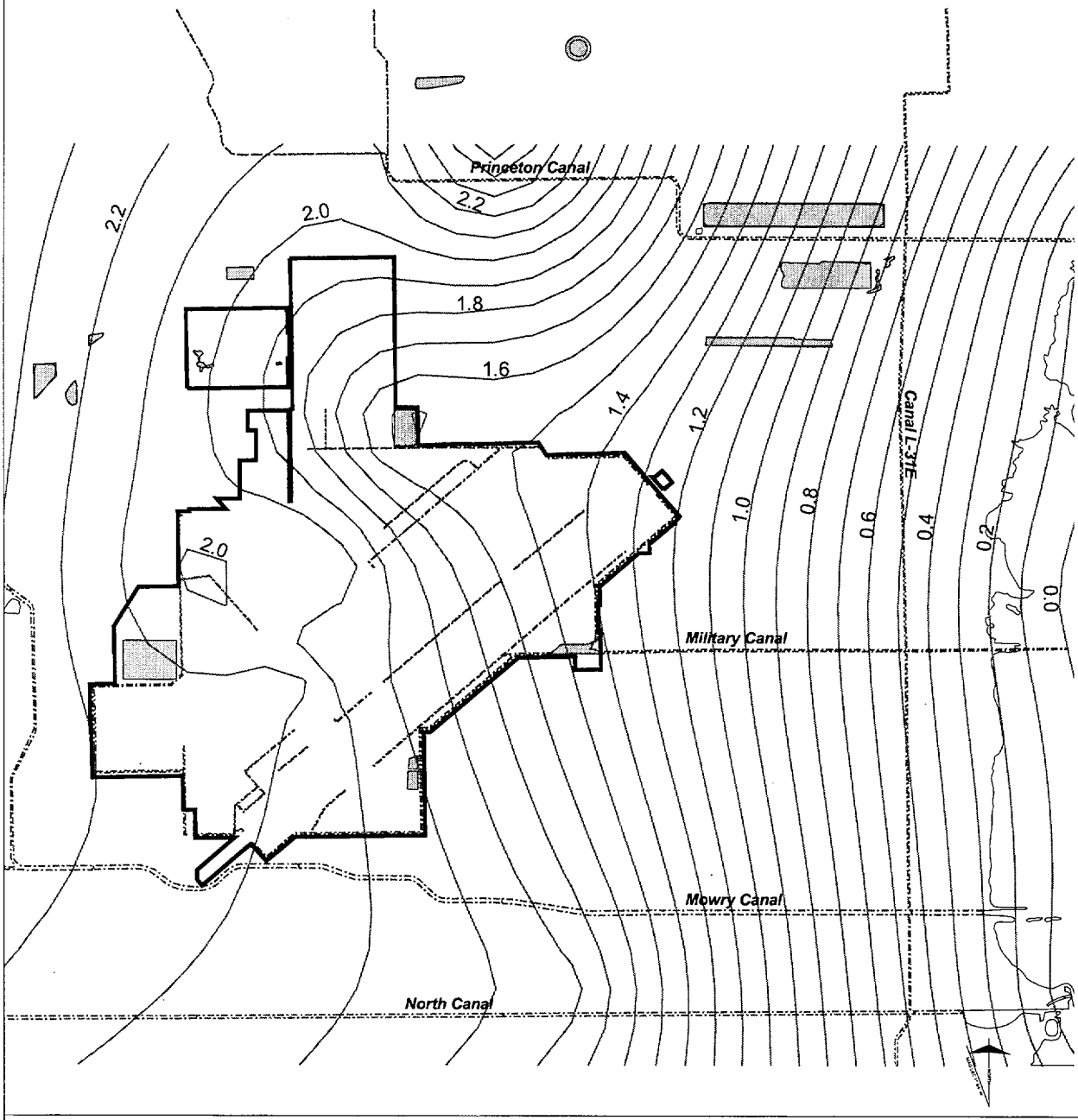


Figure 3.10-3
Observed Hydraulic Heads in the
Former Homestead AFB Area

The existing flow pattern in the aquifer in the former Homestead AFB area was determined by simulation using MODFLOW (**McDonald and Harbaugh 1988**). The simulated steady state groundwater levels in the aquifer are illustrated in **Figure 3.10-4**. The calibrated groundwater levels represent an approximate average condition.

Groundwater flow lines were determined using the three-dimensional particle tracking model MODPATH (**Geraghty & Miller 1997**). Results are shown in **Figure 3.10-5**. The groundwater level contours and flow lines indicate that Biscayne Aquifer groundwater flows generally toward Biscayne Bay from former Homestead AFB, but there are also flows to Mystic Lake and Pine Lake from nearby areas. These lakes are local groundwater discharge areas.

Groundwater flux to Biscayne Bay from Biscayne Aquifer in the former Homestead AFB area was obtained directly from the MODFLOW outputs. The outflow to Biscayne Bay between Princeton and Mowry canals was estimated to be 7,174 acre-feet per year.

The direction and rate of groundwater flow from former Homestead AFB was determined using MODPATH. Fluid particles were placed at selected locations to simulate the flow lines by tracking the movement of the particles. The overall average seepage velocity in the former Homestead AFB area is estimated to be 310 feet per year.

Floridan Aquifer. Underlying the low-permeability clayey marls, clays, and dense limestones of the Pliocene-age Tamiami Formation, and similar low-permeability sediments of the Hawthorn Group, are the formations that constitute the Floridan Aquifer. The Floridan Aquifer is made up of limestones and dolomites. This extensive system is present in all of Florida and parts of adjacent states. It is under artesian pressure, and water levels in deep wells rise above land surface.

Within the area of former Homestead AFB, the top of the Floridan Aquifer system is located approximately 950 to 1,000 feet below mean sea level and is approximately 2,800 feet thick (**USAF 1994a**). The upper part of the system contains confined water with heads of 30 to 50 feet above mean sea level (**Fish and Stewart 1991**). Groundwater within the Floridan Aquifer system usually contains dissolved chloride, sulfate, and TDS at concentrations that exceed primary drinking water standards. In view of the poor chemical quality of water and the depth of the aquifer system, the Floridan Aquifer is of limited usefulness as a source of potable water supply in the ROI.

Groundwater Quality

Groundwater from the Biscayne Aquifer is generally calcium bicarbonate-rich and typically classified as "hard." Reported hardness levels (as $CaCO_3$) range from 230 to 370 mg/L in the area of the former base (**Sonntag 1987**). Dissolved iron concentrations are naturally high in the Biscayne Aquifer and commonly exceed the Florida Secondary Drinking Water Regulations standard (**Sonntag 1987**). Otherwise, water in the Biscayne Aquifer west of the sea water intrusion front appears to comply with Florida standards. Data on toxics is limited to metals; little data are available on concentrations of toxic organics. USGS and DERM routinely monitor the water quality of wells throughout Miami-Dade County. Recent data are summarized in **Table 3.10-15**.

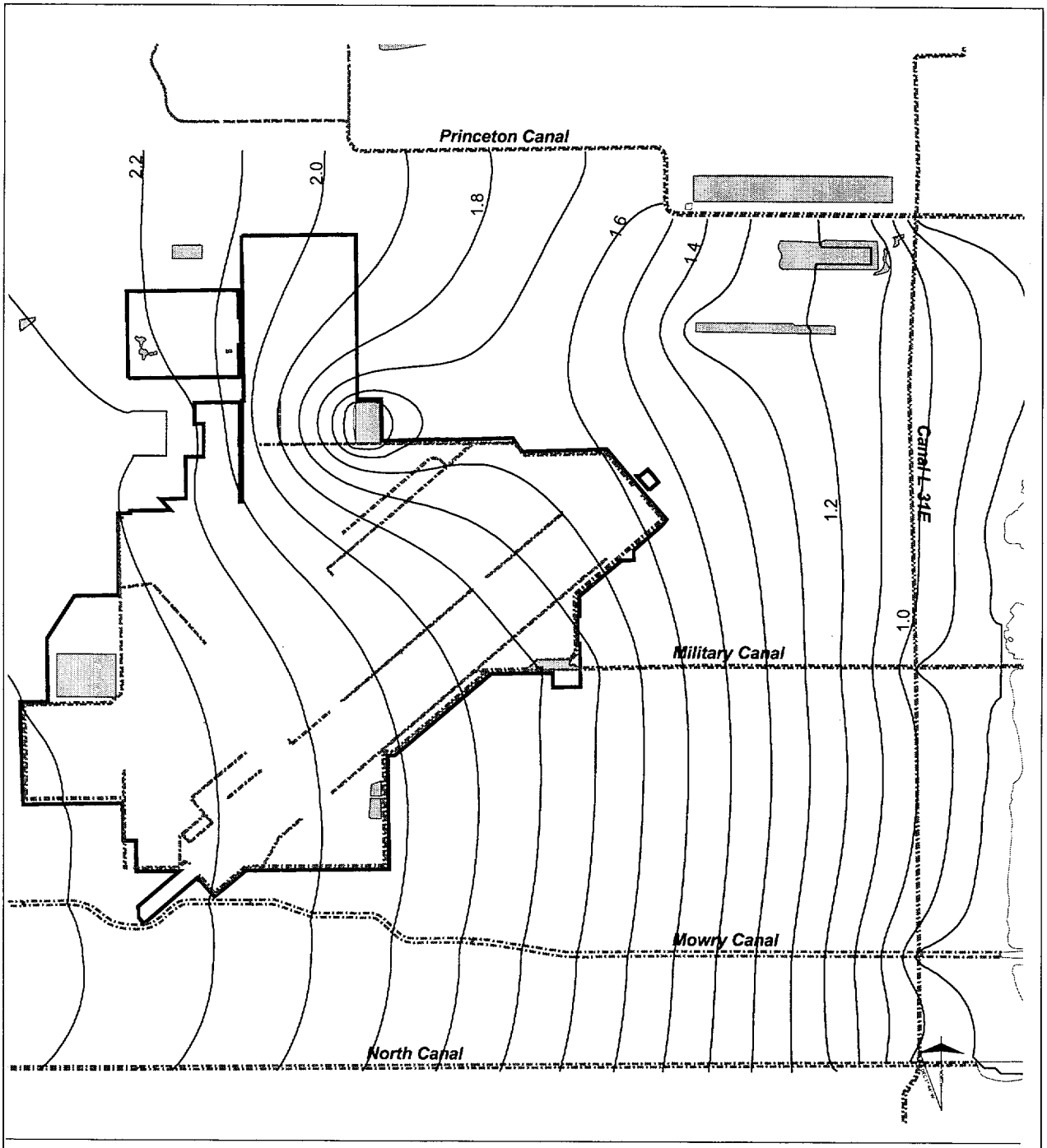
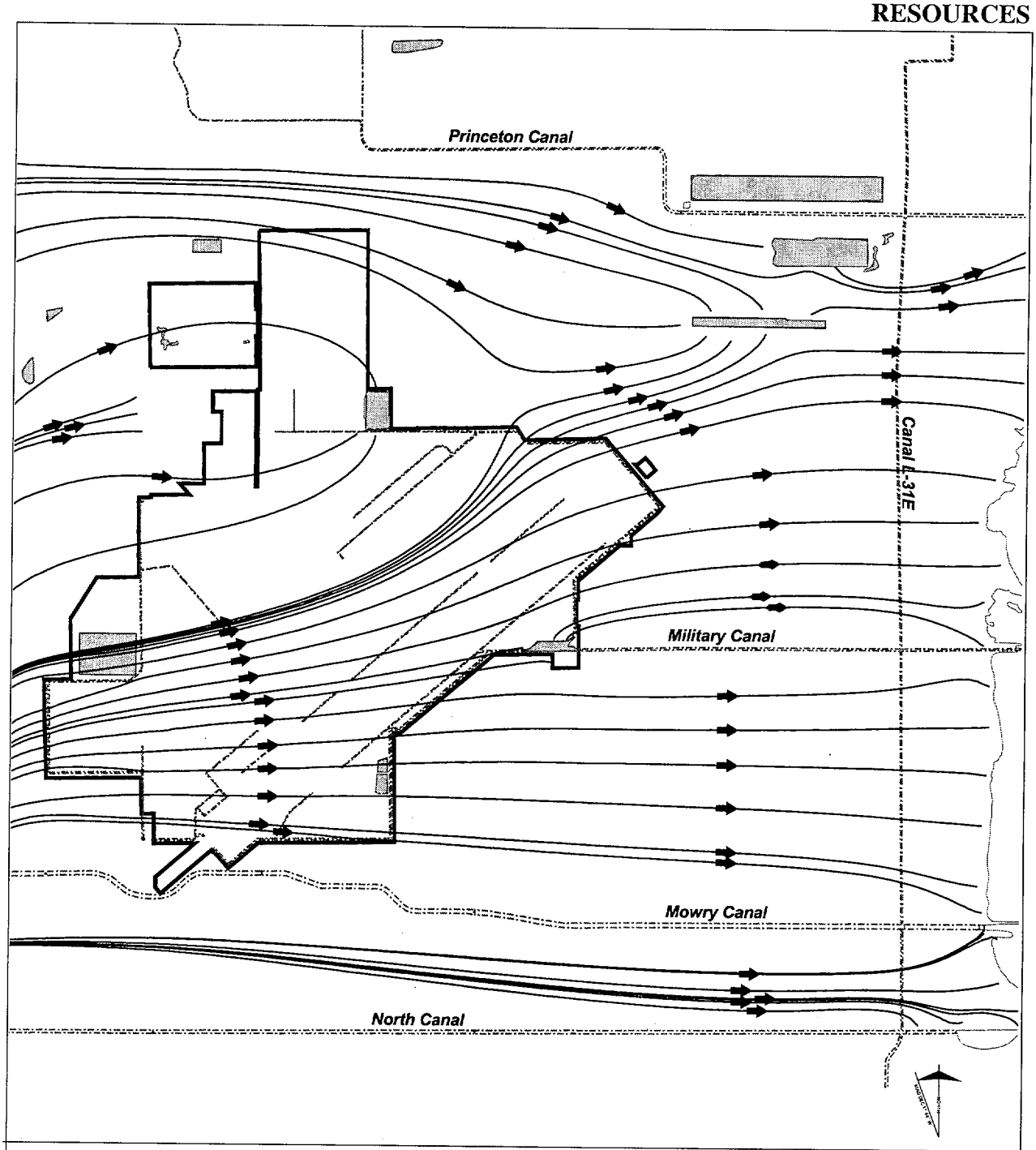


Figure 3.10-4
Simulated Ambient Hydraulic Heads
In the Biscayne Aquifer



LEGEND

- Former Homestead AFB
- Surface Water
- Flow Line
- Canal

-777650705

0.5 0 0.5

Scale in Miles

Source: SAIC

Figures 3.10-5
MODPATH Flow Lines
in Biscayne Aquifer

Table 3.10-15. Groundwater Quality of the Biscayne Aquifer in Miami-Dade County

Parameter	Units	Concentration			
		Minimum	Maximum	Mean	FDEP Class I Criterion
Water Quality Parameters					
Alkalinity (as $CaCO_3$)	mg/L	157	624	263	none
Chloride	mg/L	13	110	42	none
Fluoride	mg/L	0.1	0.5	0.2	2
Hardness (as $CaCO_3$)	mg/L	150	370	249	none
Sulfate	µg/L	0.1	45	14.6	250,000
TDS	µg/L	196	478	333	500,000
Metals					
Arsenic	µg/L	<1	2	1.2	50
Barium	µg/L	<100	100	100	2,000
Cadmium	µg/L	<1	3	1.0	5
Calcium	µg/L	55,000	140,000	90,000	none
Chromium[1]	µg/L	<10	10	—	100
Iron	µg/L	<10	1,900	560	300
Lead	µg/L	<1	6	1.9	15
Mercury	µg/L	<0.1	0.3	0.1	2.0
Magnesium	µg/L	1,700	19,000	5,600	none
Manganese	µg/L	<10	30	9.7	50
Potassium	µg/L	200	6,500	2,400	none
Sodium	µg/L	7,400	77,000	26,600	160
Zinc	µg/L	4	30	7.5	5,000

Source: **Woodward-Clyde 1995.**
Note: [1] All detected observations had the same value.
< less than the detection limit
FDEP Florida Department of Environmental Protection
µg/L micrograms per liter
mg/L milligrams per liter
TDS total dissolved solids

Saline groundwater is found in an area paralleling the coast that transects the base (**USAF 1994a**). This saltwater front is defined by water containing 1,000 mg/L chloride. The saltwater front near southeastern Miami-Dade County apparently moved landward in the early 1970s in response to groundwater pumping. Data obtained from multiple wells at the inland edge of the zone of diffusion indicated that the chloride concentrations increased from less than 200 mg/L at a depth of 80 feet below MSL to greater than 4,000 mg/L at a depth of 95 feet below MSL. Data collected from USGS monitoring wells located at former Homestead AFB showed a significant increase in chloride levels over time (**Montgomery Watson 1997**).

As part of the remedial investigation of OU-11 (Military Canal) (**Montgomery Watson 1997**), the Air Force analyzed organics and metals in the soils and groundwater adjacent to Military Canal (Base Sewage Treatment Plant Sludge/Incinerator Ash Disposal Area), just below the stormwater collection

reservoir at its head. The results are shown in **Table 3.10-16**. With the exception of aluminum, iron, manganese, and arsenic, all parameters were below FDEP standards for remediation. The maximum concentrations of aluminum, iron, manganese, and arsenic were above FDEP Guidance Concentrations. While aluminum, iron, and manganese generally do not cause toxic effects even in high concentrations, arsenic is toxic to many species. The elevated arsenic appears to be isolated to a single well (in the former base ash disposal area). Arsenic concentrations from five other wells in the same area ranged from less than 3.2 µg/L to 12.7 µg/L, all below the FDEP groundwater Guidance Concentration.

The organics results shown in Table 3.10-16 are surprising because compounds such as DDD and phthalates are not normally found in groundwater; they typically sorb to particles and do not leach. Since the wells from which these samples were taken are at least 5 feet deep, and elevated concentrations at this level could only occur by leaching, the data suggest that the samples may have been contaminated by the surface soils through which the wells were sunk. The surface soils in this area have detectable concentrations of DDD and phthalates, and this could explain the observed results. If surface soils contaminated the groundwater samples, this could also have affected the metals results.

The dissolved inorganic constituent loads to Biscayne Bay via groundwater were estimated using the modeled groundwater flow combined with the average groundwater quality of the Biscayne Aquifer in Miami-Dade County (**Woodward-Clyde 1995**). These estimates are crude and are included only to provide a context for the potential magnitude of inputs of pollutants to Biscayne Bay from groundwater sources in general. These estimates may not be representative of inputs in the Homestead area, although the groundwater flows on which they are based are for the area between Princeton and Mowry Canals. The results are presented in **Table 3.10-17**.

Only one study was found that documented the concentration of nitrogen in groundwater discharging to Biscayne Bay (**Meeder et al. 1997**). It reports the results of samples taken from 31 wells drilled in Biscayne Bay in May 1996. The wells were located along five transects between Coconut Grove and Mowry Canal at distances of 50, 200, 400, and 800 meters offshore. Samples were taken from all wells in June 1996 and from wells between Military and Mowry Canals in September 1996 and January, May, and June 1997. Dissolved inorganic nitrogen concentrations in nearshore shallow groundwater ranged from 0.48 milligrams per liter to 0.93 milligrams per liter, with a mean concentration of 0.74 milligrams per liter. Ammonia concentrations were found to be about 92 percent of total dissolved inorganic nitrogen, with a mean nearshore concentration of 0.68 milligrams per liter (range of 0.52 to 0.75 milligrams per liter). The concentrations decreased with distance from shore. Mean dissolved inorganic nitrogen concentrations ranged from 0.74 milligrams per liter in groundwater 50 meters from the shoreline to 0.47 milligrams per liter at 800 meters offshore.

Water Use

The potable water supply system for former Homestead AFB includes wells, a water treatment plant, water storage tanks, and a distribution network. The base had two wellfields, one on base and one off base. The on-base wellfield is no longer in use, and the wells have been abandoned and properly closed. Three off-base wells, located approximately 1.5 miles west of the former base, currently provide water supply to the cantonment and the remainder of the former base. The off-base wells have a permitted pumping rate of 3.9 mgd. The water system is currently operated by Miami-Dade WASD under contract to AFBCA. There are no waste disposal wells on the former base.

Table 3.10-16. Summary of Groundwater Quality Near the Origin of Military Canal

Parameter	Units	Concentration Range	FDEP Criteria Class I Criterion
Organics			
1,2-Dichloroethane	µg/L	<1.0–2.0J	700
Styrene	µg/L	<1.0–7.0J	100
Tetrachloroethene	µg/L	<1.0–3.0	5
Toluene	µg/L	<1.0–2.0	1,000
Trichloroethene	µg/L	<1.0–1.0	5
Xylene, Total	µg/L	<2.0–9.0	10,000
Di-n-butylphthalate	µg/L	0.08J–0.2J	none
Bis(2-ethylhexyl)phthalate	µg/L	0.1J–0.3J	6
p,p-DDD	µg/L	0.041J–0.056J	0.1
Metals			
Aluminum	µg/L	37.4–6,400	200
Antimony	µg/L	nd	6
Arsenic	µg/L	<3.2–63.3	50
Barium	µg/L	5.3–83.0	2,000
Beryllium	µg/L	<0.09–0.16	4
Cadmium	µg/L	nd	5
Calcium	µg/L	85,200–2,200,000	none
Cyanide	µg/L	nd	200
Chromium	µg/L	<0.92–49.00	100
Copper	µg/L	<1.8–30.0	1,000
Iron	µg/L	<1.8–2,900.0	300
Lead	µg/L	<1.3–12.0	15
Magnesium	mg/L	3.15–10.30	none
Manganese	µg/L	0.82–52.00	50
Nickel	µg/L	<1.6–5.7	100
Potassium	µg/L	916–48,600	none
Selenium	µg/L	<3.4–3.8	50
Sodium	mg/L	12.5–59.0	160
Vanadium	µg/L	<1.1–26.0	49
Zinc	µg/L	1.8–65.0	5,000

Source: **Montgomery Watson 1997**.
< less than detection limit
FDEP Florida Department of Environmental Protection
J estimated concentration
µg/L micrograms per liter
mg/L milligrams per liter
nd not detected

Table 3.10-17. Rough Estimates of Dissolved Inorganic Constituent Loads Entering Biscayne Bay via Groundwater Between Mowry and Princeton Canals

Parameter	Concentration (µg/L)	Estimated Load (lbs/year)
Water Quality Parameters		
Alkalinity (as $CaCO_3$)	263,000	5,120,610
Chloride	42,000	817,740
Fluoride	200	3,894
Hardness (as $CaCO_3$)	249,000	4,848,030
Sulfate	14,600	284,262
TDS	333,000	6,483,510
Metals		
Arsenic	1.2	23.4
Barium	100	1,947
Cadmium	1.0	19.5
Calcium	90,000	1,752,300
Iron	560	10,032
Lead	1.9	37.0
Mercury	0.1	1.9
Magnesium	5,600	109,032
Manganese	9.7	188.9
Potassium	2,400	46,728
Sodium	26,600	517,902
Zinc	7.5	146.0

Sources: **Woodward-Clyde 1995**; modeled by SAIC.
lbs pounds
µg/L micrograms per liter
TDS total dissolved solids

3.10.3.2 Projected Baseline Environment

A 7 percent increase in runoff flow by 2015 was projected in connection with projected baseline growth and development in the vicinity of the former base (see Section 3.10.2.2). Given the relationship between surface and groundwater systems, a comparable percent reduction of recharge to the groundwater system could be expected. With the reduction in groundwater recharge, there would be a reduction in both the total volume of groundwater discharged to Biscayne Bay and in the rate of movement of groundwater towards the bay. The complexity of the groundwater system, however, precludes estimation of the magnitude of these changes over such a broad area.

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3.11 BIOLOGICAL RESOURCES

3.11.1 Introduction

This section presents information on the biological resources that occur or potentially occur in, around, and near former Homestead AFB. It describes the three major biological community types that occur in the ROI: estuarine and marine communities, wetland and freshwater communities, and upland and disturbed communities. The section also addresses species of special concern including species designated as threatened and endangered under the Endangered Species Act and other species of concern in south Florida. Scientific names of species discussed in this section are presented in Appendix G.

3.11.1.1 Resource Definition

The estuarine and marine biological community includes the mangrove swamps along the shoreline of Biscayne Bay, seagrass beds in nearshore areas of the bay, the coral reefs east of the Florida Keys, and the open waters of Biscayne Bay.

Freshwater aquatic communities are found in canals, ponds, lakes, and reservoirs. Wetlands are areas that are distinguished by the presence of water, unique soil type, and hydrophytic vegetation.

Upland communities include dry prairie, pineland, and tropical hardwood hammock. Disturbed communities include agriculture lands, grassland, shrub and brushland, exotic plants, and barren and urbanized areas.

Biological resources described in this SEIS include plants and animals that could be affected by the disposal and reuse of former Homestead AFB property.

3.11.1.2 Applicable Laws and Regulations

A variety of laws and regulations apply to biota in southern Florida. Federal laws, regulations, and executive orders generally provide protection to very rare species or species whose range extends over large areas. The most important laws, regulations, and executive orders are summarized below.

Endangered Species Act of 1973 (16 U.S.C. 1531–1544, as amended). The Endangered Species act established measures for the conservation of federally listed plant and animal species listed as threatened or endangered, including the protection of critical habitat necessary for their continued existence. Section 7 of the Act requires federal agencies to consult with the Secretary of the Interior (delegated to the U.S. Fish and Wildlife Service for non-marine species) prior to carrying out any action that might affect a threatened or endangered species.

Migratory Bird Treaty Act (16 U.S.C. 701–715s). This act established protections for migratory birds and their parts (including eggs, nests, and feathers) from hunting, capture, or sale by non-federal entities.

Bald Eagle Protection Act (16 U.S.C. 668–668C). This act protects bald and golden eagles by prohibiting the take, possession, or transportation of these species, dead or alive. The act extends protection to eagle nests and eggs.

Fish and Wildlife Conservation Act (16 U.S.C. 2901–2911). This act authorizes funding for grants aimed at developing and implementing comprehensive state nongame fish and wildlife management plans.

Fish and Wildlife Coordination Act (16 U.S.C. 601–666c). This act provides for conservation and management of fish and wildlife when a proposed action will affect a water body by encouraging cooperation between the U.S. Fish and Wildlife Service and other federal, state, public, and private agencies in developing stocking programs, conducting inventories of wild populations, conserving habitat, and providing public shooting and fishing areas.

Marine Mammal Protection Act (16 U.S.C. 1361–1421h). This act established protection for marine mammals by implementing a moratorium on the take of marine mammals, establishing a program for monitoring for the health and size of populations, and forming a commission to oversee the conservation of marine mammal species.

Federal Water Pollution Control Act (Clean Water Act; 33 U.S.C. 1251–1387). This act established procedures and programs for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters, thus protecting habitat conditions in aquatic and wetland ecosystems.

North American Wetlands Conservation Act (16 U.S.C. 4401–4412). This act supports the management and preservation of waterfowl by funding the implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, United States, and Mexico.

Executive Order 11990, Protection of Wetlands. This executive order established a policy of no net loss of wetland for any federal action that may affect wetlands and to avoid activities in wetlands whenever there is a practicable alternative.

Executive Order 11988, Floodplain Management. This executive order requires federal agencies to avoid, when possible, adversely affecting floodplains with their actions and to avoid supporting floodplain development whenever there is a practicable alternative.

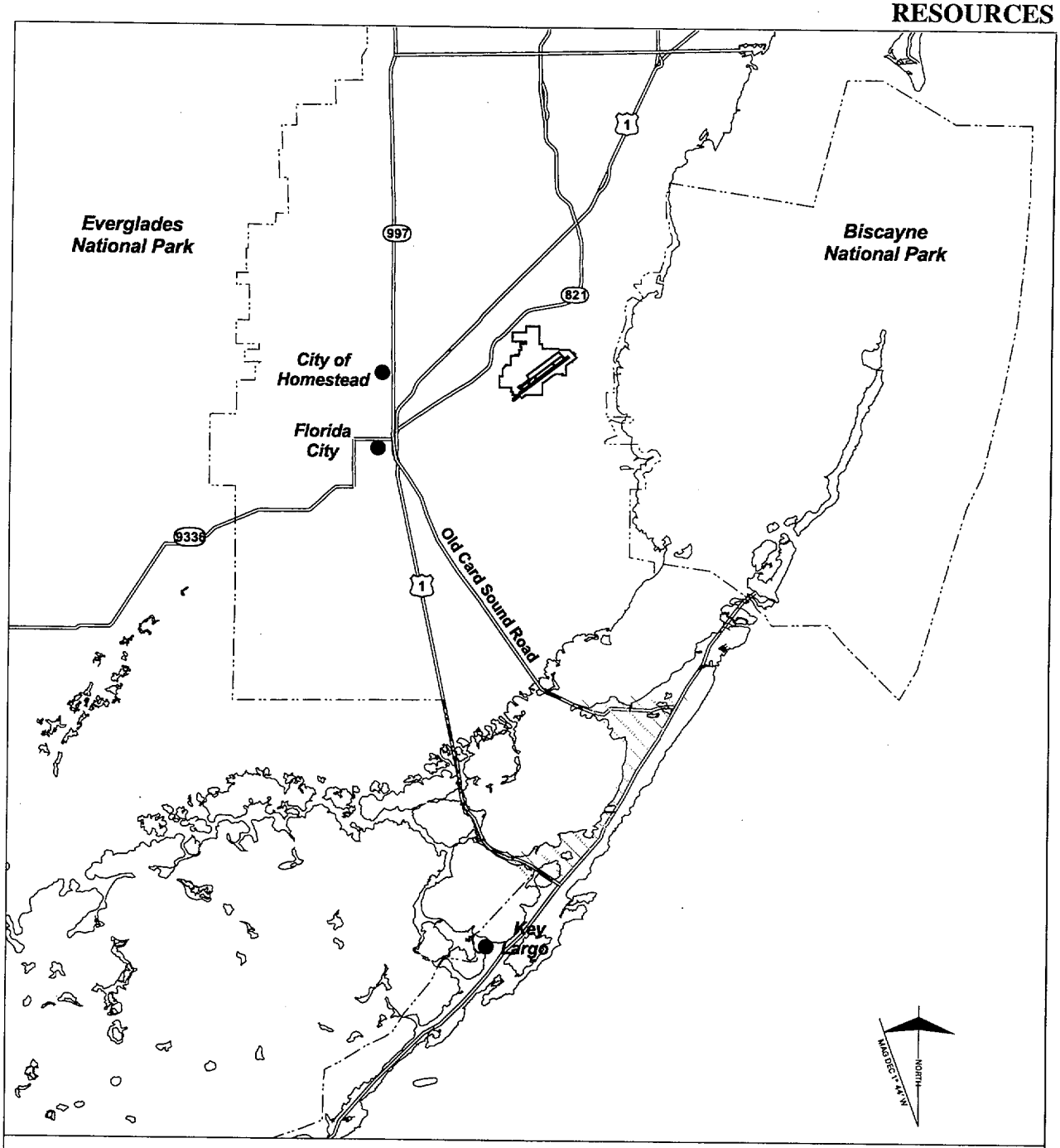
Executive Order 13112, Invasive Species. This executive order requires federal agencies to identify actions that affect the status of invasive species; use relevant programs and authorities to prevent the introduction of invasive species; detect and control populations of such species; provide for restoration of native species and habitat conditions; and not authorize, fund, or carry out actions that are likely to promote the introduction or spread of invasive species.

3.11.1.3 Region of Influence

The ROI for biological resources (**Figure 3.11-1**) includes the area most likely to be affected by construction (Miami-Dade County south of Eureka Drive), areas affected by stormwater runoff from former Homestead AFB (nearshore Biscayne Bay within Biscayne NP), and areas that could be affected by elevated noise levels from aircraft overflights (Biscayne NP, Crocodile Lake NWR, and eastern Everglades NP). Biota in the western part of Everglades NP and Florida Bay are not expected to be measurably affected by reuse of former Homestead AFB.

3.11.2 Biological Communities

A variety of community types occur in the vicinity of former Homestead AFB. The habitats that comprise biological community types are often close to each other geographically, providing a diversity of habitats in relatively small areas. The diversity of habitats provides for a rich flora and fauna. This section contains a brief description of the major biological communities in the ROI. Each major biological



-1956378816

LEGEND

- Former Homestead AFB
- Crocodile Lake National Wildlife Refuge
- National Park Boundary
- Major Road
- U.S. Highway
- State Highway
- City

4 0 4
Scale in Miles

Source: SAIC

Figure 3.11-1
Region of Influence
for Biological Resources

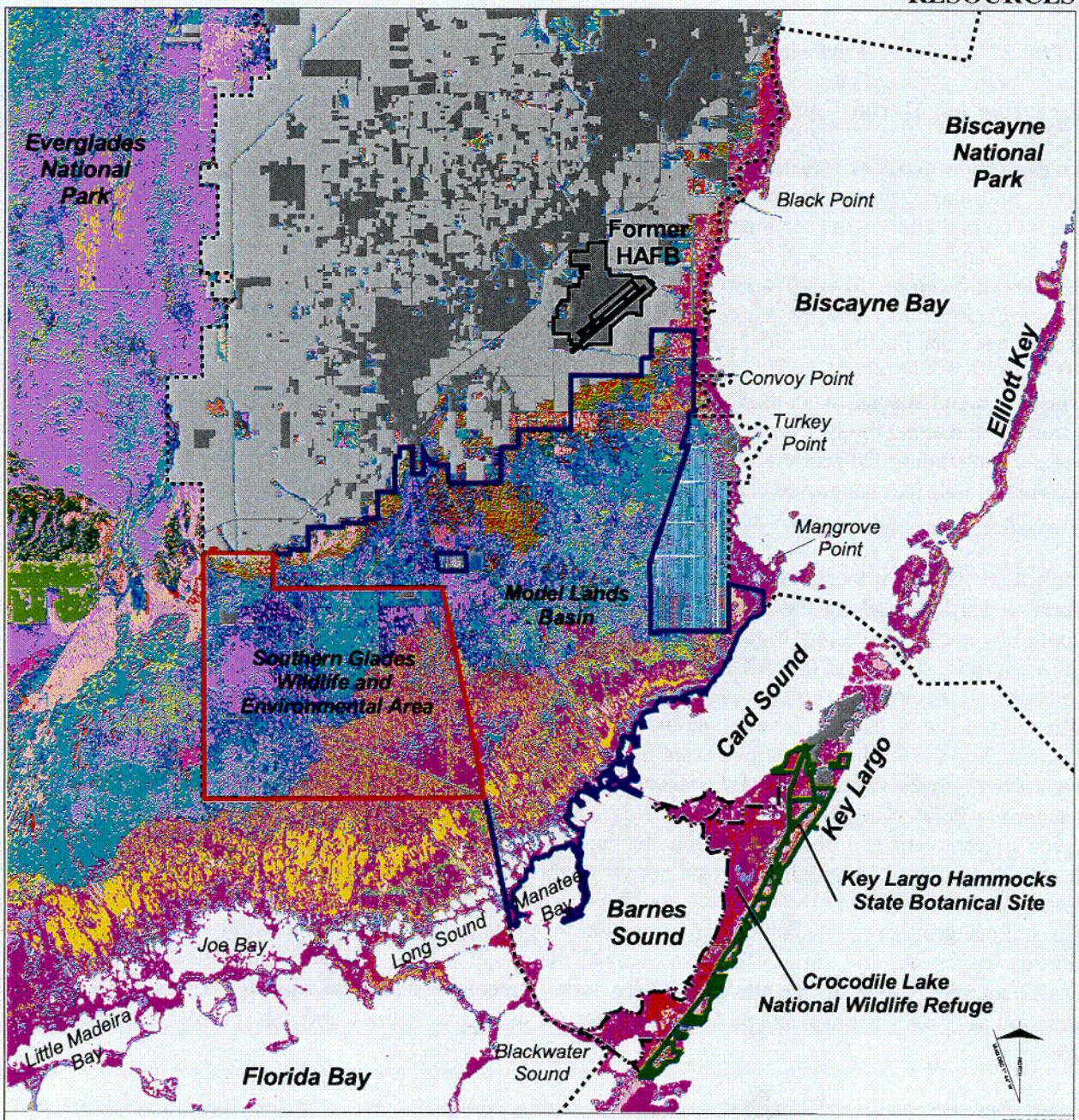
community type is further divided into a series of habitats. **Figure 3.11-2** shows land-cover types in the ROI in 1995. Land-cover types are generally equivalent to habitat types and are used to describe wildlife habitat and associated plant and animal species. The approximate acreage associated with each land-cover type shown in Figure 3.11-2 is presented in **Table 3.11-1**.

Table 3.11-1. Approximate Acreage of Land-Cover Types in the ROI

Land-Cover Types	Acres	Percent of ROI
Mangrove Swamp	56,900	14.4
Grass, Forb, and Cattail Emergent Marsh	8,400	2.1
Sawgrass Marsh	69,300	17.5
Muhly Grass Marsh	60,700	15.4
Salt Marsh, Saltwort/Glasswort, Spikerush, Sand Cordgrass Types	28,350	7.2
Dwarf Cypress Prairie and Cypress Forest	3,600	0.9
Hardwood Swamp	9,300	2.4
Scrub Swamp	17,200	4.4
Open Water[1]	1,500	0.4
Dry Prairies	3,100	0.8
Pineland	5,600	1.4
Tropical Hardwood Hammock	6,800	1.7
Agriculture	73,500	18.6
Exotic Plant Communities	6,400	1.6
Barren and Urban	44,600	11.3
Total ROI	**395,250**	**100.0**[2]

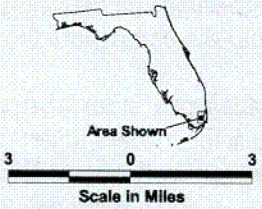
Source: SAIC.
Note: [1] Includes freshwater bodies.
[2] Does not sum due to rounding.

The ROI contains a number of important biological areas, including Everglades and Biscayne NPs. Two other areas south and southwest of former Homestead AFB are the Model Lands Basin and the SFWMD Southern Glades Wildlife and Environmental Area. The Model Lands Basin includes the Southeast Wetlands and the Coastal Wetlands and Hammocks, and the majority of this area is undisturbed freshwater and estuarine wetlands. The dominant freshwater wetlands are wet prairie interspersed with tree islands. Red, white, and black mangroves are the dominant estuarine species. The Southern Glades Wildlife and Environmental Area is southwest of former Homestead AFB and is dominated by wet prairie wetlands with tree islands (hammocks) and thickets. Sawgrass and muhly grass wetlands are common, with some areas dominated by cypress and others by tropical hardwood hammocks (**Florida Game and Fresh Water Fish Commission 1998b**).



LEGEND

- Agriculture
- Urban
- Brasilian Pepper Shrubland
- Melaleuca Forest Compositional Group
- Cattail Marsh Compositional Group
- Cypress Forest Compositional Group
- Dry Prairie & Graminoid Dry Prairie Ecological Complex
- Dwarf Cypress Prairie
- Flooded Cold-Deciduous Shrubland Ecological Complex
- Forb Emergent Marsh & Water Lilly or Floating Leaved Vegetation
- Graminoid Emergent Marsh Group
- Mangroves/Buttonwood
- Mesic-Hydric Pine Forest Group
- Muhly Grass Marsh
- Open Water
- Salt Marsh Ecological Complex
- Saltwort/Glasswort Ecological Complex
- Sand Cordgrass Grassland
- Sawgrass Marsh
- Semi-Deciduous Tropical/Subtropical Swamp Forest & Swamp Forest Compositional Group
- South Florida Slash Pine Forest
- Spikerush Marsh & Black-Needle Rush Marsh
- Tropical Hardwood Hammock



Derived From:
University of Florida 2000, SFWMD 1999b, FDEP 1998a, Miami-Dade County 2000b

Figure 3.11-2
Land Cover Types Within the ROI, 1995

3.11.2.1 Existing Environment

Estuarine and Marine Communities

There are four types of estuarine and marine communities in the ROI: mangrove swamps, seagrass beds, reefs, and open water. The distribution of these communities and the species that comprise them are described in the following sections.

Mangrove Swamps. Mangrove swamps form the majority of the transition between the land of south Miami-Dade County and the waters of Biscayne Bay (see Figure 3.11-2). Mangroves are salt-tolerant, woody trees that inhabit intertidal zones with varying salinity regimes in coastal warm tropical regions.

The four major species in south Florida are red, white, and black mangroves and buttonwood[1]. Mangrove forests found along the Biscayne Bay shoreline consist of tall red and black mangroves (1.5 meters tall or greater) extending 200 meters inland. Directly behind these tall mangroves are dwarf (less than 1.5 meters tall) red mangroves. The dwarf mangroves end abruptly near the human-made canals adjacent to south Miami-Dade County's agricultural and suburban areas (**Smith et al. 1994**).

Only a few stands of mangrove forests are present in the north bay: near the Oleta River State Recreation Area, at Bird Key, along the western shore of Virginia Key, and on Key Biscayne. Mangroves in the south bay are located along Matheson Hammock Park and extend southward to the mainland shoreline adjacent to Barnes Sound (**Sewell 1996**).

The tall red and black mangroves along the western shore of Biscayne Bay were damaged from Matheson Hammock in the north to Mangrove Point in the south by Hurricane Andrew in 1992 (**Smith et al. 1994**). Dwarf mangroves adjacent to these areas were partly defoliated from Northern Black Point to south of Mangrove Point. The shorter red mangroves were apparently unaffected by the hurricane. Presently, areas of regrowth are observed within the mangrove swamps. Abundant new growth regions have become established, although stands are not yet mature.

Coastal mangroves provide habitat and protection for numerous animals. Crustaceans such as amphipods, mysids, copepods, and shrimp feed on decayed mangrove leaves. Juvenile spiny lobsters, crabs, and snails commonly live on the mangrove prop roots (emergent mangrove tree roots). Prop roots often function as nursery habitats and protective refuges for many invertebrate and fish species (**Alleman et al. 1995**).

Sport fish surveys along Rickenbacker Causeway near Miami indicate that the Spanish mackerel is a dependent mangrove species. Young Spanish mackerel use the mangrove environment prior to migrating into the bay, where they spawn offshore as adults (**Alleman et al. 1995**).

Mangrove areas also support fish species that are critical links in the Biscayne Bay food web. Live-bearing (Poeciliidae) and egg-laying (Cyprintodontidae) topminnows regularly inhabit mangrove and estuarine habitats. Egg-laying topminnows include two species of mosquito fish and a mollie; live-bearing topminnows comprise six killifish species. Numerous gobies, blennies, eels, and wormfish also inhabit mangrove areas. In addition, the barracuda, smalltooth sawfish (Pristiformes), and various flatfish species (Bothidae and Cynglossidae) also frequently inhabit mangroves (**Alleman et al. 1995**).

[1] Scientific names of all species are presented in Appendix G.

The American crocodile is a federally and state listed endangered species and is found in sheltered areas such as mangrove creeks, the salt water portion of canals, and coastal ponds. The American crocodile has nested in recent years only along the coast from Florida Bay to Turkey Point and north Key Largo. About half of the nesting sites are in Biscayne Bay, Card Sound, and Barnes Sound. One-third of these nests occur in the cooling canals at the Turkey Point Nuclear Power Plant. An increase in the number of nests has recently been recorded in these areas. In 1987, a total of 29 nests were counted. By 1992, 32 nests were found, with 12 located at Turkey Point (**Alleman et al. 1995**). Another breeding population occurs in Crocodile Lake NWR. In recent years, the range of this species has expanded north of Turkey Point. It has been observed along the western shoreline of Biscayne Bay north of Turkey Point and nests at Chapman Field Park (**Denton and Godley 1999**, **Mazzotti 1999b**, **Mazzotti and Cherkiss 1998**). Crocodiles have recently been observed as far north as Matheson Hammock County Park.

Seagrass Beds. Seagrass beds occupy extensive areas of the nearshore Biscayne Bay (**Figure 3.11-3**). Seagrass beds cover approximately 370 square kilometers of Biscayne NP aquatic habitat (**Ault et al. 1997**) and comprise the dominant vegetation in the area closest to shore that is most influenced by groundwater inflow. In nearshore areas within approximately 400 meters of the shoreline, seagrasses are extensively covered by epiphytes.

Seagrass species commonly occurring in Biscayne Bay include turtle grass, manatee grass, shoal grass, and species of *Halophila* (**Serafy et al. 1997**, **Alleman et al. 1995**). In addition to being a main source of primary productivity, seagrasses provide essential habitat and shelter for a variety of benthic species. Seagrasses require high light intensities and depend on water clarity and shallow depths for their survival (**Alleman et al. 1995**).

A large number (over 850) of invertebrate species inhabit the seagrass beds of Biscayne Bay. These species are commonly trawled by fisherman. Commercially harvested species include stone crabs, blue crab, penaeid shrimp, and the spiny lobster. There are also eight species of blue crabs (*Portunidae*) in more saline waters of the eastern bay, and five species of the blue crab genus (*Callinectes*) that inhabit estuarine regions within the western half of Biscayne Bay (**Alleman et al. 1995**). The Florida spiny lobster depends on seagrass beds for food.

In addition to the many commercially harvested invertebrate species inhabiting the seagrass beds, there is a diverse assemblage of other benthic invertebrate species that are part of the seagrass community. Benthic organisms—clams, worms, bryozoans, and sponges—are bottom dwellers that live in, upon, or attach to the sea floor. These animals are important components of the Biscayne Bay food web. In general, greater numbers and higher diversities of benthic organisms are associated with seagrasses, especially turtle and manatee grass beds (**Alleman et al. 1995**).

Numerous commercially and recreationally important fish in Biscayne Bay are dependent on seagrass beds. Seagrass-dependent species include bonefish, ladyfish, pompano, permit, red drum, spotted seatrout, silver perch, hogfish, and Nassau, red, and black grouper (**Alleman et al. 1995**). Other seagrass bed inhabitants include blennies (Clinidae), conchfish, cowfish and trunkfish (*Lactophrys* spp.), eels (Congridae, Ophidiidae, and Muraenidae), gobies (Gobiidae), jawfish (Opisthognathidae), parrotfish (Scaridae), pearlfish, puffers (Tetraodontidae), sea horses and pipefish (Syngnathidae), toadfish, and wrasses (Labridae). Several species of venomous scorpionfish also inhabit the bay, and a variety of shark species can be found traveling through seagrasses, including lemon, blacknose, sharpnose, and bonnethead. Many common fish species, including grunts (Pomadasyadae) and snappers (Lutjanidae), forage for food in seagrass beds (**Alleman et al. 1995**).

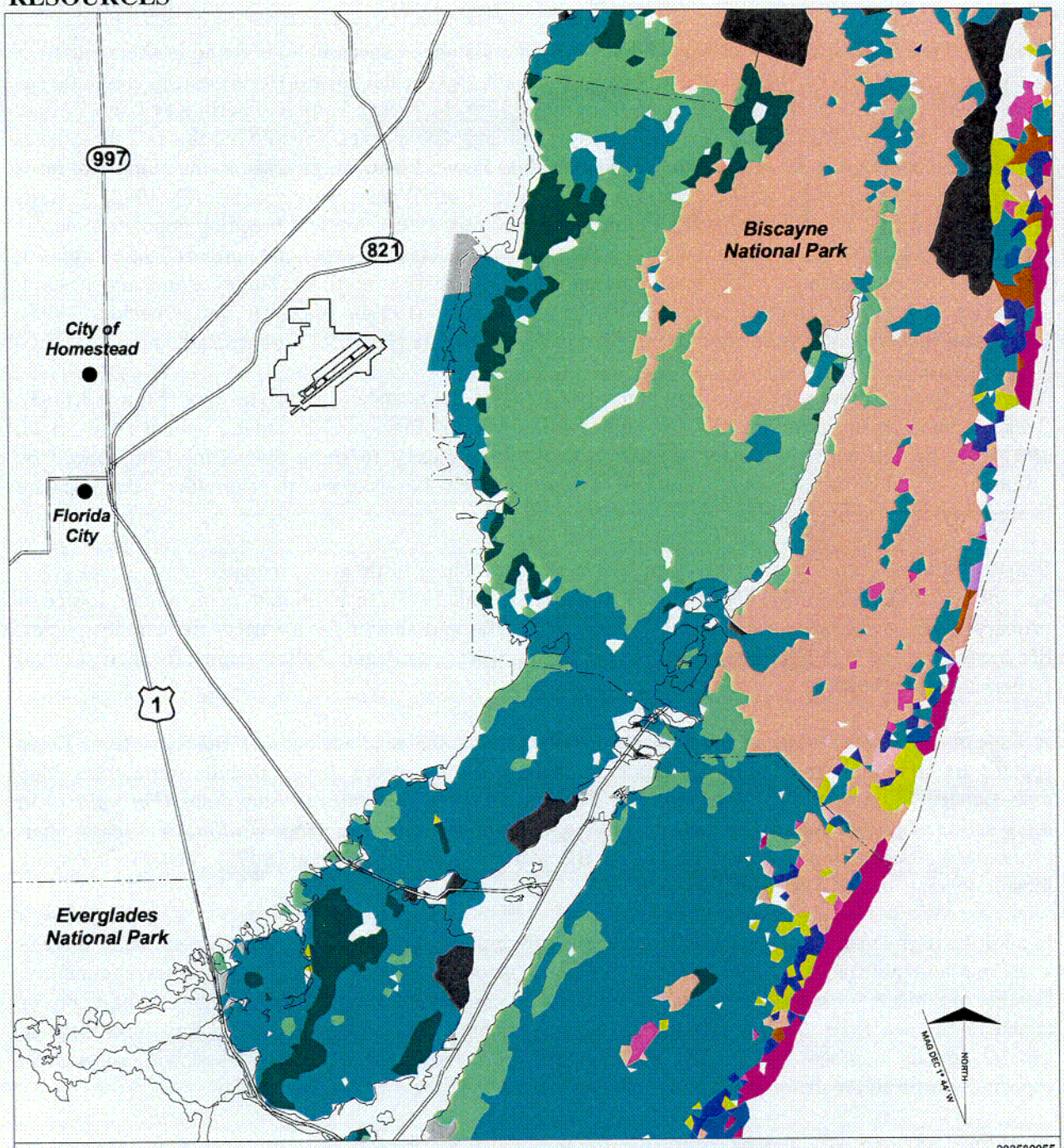


Figure 3.11-3
Seagrass and Reef Habitats in the ROI

C-3

The West Indian manatee is a federally listed endangered species inhabiting both fresh and salt water parts of shallow coastal waters, canals, and rivers of Florida, including Biscayne Bay. The manatee, or sea cow, is a large, herbivorous aquatic mammal that inhabits the warm subtropical waters of Biscayne Bay. Manatees are often observed swimming, feeding, or resting in seagrass areas and near freshwater canal mouths.

Reef. The northern portion of the Florida reef tract lies within Biscayne NP. This tract extends approximately 360 kilometers from Miami south and west to the Dry Tortugas. The Biscayne NP reef complex forms an outer discontinuous barrier reef approximately 7 kilometers offshore of the Florida Keys (Figure 3.11-3) (**Bohnsack et al. 1992**).

Studies performed by Ault et al. (**Ault et al. 1997**) report reef area plants consisting of red and calcareous algae. No other reports identify the species of red, brown, and green algae and other plants that inhabit reef areas in Biscayne NP.

The reef/hard bottom community covers 11 to 13 percent of Biscayne NP, with the greatest coverage in central south bay at depths of 1 to 3 meters (**Alleman et al. 1995**, **Ault et al. 1997**). Reef/hard bottom habitats are inhabited by a diverse assortment of soft and hard corals, anemones, sponges, and other invertebrates (i.e., shrimps, crabs, tubeworms, brittle stars, and sea urchins). Sponges commonly found on hard bottoms include the loggerhead sponge and basket sponge. Sheepswool, yellow, grass, and glove sponges are commonly found in central and south bay. The finger coral, star coral, fire coral, and starlet coral are hard corals also found in hard bottom communities (**Alleman et al. 1995**).

Reef fish are not typical inhabitants of the bay, although some species are known to occur in reef and hard bottom areas. Trawl surveys found several reef fish species in the hard bottom communities of the bay, along with sponges, alcyonarians, and shallow water corals (**Alleman et al. 1995**). Visual censusing of ten study reefs located on the eastern side of the barrier islands identified fish populations in Biscayne NP. Abundant fish in this area were wrasses (Carangidae and Labridae), damselfish (Pomacanthidae), grunts (Haemulidae), parrotfish (Scaridae), and surgeonfish (Acanthuridae). Other fish observed were snapper, gobies, angelfish, butterflyfish, and two species of sea bass (*Epinephelus cruentatus* and *Serranus tigrinus*) (**Bohnsack et al. 1992**).

Open Water. A variety of flora and fauna spend the majority or all of their lives in open water. These species may be free-floating (planktonic) or active swimmers (pelagic).

Planktonic organisms are organisms that float in the water and have poor or no ability to move themselves, drifting with currents. Phytoplankton (plant plankton) are important food producers, converting sunlight to biomass through photosynthesis.

Brand (**1988**) found low chlorophyll concentrations (signifying small populations of phytoplankton) in the open waters of southern Biscayne Bay, with five to ten times higher chlorophyll concentrations in the northern bay. Chlorophyll concentrations were higher near canal mouths than in the open water (**Brand et al. 1991**).

Brand found that the dominant phytoplankton of the bay were small coccoid cells, comprising approximately 80 percent of the north bay phytoplankton and 90 percent of the south bay phytoplankton. The remaining 10 to 20 percent of north bay phytoplankton were composed of centric diatoms. Centric diatoms constitute 1 percent or less of the south bay phytoplankton community. Pennate diatoms and dinoflagellates comprised less than 1 percent of the overall phytoplankton community (**Brand 1988**).

Zooplankton (animal plankton) are the most abundant animals in the marine environment (**Tilmant et al. 1994**). Zooplankton are secondary consumers that graze on phytoplankton, other zooplankton, bacteria, and organic matter. The most common form of zooplankton are copepods, small shrimp-like organisms that generally comprise 95 percent of all zooplankton. Copepods serve as food for larger predators such as shrimp, fish, and baleen whales.

In Biscayne Bay, Brand calculated zooplankton biomass to be two to five times higher in the north bay than in the south bay, with the highest zooplankton biomass in Dumfoundling Bay. North bay zooplankton are composed primarily of various life stages of copepods (nauplii, copepodites, adults). Card Sound had a somewhat higher biomass for all developmental stages. Copepods were most abundant in the fall and winter months (**Brand 1988**).

Shrimp larval stages were most abundant in seagrass beds north of the Julia Tuttle Causeway. As observed for copepods, shrimp larvae were more abundant in the north than in the south bay. Seasonally, shrimp larvae were most abundant in the fall, and juvenile shrimp densities were greatest in winter. Other incidental zooplankton collected during Brand's survey included ostracods and amphipods, larval and juvenile stages of crabs, mollusks (bivalves and other shellfish), juvenile barnacles, and larval fish. Fish eggs and larvae were most abundant in the north bay during the spring and summer seasons.

Biscayne Bay provides a suitable environment for a highly diverse fish community, estimated to consist of at least 512 species. The bay serves as a transition area where tropical and temperate species intermix. Tropical species are most abundant during summer months, while more temperate species are prevalent in winter months. Oceanic fishes are not normal inhabitants of the bay, but occasional strays from deeper ocean water and the Florida Current, such as dolphins, sailfish, and other deep sea fish, have been observed. In addition, fish important to the food chain, such as silversides (Atherinidae), sardines and herrings (Clupeidae), and anchovies (Engraulidae), live in open waters of Biscayne Bay. These species often serve as prey for larger predatory species such as needlefish (Belonidae) and barracuda (Sphyraenidae) (**Alleman et al. 1995**).

Several species of sea turtles are observed in Biscayne Bay, including the federally and state listed endangered or threatened Atlantic green turtle, Atlantic hawksbill turtle, Atlantic ridley turtle, and loggerhead turtle. The diamondback terrapin and the mangrove saltmarsh terrapin have also been observed. The loggerhead turtle occurs regularly in Biscayne Bay and has nested on the outer beaches of some of the keys in Biscayne NP at least since 1995 (see Appendix G for more details). The Atlantic hawksbill turtle is commonly observed in waters overlying bay seagrass beds and it nested along the outer keys of Biscayne Bay in 1981 and 1990. The green turtle is frequently seen foraging in the bay but are not known to have nested in Biscayne NP (**Moulding and Lockwood 1997**). The diamondback terrapin has often been observed nesting on the outer keys and foraging throughout Biscayne Bay, Card Sound, and Barnes Sound. The mangrove saltmarsh terrapin is closely related to the diamondback terrapin. Primarily found in the lower keys, the mangrove terrapin is incidentally found in Barnes Sound.

Surveys from 1990 through 2000 indicate there is a resident population of bottlenose dolphin, which is protected under the Marine Mammal Protection Act, in Biscayne Bay (**Contillo et al. 1997**). A total of 136 individuals were observed between 1990 and 1997, and 120 (88 percent) were sighted more than once. Distribution data indicate that dolphins tend to occur in more open and deeper waters along the central and eastern sides of the bay. Fewer records exist on this species along the western shoreline of south Biscayne Bay (Black Point south to Card Sound), and it has not been observed in the canals that discharge to the bay.

Wetland and Freshwater Aquatic Communities

Wetlands generally occupy a transition zone between aquatic and upland communities and typically have well-developed hydrophytic vegetation, reliable hydrology, and hydric soils. Wetlands are usually shallow. Wetlands east of former Homestead AFB are further designated as areas suitable and not suitable for fill (**Metro-Dade County 1994b**). Freshwater aquatic communities exist in canals, ponds, lakes, and reservoirs. Aquatic habitats generally lack extensive vegetation because of water depth or movement.

The primary data sources used for describing the distribution of wetland and aquatic communities in the ROI include a Florida land-cover map developed from 1994 and 1995 satellite imagery and a number of local studies (**Geraghty & Miller 1993**, **PBS&J 1996c**, **Florida Game and Fresh Water Fish Commission 1998a**).

Land-cover types identified in Figure 3.11-2 provide the basis for the discussion of plants and animals associated with wetland and aquatic communities in the ROI. Local studies provide detailed information on presence, absence, abundance, and other attributes of plant and animal species that is not available from land-cover maps.

The development of the drainage and levee system on and around former Homestead AFB resulted in a reduction of freshwater sheetflow into Biscayne Bay, establishing isolated wetland basins and a shift from freshwater to marine/brackish wetland plant communities between the former base and Biscayne Bay (**Metro-Dade County 1994b**). The changes in wetland hydrology enhanced the invasion of wetlands by exotic species, noticeably Brazilian pepper. Other development and associated clearing and filling also altered the natural distribution and types of wetlands in the ROI. Even without development and other human-induced alterations, wetland and aquatic communities are in constant change due to succession, fire, floods, hurricanes, and sea-level fluctuations.

The satellite imagery used to develop land-cover types shown in Figure 3.11-2 was taken in 1995, so the type and distribution of wetland and aquatic communities represent conditions in the ROI after Hurricane Andrew. As depicted in Figure 3.11-2, most wetland communities occurred west, south, and east of former Homestead AFB. The fresh water marsh and wet prairie community dominated wetland areas west and south of the former base, while the mangrove swamp community occupies the coastal fringe to the east. Smaller, isolated areas of these and other wetland communities are also found within the disturbed communities immediately surrounding former Homestead AFB.

Some of the physical damage to vegetation from Hurricane Andrew (e.g., defoliation and limb breakage) has been, and will continue to be, naturally repaired (**Metro-Dade County 1994b**), but more extensive damage may have led to long-term changes in plant species composition in some areas (**Ogden 1992**, **Loope et al. 1994**, **Roman et al. 1994**). For example, a change in the types of wetland communities within the ROI might have occurred as a result of openings in the canopy and dispersal of exotics (**Ogden 1992**, **Loope et al. 1994**). The spread of exotics within ROI wetland communities is an ongoing concern.

The ROI is within the Everglades Province of the Savannah Division Ecoregion (**Bailey 1980**). Historically, this area likely exhibited a mosaic of communities typical of the south Florida rockland and freshwater marsh ecosystems described in Abrahamson and Hartnett (**Abrahamson and Hartnett 1990**).

National Wetland Inventory (NWI) data are also included in the description of wetland communities when appropriate. NWI acreage is summarized in **Table 3.11-2**. Except on the former base, no formal wetlands delineations have been conducted in the general vicinity.

Table 3.11-2. Approximate National Wetland Inventory Acreage in the ROI

Wetland Type	Acres	Percent of Total Wetlands
Estuarine	208,475	68.1
Riverine	488	0.2
Lacustrine	407	0.1
Palustrine		
Unconsolidated Bottom	636	0.2
Aquatic Bed	3	<0.1
Unconsolidated Shore	19	<0.1
Emergent Wetland	64,175	21.0
Scrub-Shrub Wetland	6,980	2.3
Forested Wetland	11,393	3.7
Open Water	166	<0.1
Emergent/Scrub-Shrub	13,588	4.4
Total Palustrine	*96,960*	*31.6*
Total Wetlands	**306,330**	**100.00**

Source: **USFWS 1991a, 1991b, 1991c, 1991d, 1991e, 1991f, 1991g, 1991h.**

Coastal Salt Marsh. Within the ROI, the coastal salt marsh communities primarily occur south and southeast of former Homestead AFB as a transition zone between the fresh water marsh and wet prairie or mangrove swamp communities. Coastal salt marsh occurs in brackish waters along protected estuarine shorelines where wave energy is low. Comprising approximately 28,350 acres within the ROI, the coastal salt marsh community is dominated by non-woody vegetation, including smooth cordgrass in the lower elevations (e.g., low marsh) and black needlerush in the less frequently inundated areas. Smooth cordgrass and black needlerush are considered indicators of this community. Glasswort, saltwort, saltgrass, sea oxeye daisy, marsh elder, and saltbush occur in the higher elevation (e.g., high marsh) and upper edge of the marsh (**Cox et al. 1994**). The density of this vegetation and the low topographic relief of this community are important attributes for the function of shoreline stabilization.

Tides and salinity drive the composition of the coastal salt marsh community and result in productivity among the highest of any ecosystem. This productivity forms the basis for both marine and terrestrial food webs. The grazing food web within the leaves and stems of marsh vegetation is dominated by herbivorous insects, which in turn supports a predatory food web consisting of spiders, parasitic wasps, and other invertebrates. Below the leaves and stems of marsh vegetation, at the sediment-water interface, exists an array of fauna, including polychaetes, mollusks, and crustaceans (**Montague and Wiegert 1990**). In tidal creeks, shrimp and a variety of fish, including mullet, function as both prey and predator in the food web of this community.

In addition to invertebrates, the coastal salt marsh community serves as nursery habitat for numerous fish and is also the home of salt marsh snakes, amphibians, mammals, and a variety of birds. The fringe of the high marsh is frequented by mammals such as raccoons and marsh rabbits (**Montague and Wiegert**

1990). Common birds of this community include clapper rails, marsh wrens, seaside and sharp-tailed sparrows, herons, egrets, ibises, and northern harriers. Red-breasted mergansers, oystercatchers, terns, and other shorebirds occupy the network of tidal creeks dissecting this community (**Kale and Maehr 1990**).

Fresh Water Marsh and Wet Prairie. The fresh water marsh and wet prairie community occupies part of the Everglades south and west of former Homestead AFB. Freshwater marshes generally occur in topographical depressions, and wet prairies typically occur in shallow, periodically inundated areas. Comprising approximately 138,400 acres within the ROI, this community is dominated by sawgrass and muhly grass marsh, as well as grass, forb, and cattail emergent marsh. Other plant species include pickerel weed, maidencane, arrowhead, fire flag, spike rush, bulrush, white water lily, water shield, and sedges (**Cox et al. 1994**). Saw grass marsh is the predominant association in the Everglades and is typically categorized as dense or sparse. Periphyton, an algal mat growing on the land surface, is a common feature of sparse sawgrass marsh (**Kushlan 1990**).

Prior to development, the wetland community of former Homestead AFB was likely a wet prairie (**FDEP 1996**). The historical development of facilities and infrastructure combined with natural forces, has altered wetland and aquatic communities within former Homestead AFB (**Figure 3.11-4**). Current wetland and aquatic communities in this area are human-made (e.g., canals, borrow pits) or altered in some way (e.g., fill, drainage, invasion by exotic species) (**PBS&J 1997a**). Recent field surveys of former Homestead AFB described species and features of current wetland and aquatic communities (**PBS&J 1997a, SEA 1997, Geraghty & Miller 1993, Hilsenbeck 1993**).

Freshwater marsh is the most extensive (198 acres) wetland type within former Homestead AFB (**PBS&J 1997c**). A recent field survey of these wetlands revealed sawgrass marsh, spikerush-beakrush flats, and cattail marsh. Species reported by this survey include torpedo grass, foxtail, maidencane, smartweed, duck potato, and arrowhead (**PBS&J 1997a**).

Species that occur along the fringes of emergent wetlands on former Homestead AFB are grouped in a mixed wetlands hardwood association that includes Brazilian pepper/Australian pine thickets, Carolina willow, and saltbush. Understory plant species include castor bean, morning glory, sawgrass, sedges, and rushes (**PBS&J 1997a**). This association covers approximately 21 acres of former Homestead AFB (**PBS&J 1997c**).

The fresh water marsh and wet prairie community provides foraging and nesting habitat for a variety of wildlife, including many wading birds. Wading birds within the ROI that rely on wetland include the wood stork, white ibis, little blue heron, tricolored heron, snowy egret, great egret, reddish egret, and roseate spoonbill. Cox et al. (**Cox et al. 1994**) identified the importance of Everglades NP and other wetland systems to these wading birds.

Other animal species of the fresh water marsh and wet prairie include invertebrates, fish, amphibians, reptiles, and mammals. Important small invertebrate species in the food chain of this community include dragonflies, mayflies, fly larvae, mosquitoes, water bugs and beetles, and various gnats and fly species. Important macroinvertebrates include prawns, crayfish, and snails. Common fish species of the Everglades include the mosquitofish, other live-bearing fish, and killifish. A variety of frogs, newts, water snakes, and turtles occupy the fresh water marsh and wet prairie community. The American alligator serves a dominant role in many fresh water marshes as a predator and by the "gator holes" that it creates (**Kushlan 1990**).

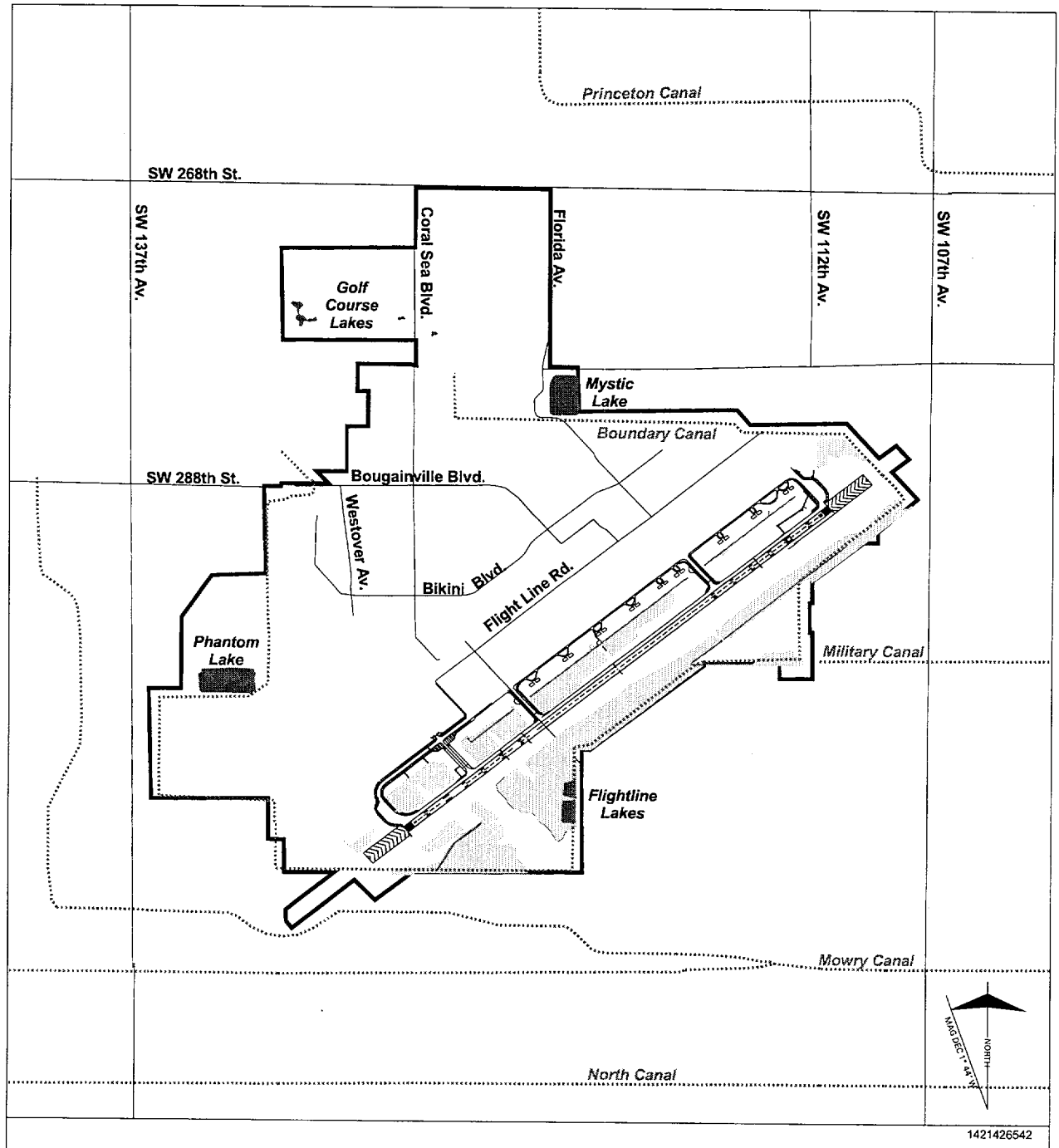


Figure 3.11-4
Wetlands and Surface Water
on Former Homestead AFB

Although wildlife typically use a variety of habitats, many of the wildlife species observed on former Homestead AFB are associated with wetlands for at least part of their life cycle. Plant and animal species observed or recorded on or in the vicinity of the former Homestead AFB by others are included in the appendix.

Raccoon and marsh rabbit are the two most abundant mammal species observed on Homestead ARS (**SEA 1997**). Other mammals observed in the cantonment area include striped skunk, bobcat, opossum, gray fox, gray squirrel, feral dogs and cats, moles, and miscellaneous rodents (**SEA 1996**).

Numerous reptiles and amphibians may also be observed on Homestead ARS. These species include the rough grass snake, corn snake, rat snake, checkered garter snake, Florida slider, Florida soft shell turtle, snapping turtle, American alligator, Florida chorus frog, marine toad, tree frogs, and salamanders (**SEA 1997**). In addition, exotic species such as the Cuban tree frog, giant toad, brown ande, green iguana, basilisk lizard, and spectacled caiman occur on and outside the former base (**SEA 1996**, **Denton and Godley 1999**, **Mazzotti 1999b**).

Birds are the most diverse and abundant wildlife group found on Homestead ARS, with over 70 species observed in the cantonment area. Selected birds that have been reported to occur in this area include the common grackle, mourning dove, loggerhead shrike, common nighthawk, red-bellied woodpecker, red-tailed hawk, American kestrel, burrowing owl, turkey vulture, osprey, barred owl, bald eagle, black-crowned night-heron, anhinga, and great egret (**SEA 1997**). The cattle egret is the most common exotic bird species recorded in wetland habitat on the former base (**Peterla 1999a**).

Freshwater Swamps. Due to the relatively small acreage of individual forest swamp communities (e.g., cypress, hardwood, and scrub) within the ROI, these three communities are discussed together.

As the name implies, cypress is the dominant species in cypress swamps. Bald and pond cypress dominate this community, with the former more common in flowing-water swamps and the latter more typical of still-water swamps (**Ewel 1990**). Cypress is adapted to the fluctuating water levels characteristic of this community. Hardwood swamps provide mast, an important food item for wildlife. Other important features of hardwood swamps include tree cavities, edible foliage, and cover.

A variety of animals use swamp communities within the ROI. Leeches, worms, insects, mites, spiders, crustaceans, and mollusks comprise the base of the swamp food web. The diversity of fish populations is typically greater in swamps associated with rivers and lakes than in isolated swamps because of the connections of swamps to other communities in the former and the periodic drawdowns of the latter. The periodic drawdowns and resulting wet-dry cycles of many still-water swamps provide suitable habitat for several species of frogs. The American alligator and a variety of snake and salamander species also live in swamp communities. Shrews, mice, and raccoons comprise some of the more common swamp mammals. The black bear and Florida panther are restricted to swamps in parts of their range due to loss of suitable upland habitat (**Ewel 1990**).

A variety of birds, including several rare and endangered species, occupy swamp habitat (see Section 3.11.3). Bird species found in cypress and mixed hardwood swamps include the wood stork, short-tailed hawk, bald eagle, and osprey (**Ewel 1990**). Federally listed species (wood stork and bald eagle) and state sensitive species (osprey) are described in greater detail in Section 3.11.3 and Appendix G. Other birds typical of swamp communities include wood duck, swallowtail kite, Mississippi kite, red-shouldered hawk, woodcock, barred owl, chimney swift, hairy woodpecker, pileated woodpecker, Acadian flycatcher, Carolina wren, white-eyed vireo, red-eyed vireo, parula warbler,

prothonotary warbler, hooded warbler, Swainson's warbler, cardinal, and towhee (**Florida Natural Areas Inventory 1990**).

Open Water. Approximately 1,500 acres of open fresh water occur within the ROI. This community type includes inland freshwater lakes, reservoirs, creeks, canals, and rivers, and the cooling canals at Turkey Point. Marine open water in Biscayne and Florida Bays is not included in this community (Figure 3.11-2).

The aquatic community on former Homestead AFB consists of approximately 50 acres of streams and waterways and 30 acres of small surface water reservoirs (**PBS&J 1997c**). Water in the canals in the cantonment area is clear and non-tidal (**SEA 1996**). Canals on former Homestead AFB range from 2 to 40 feet wide and from 4 to more than 10 feet deep (**PBS&J 1997a**). The sides of the canals are nearly vertical and generally support sparse aquatic vegetation; however, parsley fern, a Florida sensitive species, was observed along the walls of the western Boundary Canal (**PBS&J 1997a, SEA 1997**). Filamentous algae and coontail comprise the vegetation on the bottoms of these canals (**PBS&J 1997a**).

Eight borrow pits (lakes) comprise the surface water bodies on former Homestead AFB. These lakes were generally excavated from upland or historical wetlands to provide sources of fill. They range from 10 to 20 feet deep. Plant species associated with these lakes include cattail, torpedo grass, spikerush, Australian pine, saltbush, and poisonwood (**PBS&J 1997a**).

The canals and lakes on former Homestead AFB provide habitat for a variety of native and exotic freshwater and saltwater fish (**SEA 1997**). Mystic Lake was formerly managed for recreational fishing (**PBS&J 1997a**). The presence of largemouth bass, warmouth, bluegill, striped mullet, Florida gar, tarpon, common snook, gizzard shad, walking catfish, sailfin catfish, oscar, midas cichlid, and spotted tilapia is documented in canals on the former base (**SEA 1996**).

The spectacled caiman, native to Mexico and Central and South America, is the most widespread of the New World crocodilians, extremely adaptable in terms of habitat requirements, and common in human-made habitats. The spectacled caiman was reported in the Miami area in the 1950s and 1960s and in the Everglades in 1976 (**Wilson and Porras 1983**).

The spectacled caiman was confirmed in canals on Homestead AFB in 1974 (**Ellis 1980**). Surveys in 1985 found 25 non-hatchlings and 7 hatchlings, and an estimated 30 non-hatchlings were observed in 1998 (16 caiman and 14 unidentified crocodilians assumed to be caiman) (**Mazzotti 1999b**). Presently, there may be up to 70 non-hatchling caiman residing on former Homestead AFB, 40 in canals and 30 in the runway area.

Systematic surveys for caiman outside former Homestead AFB have not been conducted, but caiman are reportedly common in the shallow ditches on the tree farms east of the former base and may occupy most available habitat west of Canal L-31E from Black Point south to Palm Drive (**Hardwick 1999, Wasilewski 1999b**).

Upland and Disturbed Communities

Upland communities include dry prairie, pineland, and tropical hardwood hammock. None of the upland communities found on former Homestead AFB are natural or unaltered (**Hilsenbeck 1993**). Uplands outside of former Homestead AFB include both disturbed and natural communities. Disturbed communities include grassland and agriculture, shrub and brushland, exotic plant, and barren and urban.

These communities, particularly exotic plant communities, may include both wetland and upland areas as a result of natural or anthropogenic disturbance.

Upland communities tend to be the first areas developed in south Miami-Dade County because of the stable foundation offered by the Atlantic Coastal Ridge, the decreased flood risk provided by higher elevations, and restrictions on development in wetlands. As a result, many of the upland areas around the former base are already developed, leaving grassland and wetland communities primarily to the west, east, and south of the former base (**NPS 1997**).

Natural upland communities in south Florida are endangered because lower flood risks and solid limestone foundations make such sites ideal for development (**NPS 1997**, **Florida Natural Areas Inventory 1990**, **Cox et al. 1994**). The ROI contains three types of natural upland communities, covering a total of 15,500 acres: dry prairie, pineland, and tropical hardwood hammock. None of these communities, with the exception of small remnant pinelands, occur on former Homestead AFB (see Table 3.11-1). The remaining natural upland communities in south Miami-Dade County generally occur in undeveloped or protected areas east, south, and west of former Homestead AFB.

The ROI contains four types of disturbed communities: miscellaneous grasslands and agriculture, exotic plant, and urban (see Table 3.11-1). Each of these community types occurs both on former Homestead AFB and in the surrounding area, but detailed data are limited to former Homestead AFB. Detailed information on species composition and distribution is not available for most of the ROI.

The fauna of disturbed communities in general is not well documented, but former Homestead AFB is home, either permanently or temporarily, to numerous birds, amphibians, and reptiles. A field survey by Geraghty & Miller (**1993**) recorded 37 species of birds, six reptile species, six amphibian species, and one species of mammal. Birds observed on the former base are common to urban or agricultural settings. Common birds include the northern mockingbird, mourning dove, common grackle, and northern cardinal. A raccoon was the only mammal observed on the former base during the Geraghty & Miller survey. Other species found on the former base include the American alligator, bald eagle, least bittern, barred owl, black-necked stilt, burrowing owl, feral dog, and bobcat (**PBS&J 1996c**). The house sparrow and European starling are the most common introduced bird species in upland areas on former Homestead AFB. Other introduced species include the canary-winged parakeet, monk parakeet, hill myna bird, and Eurasian collared dove (**Denton and Godley 1999**, **Mazzotti 1999b**).

Dry Prairie. Dry prairie is endemic to Florida and is confined to a few regions of the state. Most representatives of this community have been converted to farm fields or citrus groves, and remaining remnants are disappearing rapidly (**Florida Natural Areas Inventory 1990**). The ROI contains approximately 3,100 acres of dry prairie, none of which occur on the former base (see Table 3.11-1). Dry prairies occur southeast of former Homestead AFB near the Turkey Point Nuclear Power Plant (see Figure 3.11-2).

Dry prairies are native grasslands and shrub-lands occurring on very flat terrain interspersed with scattered cypress domes and strands, bayheads, isolated freshwater marshes, and hardwood hammocks. Palmetto prairies, former pine flatwoods where the overstory trees have been thinned or removed, are included in this category (**Cox et al. 1994**). Dry prairie groundcover is dense and composed of wiregrass, saw palmetto, and other grasses, herbs, and low shrubs (**Florida Natural Areas Inventory 1990**). Other common herbaceous species include broomsedge, runner oak, milkwort, goldenrod, Indian grass, love grass, blazing star, rabbit tobacco, pine lily, marsh pink, musky mint, pawpaw, dwarf wax myrtle, fetterbush, staggerbush, tar flower, gallberry, blueberry, carpet grasses, and various bluestems (**Cox et al. 1994**, **Florida Natural Areas Inventory 1990**). Typical fauna include crested caracara, bobwhite,

sandhill crane, burrowing owl, loggerhead shrike, meadowlark, grasshopper sparrow, least shrew, cotton rat, harvest mouse, spotted skunk, and bobcat (**Florida Natural Areas Inventory 1990**). The crested caracara and burrowing owl are two species for which this community type provides primary habitat (**Florida Natural Areas Inventory 1990, Abrahamson and Hartnett 1990**).

Pineland. The pineland community in the ROI includes approximately 5,600 acres of both south Florida pine flatwoods and south Florida pine rocklands (see Table 3.11-1). Pine flatwoods occur on flat, sandy terrain and have an overstory of longleaf pine on well-drained sites, pond pine on poorly drained sites, and slash pine on sites with intermediate drainage. Pine rockland communities are restricted to outcrops of Miami limestone in Miami-Dade County and the Florida Keys. Development has greatly reduced the extent of this important community and remaining areas are in poor condition because of improper management, geographic isolation, or natural disturbance (**Cox et al. 1994**).

Pinelands are home to a variety of tropical and subtropical plants and animals endemic to south Florida (**Snyder et al. 1990**). Understory and groundcover species in both flatwood and rockland communities include saw palmetto, gallberry, wax myrtle, and a variety of grasses and herbs (**Cox et al. 1994**). Typical pineland animals include the southeastern five-lined skink, ringneck snake, pygmy rattlesnake, red-shouldered hawk, Carolina wren, eastern bluebird, pine warbler, opossum, marsh rabbit, cotton rat, cotton mouse, raccoon, and bobcat (**Florida Natural Areas Inventory 1990**). Rare fauna recorded in pine rocklands include the Florida evening bat, mastiff bat, Florida burrowing owl, gopher tortoise, eastern indigo snake, rim rock crowned snake, and Florida atala butterfly (**Cox et al. 1994**).

State and federal sensitive plant species have been observed at 26 locations on former Homestead AFB, and most of these areas are remnant pine rocklands (**Hilsenbeck 1993, PBS&J 1998b**). Many of the expected pine rockland understory species are missing because they were regularly mowed and maintained, and urban grasses and weeds have colonized these sites (**Geraghty & Miller 1993**). Most populations of listed plant species are irregularly scattered over these pine rockland habitats and are found around the bases of living or dead pine trees or around the edges of limestone outcrops (**PBS&J 1998b**). The Hilsenbeck et al. (**Hilsenbeck 1993**) ecological inventory recorded numerous state-listed plants in pine rockland areas. Two other field surveys (**PBS&J 1998b**) recorded additional species (see Section 3.11.3 for a list of sensitive plant species on former Homestead AFB and Appendix G for a description of these species).

Tropical Hardwood Hammock. This rare community type is characterized as hardwood forest on upland sites in regions where limestone is near the surface or exposed. Tropical hardwood hammocks occur on high ground that rarely floods. This community also requires high humidity levels. Humidity is maintained by a high water table that saturates the porous limestone (**Florida Natural Areas Inventory 1990**). The ROI contains approximately 6,800 acres of tropical hardwood hammock (see Figure 3.11-2) occurring south and southeast of former Homestead AFB.

Tropical hardwood hammocks have very high species diversity. More than 150 species of trees and shrubs are native to this community, and fewer than a quarter of these species occur north of Florida. These species tend to be at the northern limit of their range and are more commonly found in the Neotropics (**Snyder et al. 1990**). Typical plant species include live oak, gumbo-limbo, wild tamarind, pigeon plum, false mastic, poisonwood, mahogany, inkwood, marlberry, lancewood, strangler fig, wild coffee, bustic, black ironwood, paradise tree, satin leaf, redbay, cabbage palm, laurel oak, tallowwood, prickly ash, hackberry, guiana-plum, shortleaf fig, cat's claw, soapberry, sea grape, coffee colubrina, soldierwood, geiger tree, wild pine, Spanish moss, coonties, greenbrier, and fox grape. Typical fauna include the tree snail, Schaus swallowtail, white-crowned pigeon, wood rat, and cotton mouse (**Florida Natural Areas Inventory 1990**).

Miscellaneous Grasslands and Agriculture. This community consists of predominantly low-growing grasses and forbs on intensively managed sites such as improved pastures, lawns, golf courses, road shoulders, cemeteries, and agricultural fields. This is an early successional community encompassing all vegetated sites between bare ground and the shrub and brush stage (**Cox et al. 1994**), as well as actual agricultural lands.

The northern and central portions of former Homestead AFB contained extensively managed ornamental landscapes, including residential lawns, associated plantings, and the 18 hole golf course. While these areas contained a few scattered native slash pine (**Hilsenbeck 1993**), more common arboreal components were weeping fig, silk tree, bischofia, native mahogany, and black olive (**PBS&J 1997a**, **Hilsenbeck 1993**, **PBS&J 1996c**). Ground cover was primarily Bermuda grass, St. Augustine grass, and three-hole grass (**PBS&J 1997a**, **Hilsenbeck 1993**). These areas have not been managed since base realignment and have now grown up in a variety of native and exotic grasses.

Former Homestead AFB is home to an extensive grassland of native and exotic grasses and forbs. This grassland, which is maintained by mowing, is found adjacent to the runway and approach areas on the west, south, and east portions of the base. Hydric species are replacing mesic species on the deeper marls of grassland areas receiving significant amounts of drainage (e.g., southeast of the runway). Adjacent to drainage canals, a 1 meter wide strip of natural vegetation occurs on both sides of the canal. During their ecological survey, Hilsenbeck et al. discovered several rare or endangered vascular plant species living in these strips: locustberry, Porter's spurge, silver palm, Florida white-top sedge, Florida pinewood privet, Krug's holly, small-leaved melanthera, Florida five-petaled leaf flower, Bahama brake fern, and tetrazygia (**Hilsenbeck 1993**).

Exotic Plant Communities. This disturbed community includes sites dominated by exotic (non-native) plants that were either planted or have escaped and invaded native plant communities. Exotic plant species are expanding rapidly in south Florida's wetlands and uplands. Non-native species typically invade disturbed sites, displacing native vegetation, disrupting natural ecosystem functions, and reducing available habitat for endemic plant and animal species (**Schmitz et al. 1997**). The ROI currently contains approximately 6,400 acres of exotic plant communities (see Table 3.11-1).

Problematic exotic species in south Florida include air potato, Australian pine, Brazilian pepper, Burma reed, and melaleuca. Brazilian pepper is the most widespread exotic upland plant species. This species forms monospecific stands, impeding colonization by native species and reducing wildlife habitat. Australian pine, another widespread exotic, colonizes disturbed beach plant communities, preventing reestablishment of native species. Australian pine also displaces understory communities by producing dense litter that smothers most herbaceous vegetation. Burma reed is well established in most Miami-Dade County pine rockland communities. Melaleuca also invades disturbed sites, particularly wetlands with shortened hydroperiods, forming dense, monospecific stands in areas previously devoid of forests. The air potato vine colonizes tropical hardwood hammocks where canopy disturbance has increased ground light levels. This species covers mature trees and shades out understory vegetation (**Schmitz et al. 1997**).

Former Homestead AFB contains several exotic plant communities, the most extensive of which is a non-native forest in the western easement area (**Hilsenbeck 1993**). This forest is dominated by Australian pine, with a mixed understory of Brazilian pepper and the occasional slash pine or native hardwood. Groundcover is composed of brake fern, spurge, and bushy beardgrass (**Hilsenbeck 1993**, **PBS&J 1996c**). The western easement area is the most biologically diverse area on Homestead ARS and has the potential to provide a stable habitat for several listed vascular plant species. A similar Australian pine forest, without the rich diversity of native species, is located near the grenade range (**Hilsenbeck 1993**).

Urban. This community type includes unvegetated areas such as roads, beaches, active strip mines, tilled agricultural sites, and land cleared on sandy soils. Unvegetated sites in urban areas are also included in this category (**Cox et al. 1994**). Barren or urban land comprises about 44,600 acres of the ROI (see Table 3.11-1).

3.11.2.2 Projected Baseline Environment

Estuarine and Marine Communities

Future population growth and associated development could affect estuarine and marine communities by increasing stormwater runoff, resulting in potentially higher nutrient and toxicant loads in Biscayne Bay. The development would probably lead to shorter hydroperiod, but higher volume flows from the canals draining the area and further reduce groundwater inputs, resulting in higher long-term average salinities in the nearshore environment. Higher salinities would reduce the value of the nearshore environment as nursery areas and could reduce the vitality of trees in the mangrove fringe along the bay shore.

Higher nutrient inputs would increase productivity in surface waters, possibly leading to parts of the system being more influenced by phytoplankton than by seagrasses. Higher levels of toxicant inputs could reduce species diversity in the vicinity of canal mouths. The areal extent and magnitude of such changes cannot be quantified because of the lack of detailed information on the flora and fauna of the marine and estuarine ecosystem and limited understanding of the relative importance of the many factors influencing the distribution of flora and fauna.

Wetland and Freshwater Communities

It is assumed that existing areas of jurisdictional wetlands and other waters of the United States in the ROI will not be developed between now and 2015 because of the protections in place that either prohibit or require mitigation for loss of wetlands. Future development is assumed to concentrate in areas of vacant and agricultural lands. As a result, impacts associated with filling of wetlands and other waters of the United States are not expected to be extensive. The majority of wetlands are located east, west, and south of former Homestead AFB. Most of these wetlands are protected by land use designation or ownership (e.g., national park, EEL).

Changes in hydrology and neighboring land use could result in indirect changes to wetlands. Changes in hydrology resulting from development and management of stormwater runoff (loss of overland sheet flow returning to Biscayne Bay) could lower the water table. Developed areas contain more impervious surface than agricultural or vacant land. As a result, stormwater runoff in urban areas tends to be shorter in duration and greater in volume than a similar event in a rural area, with less recharge to local aquifers. Development can also interfere with overland sheetflow, the runoff regime historically responsible for maintenance of coastal wetlands.

Even subtle changes in wetland hydrology could increase invasion of exotic plant species and result in long-term changes in species composition. Changes in hydrology could reduce the distribution and extent of fresh water wetlands in the ROI by 2015. Encroachment on wetlands could also result in invasion of exotic plant species and changes in wetland functionality.

Upland and Disturbed Communities

Future commercial, residential and urban development in the vicinity of former Homestead AFB is assumed to be concentrated on vacant and agricultural uplands. Between 1995 and 2015, an estimated

4,000 acres of agricultural land and 4,500 acres of vacant land are assumed to be developed within the ROI. Vacant land can occur in any of the cover types, but future development is most likely to be concentrated on land currently classified as shrub and brushland, exotic plant communities, or barren and urban. Some natural upland communities exist within the area of potential future development, but it is not possible to determine exactly where specific development will occur. Some of the natural upland communities will probably be lost, but it is not possible to calculate the acreage lost.

The potential future impacts of this projected development on upland and disturbed communities could extend beyond direct acreage losses. Urbanization will likely change hydrologic regimes, increase habitat fragmentation, exacerbate loss of biodiversity, and enhance exotic species invasion. Habitat fragmentation would be expected to reduce the size of habitats and cause habitat patches to become increasingly isolated from each other. When patch size falls below the minimum area needed to support a viable population of a particular species, that species will disappear from the patch. As isolated patches become increasingly distant, individual animals will not be able to move across patches to reproduce with other members of the species, genetic variability will be lost, and the presence of the species across all the patches could be jeopardized. Habitat fragmentation is also accompanied by proportional increases in edge environments. Edge environments in and near urban areas are associated with increased mortality and decreased reproduction resulting from changes in habitat, encounters with humans and domesticated animals, and vehicle collisions (**Cox et al. 1994**).

Invasive exotic species will continue to displace native vegetation, disrupt natural ecosystems, and reduce habitat for endemic species. SFWMD, other government agencies, and private landowners are currently involved in eradication efforts against melaleuca, Brazilian pepper, and Australian pine (**Ferriter et al. 1997**). These efforts will continue, but continued disturbance and development of south Florida environments will encourage the spread of invasive exotic species.

3.11.3 Threatened, Endangered, and Special-Status Species

This section provides a summary of the status of species of special concern. More detailed information appears in Appendix G. This section addresses federally listed threatened and endangered species; state listed threatened, endangered, and sensitive species; and other species of concern that occur or have the potential to occur in the ROI. The determination of species to include in this section was based on discussions with biologists from the U.S. Fish and Wildlife Service, Florida Game and Fresh Water Fish Commission, and Biscayne and Everglades NPs. Additional information regarding species to include was derived from pertinent literature.

Much of the information regarding species of concern was derived from the existing literature and from discussions with experts as referenced in Appendix G. In addition, sensitive species surveys were conducted for this SEIS, including surveys for sensitive plants, the American crocodile, eastern indigo snake, wood stork, other sensitive species of wading birds, rim rock crowned snake, southwestern American kestrel, burrowing owl, and breeding birds such as the mangrove cuckoo, Cuban yellow warbler, and Florida prairie warbler (**Denton and Godley 1999**, **Mazzotti 1999b**). The methods, areas surveyed, and results of these surveys appear in Appendix G.

3.11.3.1 Existing Environment

Federally Listed Species

A total of 18 federally listed threatened or endangered species occur or have the potential to occur in the ROI (**Table 3.11-3**) (**USFWS 1998b**). All federally listed species are also listed by the State of Florida (**Florida Game and Fresh Water Fish Commission 1997**). Federally listed species include two plants, one invertebrate, five reptiles, six birds, and four mammals. **Figure 3.11-5** shows critical habitat for federally listed species in the ROI.

Table 3.11-3. Federally Listed Threatened and Endangered Species Potentially in the ROI

Common Name	Scientific Name	Status		Areas of Occurrence
		Federal	State	
Plants				
Small's milkpea	*Galactia smallii*	E	E	Endemic to pine rocklands in Miami-Dade County. Observed in three areas on disposal land but not on Homestead ARS or along Military Canal; potential in other locations in Homestead area.
Deltoid spurge	*Chamaesyce deltoidea*	E	E	Endemic to pine rocklands in Miami-Dade County. Not recorded at remnant pine rocklands on former Homestead AFB, but known from pine rocklands in the Homestead area.
Invertebrates				
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	E	Occurs in tropical hardwood hammocks on the keys of Biscayne NP and north Key Largo, with an introduced population in the Deering Estate County Park. Appropriate habitat lacking on former Homestead AFB and between the former base and Biscayne Bay.
Reptiles				
American crocodile	*Crocodylus acutus*	E	E	Occurs in coastal areas of Dade, Monroe, Collier, and Lee counties in south Florida. Recently observed in east end of Military Canal and mangrove swamps along Biscayne Bay shoreline, Crocodile Sanctuary in northern Florida Bay at Little Madeira and Joe Bays. Does not occur on disposal land or Homestead ARS.
Eastern indigo snake	*Drymarchon corais couperi*	T	T	Occurs throughout Florida and in parts of Georgia. Recently observed near Military Canal and Florida City. Potential habitat along nearby canals, mangrove swamps, freshwater wetlands, and vacant land with marginal habitat on disposal land and Homestead ARS.
Green Sea Turtle	*Chelonia mydas mydas*	E	E	Occurs worldwide and nests and feeds in most Florida coastal waters. Known to feed on aquatic vegetation in Biscayne Bay and the reefs outside the bay. Not known to nest at Biscayne NP.
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E		Occurs worldwide including Florida coastal waters, as well as other Gulf coast and Atlantic coast states. Known to have nested on Soldier key in Biscayne NP in 1981 and 1990. No nesting recorded from 1990 through 1998.
Loggerhead Sea Turtle	*Caretta caretta*	T	T	Occurs worldwide and nests in coastal areas from Louisiana to Virginia. Most common sea turtle to nest at Biscayne NP. Nests on keys near eastern boundary of the park. Has nested successfully from at least 1995 through 1998 at Biscayne NP.

Common Name	Scientific Name	Status		Areas of Occurrence
		Federal	State	
Birds				
Bald eagle	*Haliaeetus leucocephalus*	T	T	Nests throughout most of North America including most of Florida. Nests in the keys of Biscayne NP. Forages along mangrove swamps and occasionally occurs on disposal land and Homestead ARS.
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E	E	Currently exists in three populations in the Shark River slough areas in the Everglades; potential habitat generally lacking outside of the Everglades.
Piping plover	*Charadrius melodus*	T	T	Winters along the Gulf of Mexico and the Atlantic coast. Very rare wintering species in Miami-Dade County. Very infrequent on the beaches of the Biscayne NP keys. Not expected in the Homestead area due the lack of suitable habitat.
Roseate tern	*Sterna dougallii*	T	T	The Caribbean population nests in the Florida Keys and Dry Tortugas. A marine bird that may forage along the mangrove swamps; is very rare in Biscayne NP. Suitable habitat lacking in Homestead area and it is not expected to occur on disposal land or Homestead ARS.
Snail kite	*Rostrhamus sociabilis plumbeus*	E	E	Current distribution in Florida is the central and southern portions of the state from Kissimmee Chain-of-Lakes south to the Everglades. Nesting sites and migratory corridors west of Homestead. Occasional transient birds could be observed in Homestead area.
Wood stork	*Mycteria americana*	E	E	Nests throughout most of Florida, as well as parts of Georgia and South Carolina. Most winter in south Florida. Forages and roosts in small numbers along mangrove swamps and in wetlands between mangrove swamps and Homestead ARS mostly during the winter. Very infrequent on disposal land and Homestead ARS. Nests in the Everglades west and north of Homestead.
Mammals				
Florida panther	*Felis concolor coryi*	E	E	Only known remaining populations are centered in Big Cypress Swamp and Everglades region. Center of population in Collier and Hendry counties. Also known from land to the south of former Homestead AFB. No appropriate habitat on disposal land or Homestead ARS.
West Indian manatee	*Trichechus manatus*	E	E	Present distribution includes the coasts and rivers of Florida and Georgia. Reported from shoreline of mangrove swamps and portions of Military Canal, but unlikely in canals on disposal land or Homestead ARS.
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	E	E	Known from early successional to mature tropical hardwood hammocks in north Key Largo. Historic range only on Key Largo.
Key Largo woodrat	*Neotoma floridana smalli*	E	E	Known from mature tropical hardwood hammocks in north Key Largo. Historic range only on Key Largo.

Source: **Florida Game and Fresh Water Fish Commission 1997; USFWS 1998b; PBS&J 1998b; Mazzotti 1999b; Denton and Godley 1999; Moler 1999; BNP 1995, 1998; Mansfield 1996; Moulding and Lockwood 1997; Lockwood et al. 1999; DOI 1997; Howitt 1996; Lockwood 1999b; Ferro 1999a.**

E endangered

T threatened

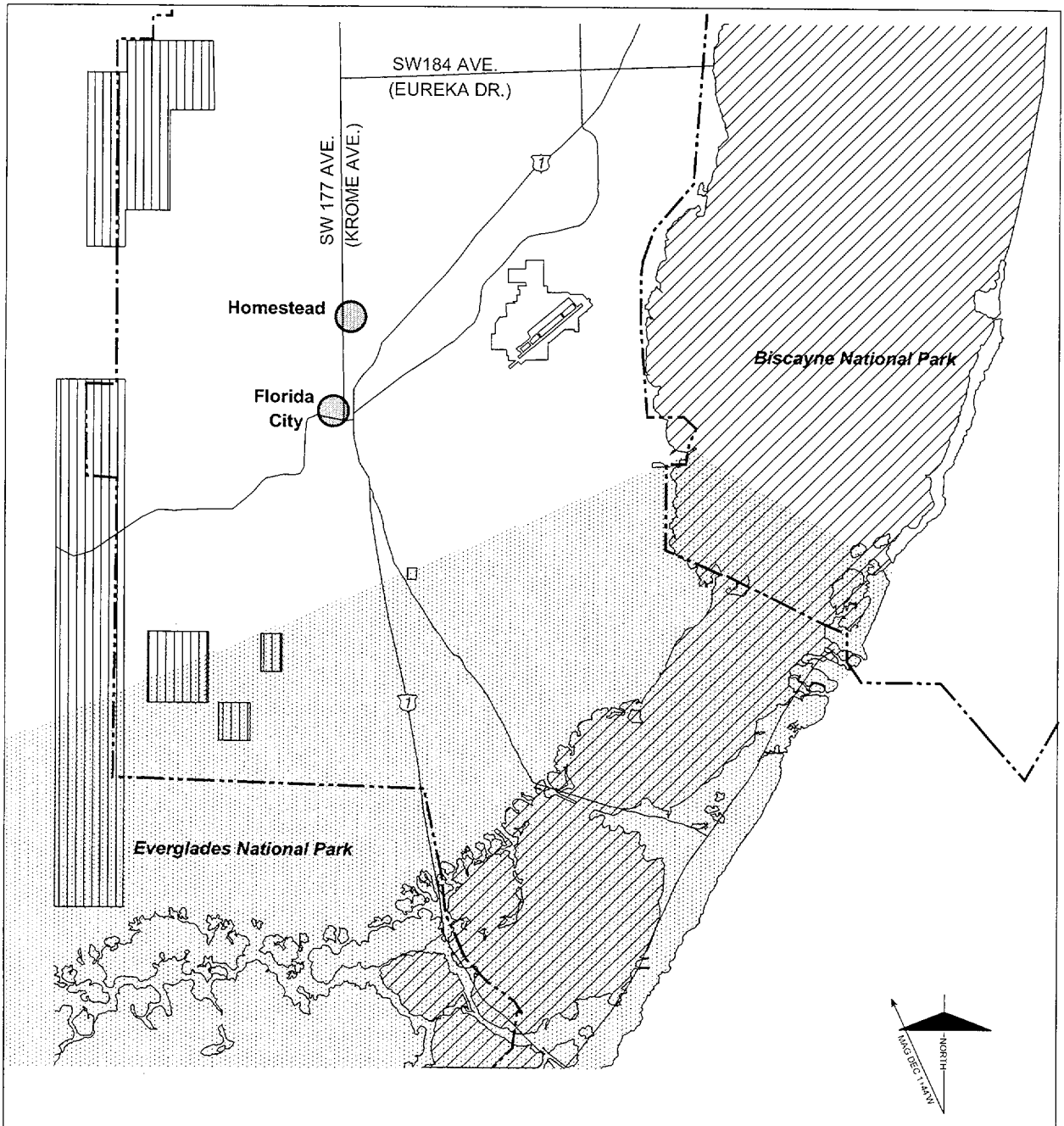


Figure 3.11-5
Federally Designated Critical Habitat
in the Area of Former Homestead AFB

State Listed Species

A total of 29 species that occur or have the potential to occur in the ROI are listed as threatened or endangered by the State of Florida but not listed by the federal government (**Rodgers et al. 1996**, **Florida Game and Fresh Water Fish Commission 1997**). The state-listed threatened and endangered species include 24 plants, one reptile, and four birds (**Table 3.11-4**). **Figure 3.11-6** shows the 12 areas where sensitive plant species were observed on the disposal property. **Table 3.11-5** lists plants that were observed during the 1992–93 and 1997 surveys of disposal property at former Homestead AFB, and during 1992–93 and 1996–97 surveys of Homestead ARS.

State Species of Special Concern

State species of special concern include four plants and 29 birds (**Table 3.11-6**). More details regarding these species appear in Appendix G.

Neotropical Migrants

In Florida, neotropical migrant birds receive special attention from state and local government agencies. DeGraaf and Rappole (**1995**) define neotropical migrants as Western Hemisphere birds that breed north of and winter south of the Tropic of Cancer. Of the 361 species of neotropical migrants identified by DeGraaf and Rappole, 27 have been recorded on selected breeding bird survey routes within the ROI. **Table 3.11-7** identifies the population trends for neotropical migrants recorded from 1966 through 1996 on breeding bird survey routes within the ROI. The breeding bird survey is a highly standardized roadside survey consisting of randomly distributed routes of 50 three-minute stops (**Robbins et al. 1989**). Surveys begin one-half hour before local sunrise, and at each stop all birds heard or seen within one-quarter mile are identified. The breeding bird surveys are the primary method by which USFWS monitors songbirds and other nongame species (**Robbins et al. 1989**).

Trend analysis of breeding bird survey data (Table 3.11-7) reveals that selected populations of forest-dwelling neotropical migrants have declined, especially during the 1980s (**Price et al. 1995**). Some of these population declines are likely due to alterations in tropical winter habitat (e.g., deforestation) (**DeGraaf and Rappole 1995**), but may also be due to, or exacerbated by, alterations in breeding habitat (e.g., forest fragmentation) within the United States.

Hunter et al. (**Hunter et al. 1993**) identify important habitats for neotropical migrants in the southeast United States, including the mangrove swamps and tropical hardwood communities characteristic of the ROI (see Figure 3.11-2). Using breeding bird survey data, Audubon Christmas Bird Count data, and other criteria, the U.S. Fish and Wildlife Service (**USFWS 1995**) identified migratory nongame birds of management concern in the United States. Of the species of neotropical migrants listed in Table 3.11-7, only the yellow-billed cuckoo has been designated a species of management concern.

Land bird species observed at Biscayne NP have been recorded sporadically from 1973 through 1998 (**BNP 1998**). A total of 87 species of neotropical migrant land birds have been recorded, including 28 species of warblers, 8 species of flycatchers, and 6 species of vireos (**Table 3.11-8**). The relative abundance of these species was determined based on the number of observations. Thirty-nine species (45 percent of the total) were rarely observed (10 or fewer times) and 29 species (33 percent) were uncommon (11 to 100 observations). Common (12 species) and abundant (7 species) species comprised the remaining species. Common and abundant species included the belted kingfisher, white-eyed vireo, black-whiskered vireo, blue-gray gnatcatcher, black-throated blue warbler, prairie warbler, American redstart, and ovenbird. Some of the common to abundant species are sensitive species in Florida (black-whiskered vireo, American redstart, prairie warbler) and are also of conservation concern range-wide (black-throated warbler and prairie warblers) (**Meuhter 1998**).

Table 3.11-4. State Threatened and Endangered Species Known or Potentially Occurring in the Homestead Area

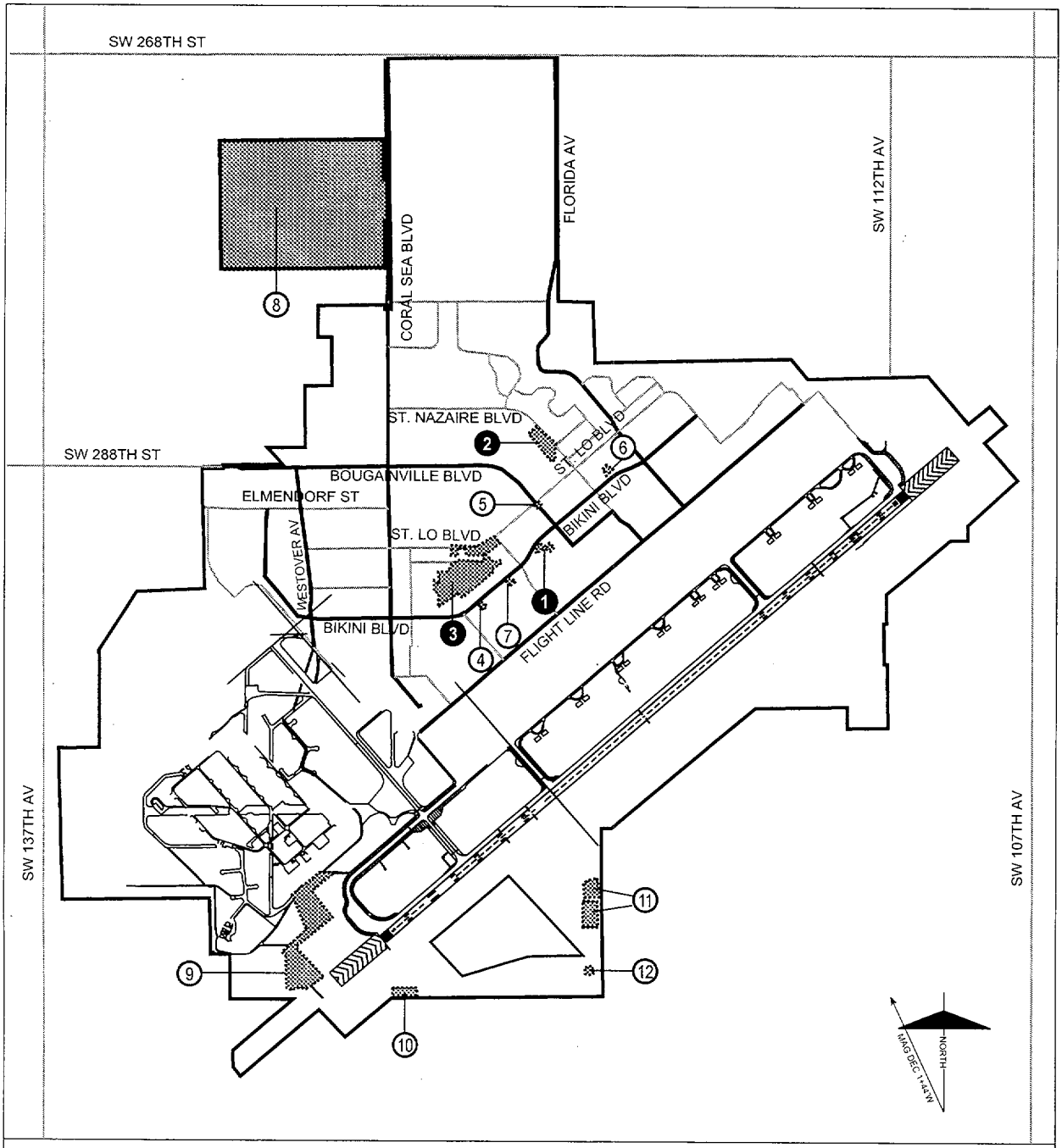
Common Name	Scientific Name	State Status	Areas of Occurrence
Plants			
Bahama brake	*Pteris bahamensis*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Bahama sachsia	*Sachsia polycephala*	E	Occurs in south Florida and a few plants observed on disposal land and Homestead ARS; potentially in other areas.
Blodgett's wild mercury	*Argythamnia blodgettii*	E	Endemic to pine rocklands in Miami-Dade County and the Florida Keys. Four plants along Military Canal. Not observed on disposal land or Homestead ARS.
Carter's small-flowered flax	*Linum carteri*	E	Occurs in south Florida. Found only on disposal land; potentially in other areas.
Christmas berry	*Crossopetalum ilicifolium*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Florida lantana	*Lantana depressa*	E	Occurs in south Florida and scattered plants on disposal land and Homestead ARS; potentially in other areas.
Giant wild pine	*Tillandsia utriculata*	E	Occurs in south Florida. One plant from one location on disposal land; potentially in other areas.
Krug's holly	*Ilex krugiana*	E	Occurs in south Florida and found in moderate to high density on Homestead ARS; potentially in other areas.
Locustberry	*Byrsonima lucida*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.
One-nerved ernodea	*Ernodea cokeri*	E	Occurs in south Florida. Observed in two areas only on disposal land; potentially in other areas.
Pineland jacquemontia	*Jacquemontia curtissii*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Pineland noseburn	*Tragia saxicola*	E	Occurs in south Florida. Small number of individuals from one area in disposal land; potentially in other areas.
Pink pine orchid	*Bletia purpurea*	T	Occurs in south Florida. Known only from disposal land; potentially in other areas.
Porter's spurge	*Chamaesyce porteriana*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Rockland painted-leaf	*Poinsettia pinetorum*	E	Occurs in south Florida. Very few individual on disposal land and Homestead ARS; potentially on other areas.
Royal palm	*Roystonea elata*	E	Occurs in south Florida. One plant on disposal land; may have been from cultivated stock.
Sand flax	*Linum arenicola*	E	Occurs in south Florida. Found only on disposal land; potentially in other areas.
Sea lavender	*Tournefortia gnaphalodes*	E	A seashore shrub that occurs from the Florida Keys north to Brevard County. Two plants at eastern tip of Military Canal. Not observed on disposal land or Homestead ARS.
Silver palm	*Coccothrinax argentata*	E	Occurs in south Florida. Scattered plants on disposal land and Homestead ARS; potentially in other areas.
Small-leaved melanthera	*Melanthera parvifolia*	E	Occurs in south Florida and fairly widespread on disposal land and Homestead ARS; potentially in other areas.

Common Name	Scientific Name	State Status	Areas of Occurrence
Tetrazygia	*Tetrazygia bicolor*	T	Occurs in south Florida and in fairly larger numbers on disposal land and Homestead ARS; potentially in other areas.
Wedgelet fern	*Sphenomeris clavata*	E	Occurs in south Florida. Known only from Homestead ARS; potentially in other areas.
West Indian mahogany	*Swietenia mahogani*	E	Occurs in south Florida. Observed in low numbers on disposal land and Homestead ARS; potentially in other areas.
Wild potato morning-glory	*Ipomoea microdactyla*	E	Occurs in south Florida. Found at low densities on disposal land; potentially in other areas.
Reptiles			
Rim rock crowned snake	*Tantilla oolitica*	T	Found in eastern Miami-Dade and Monroe counties. Not recorded from disposal land, or Homestead ARS, during species-specific surveys.
Birds			
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	Winters in south Florida. Forages along western shore of Biscayne Bay and possibly other locations.
Least tern	*Sterna antillarum*	T	Breeding range along the Gulf and Atlantic coasts including most of Florida's coastline. Forages along the western shoreline of Biscayne Bay and elsewhere in Biscayne NP. Nearest known nesting site is on the keys of Biscayne NP. Occasional birds observed on disposal land and Homestead ARS.
Southeastern American kestrel	*Falco sparverius paulus*	T	Breeding range includes central and northern Florida, as well as adjacent states. Unconfirmed reports from disposal land and Homestead ARS; but not observed during southeastern American kestrel surveys during the summer of 1998. Unlikely anywhere in Homestead area as it may have been extirpated from Miami-Dade County.
White-crowned pigeon	*Columba leucocephala*	T	Found in mangrove swamps and tropical hardwood hammocks of Miami-Dade and Monroe counties. Nests and roosts on keys of Biscayne NP and not recorded from mangrove swamps along western shoreline. Potentially rare transient on disposal land and Homestead ARS.

Source: **Florida Game and Fresh Water Fish Commission 1997, Denton and Godley 1999, Argonne National Laboratory 1997, Howitt 1996, BNP 1998, Hilsenbeck 1993, PBS&J 1998b.**
E endangered
T threatened

Wintering Water Birds and Raptors

Wintering water birds, raptors, and other species have been tallied at Biscayne NP during 13 Christmas Bird Counts from 1979 through 1997 (**BNP 1998**) and at Everglades NP during 19 Christmas Bird Counts from 1978 through 1998 (**Cornell Laboratory of Ornithology 2000**). A total of 81 species of water birds and raptors were recorded at Biscayne NP with observations of over 27,000 individuals (**Table 3.11-9**). Fourteen species were abundant (500+ records), ten species were common (101 to 500 records), and the remaining species were rare (10 or fewer records) or uncommon (11 to 100 records). Two species (bald eagle and wood stork) are federally listed. The brown pelican, tricolor heron, little blue heron, reddish egret, great white heron, great egret, white ibis, roseate spoonbill, osprey, and Wilson's plover are state sensitive species.



LEGEND

- Former Homestead AFB Boundary
- Sites Containing Sensitive Plants
- (#) Site Number
- Sites with Small's milkpea
- (#) Site Number

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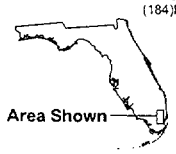

0 0.25 0.5
Scale In Miles

Derived from: PBS&J 1998b

Figure 3.11-6
Locations Where Sensitive Plant Species Were Observed on Former Homestead AFB

Table 3.11-5. Federal and State Listed Plant Species and Species of Special Concern Observed on Former Homestead AFB

Species	Surveys			
	Disposal Property		Homestead ARS	
	1992/93	1997	1992/93	1996/97
Bahama break	✓	✓	✓	✓
Bahama sachsia	✓	—	✓	—
Blodgett's ironweed	✓	—	✓	✓
Carter's small flowered flax	✓	—	—	—
Christmas berry	✓	✓	✓	✓
Florida five-petaled leaf flower	✓	✓	✓	✓
Florida lantana	—	✓	✓	✓
Florida pinewood privet	—	—	✓	✓
Florida white-topped sedge	✓	✓	✓	✓
Giant wild pine	—	✓	—	—
Krug's holly	—	—	✓	✓
Locustberry	✓	✓	✓	✓
One-nerved ernodea	—	✓	—	—
Pineland jacquemontia	✓	✓	✓	✓
Pineland noseburn	—	—	✓	—
Pink pine orchid	—	✓	—	—
Porter's spurge	✓	✓	✓	✓
Rockland painted-leaf	—	✓	✓	✓
Royal palm	—	✓	—	—
Sand flax	—	✓	—	—
Silver palm	✓	✓	✓	✓
Small-leaved melanthera	✓	✓	✓	✓
Small's milkpea	—	✓	—	—
Tetrazygia	—	✓	✓	✓
Wedgelet fern	—	—	✓	✓
West Indian mahogany	—	✓	—	✓
Wild-potato morning-glory	✓	✓	—	—

Source: **Argonne National Laboratory 1997, Hilsenbeck 1993, PBS&J 1998b.**

A total of 121 species of water birds and raptors totaling over 616,000 individuals were tallied during the 19 Christmas Bird Counts at Everglades NP (**Table 3.11-10**). The most abundant groups were shorebirds, with almost 250,000 observations (41 percent of total), and wading birds, with about 105,000 observations (17 percent). Twenty-one species were abundant, 35 were common, 18 were uncommon, and 47 were rare. The bald eagle and wood stork are federally listed species. State sensitive species recorded at Biscayne NP were also seen at Everglades NP.

Table 3.11-6. State Rare Species and Species of Special Concern Known to Occur in the Homestead Area

Common Name	Scientific Name	Areas of Occurrence
Plants		
Blodgett's ironweed	*Vernonia blodgettii*	Found in south Florida. Occurs in small numbers on Homestead ARS and disposal property; potentially in other areas.
Florida five-petaled leaf flower	*Phyllanthus pentaphyllus floridanus*	Found in south Florida. Fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Florida pinewood privet	*Forestiera segregata var. pinetorum*	Found in south Florida. Known from Homestead ARS; potentially in other areas.
Florida white-topped sedge	*Dichromena floridensis*	Found in south Florida. Fairly widespread on disposal land and Homestead ARS; potentially in other areas.
Birds		
American oystercatcher	*Haematopus palliatus*	Major breeding habitat north of Miami. Occurs sporadically at Biscayne NP. Not expected to occur on disposal land or Homestead ARS.
American redstart	*Setophaga ruticilla*	Breeding range includes much of the eastern United States and Canada; it winters in and migrates through south Florida. Very common migrant and rare winter resident on Biscayne NP. Common to uncommon on disposal land and Homestead ARS.
Antillean nighthawk	*Chordeiles gundlachii*	Nests in the Florida Keys and the outer keys of Biscayne NP. Observed on disposal land and nearby areas during 1998 avian surveys.
Black-crowned night heron	*Nycticorax nycticorax*	Widespread in North America and breeds throughout Florida. Likely nests in wetlands on disposal land and Homestead ARS.
Black-whiskered vireo	*Vireo altiloquus*	Nests in Florida Keys and along east and west coastlines up to central Florida. Nests on mangrove islands in Biscayne NP but not detected along mangrove swamps along western shoreline of Biscayne NP. Not reported from, and low potential to occur on, disposal land and Homestead ARS.
Brown pelican	*Pelecanus occidentalis*	Breeds at various locations along the eastern and western coastlines of Florida. Found in most coastal areas during non-breeding season. Common along mangrove swamps and salt water section of Military Canal especially in winter. Occasional transient elsewhere in Homestead area.
Burrowing owl	*Speotyto cunicularia*	Occurs in peninsular Florida south to the Florida Keys. Nesting recorded on disposal land and Homestead ARS; currently nests at three locations near edge of the runway in the area of the control tower. May nest elsewhere in Homestead area.

Common Name	Scientific Name	Areas of Occurrence
Caspian tern	*Sterna caspia*	Breeds in a few locations along eastern and western coastline of central Florida. Occurs in most coastal areas during non-breeding season. Occasionally observed at Biscayne NP. Not reported, and unlikely to occur, on disposal land and Homestead ARS.
Cooper's hawk	*Accipiter cooperii*	Breeding range includes much of North America including northern two-thirds of Florida. Wintering and migrating species in south Florida. Rarely reported from Biscayne NP. Rare migrant or wintering species on disposal land and Homestead ARS.
Cuban yellow warbler	*Dendroica petechia gundlachi*	Breeds in mangroves in extreme southern Florida. Nests on mangrove islands and in small numbers along the mangrove swamps along the western shoreline of Biscayne NP. Not reported, and unlikely to nest, on disposal land and Homestead ARS.
Florida prairie warbler	*Dendroica discolor paludicola*	Breeds in mangroves along the eastern and western coastlines of central Florida south to the Florida Keys. Nests in mangroves on the keys and along the western shoreline of Biscayne NP and along Military Canal. Not reported, and unlikely to nest, on disposal land and Homestead ARS.
Glossy ibis	*Plegadis falcinellus*	Nests primarily at inland locations in central Florida with small numbers nesting in south Florida. Found throughout the state in non-breeding season. Occasionally observed in Biscayne NP and in wetlands between Biscayne NP and former Homestead AFB. Occasional birds observed on the disposal land and Homestead ARS.
Great egret	*Casmerodius albus*	Current breeding range includes much of North America including all of Florida. Common on Biscayne NP and in wetlands between Biscayne NP and former Homestead AFB. Uncommon all year on disposal land and Homestead ARS.
Great white heron	*Ardea herodias occidentalis*	Nests mostly in coastal islands in Florida Bay. Occurs in central and south Florida during non-breeding season. Occurs sporadically at Biscayne NP and along canals and wetlands between Biscayne NP and former Homestead AFB. Not reported, but could occur, on disposal land and Homestead ARS.
Least bittern	*Ixobrychus exilis*	Occurs over much of the eastern United States. Occurs in wetlands at disposal land and Homestead ARS.

Common Name	Scientific Name	Areas of Occurrence
Little blue heron	*Egretta caerulea*	Widely distributed nesting species in Florida and elsewhere along the Atlantic coast and in Gulf coast states. Forages on disposal land and Homestead ARS and along Military Canal and mangrove swamps. Roosts in small numbers along mangrove swamps along western shoreline of Biscayne Bay during the winter. Closest rookery on keys of Biscayne NP.
Louisiana waterthrush	*Seiurus motacilla*	Breeds throughout much of the eastern United States including northern Florida. Occasional wintering and migrating species in south Florida. Very rarely reported from Biscayne NP. Not reported from, and low potential to occur on, disposal land and Homestead ARS.
Mangrove cuckoo	*Coccyzus minor*	Generally restricted to wooded habitat along the coasts of Miami-Dade and Monroe counties. Detected at four locations during 1998 breeding season east of former Homestead AFB including along Military Canal. Not reported from, and low potential to occur on, disposal land and Homestead ARS.
Osprey	*Pandion haliaetus*	Nests throughout much of North America including most of Florida. Known to nest on the keys at Biscayne NP. Forages but not known to nest along western shoreline of Biscayne Bay. Occasionally seen on disposal land and Homestead ARS.
Reddish egret	*Egretta rufescens*	Nests exclusively on islands along the eastern and western coastline from central Florida south to the Florida Keys. May forage along Military Canal and the western shoreline of Biscayne Bay but was not recorded during any surveys in the area. Not observed in the disposal land or Homestead ARS. Closest rookery on keys of Biscayne NP.
Roseate spoonbill	*Ajaia ajaja*	Nests in wooded coastal islands mostly in Florida Bay and Everglades NP. Rare foraging species in Biscayne NP and not recorded from the disposal land or Homestead ARS. Only one individual recorded during 1998 wading bird surveys. Nests in the Everglades west of Homestead.
Royal tern	*Sterna maxima*	Breeds along the Atlantic and Gulf coasts including coastal colonies in central Florida. Occurs in south Florida during non-breeding season. Commonly observed at Biscayne NP. Not reported, and unlikely to occur, on disposal land and Homestead ARS.
Sandwich tern	*Sterna sandvicensis*	Nests in a few locations along the western coastline of central Florida; occurs throughout Florida during non-breeding season. Commonly observed at Biscayne NP. Not reported, and unlikely to occur, on disposal land and Homestead ARS.

Common Name	Scientific Name	Areas of Occurrence
Snowy egret	*Egretta thula*	Widely distributed in Florida; also occurs along the Atlantic coast north of Florida and lower Mississippi Valley. Forages on disposal land, Homestead ARS, along Military Canal, and in mangrove swamps. Roosts in small numbers along western shoreline of Biscayne NP in winter. Closest rookery on keys of Biscayne NP.
Tricolored heron	*Egretta tricolor*	Breeding range includes most of the Atlantic and Gulf coasts, as well as most of coastal and inland Florida. Forages on disposal land, Homestead ARS, along Military Canal, and in freshwater and wetlands and in mangrove swamps along western shoreline of Biscayne NP. Closest rookery on keys of Biscayne NP.
White ibis	*Eudocimus albus*	Breeding range includes Atlantic seaboard to Virginia, the Gulf coast and central and south Florida. Common in Biscayne NP and in wetlands between Biscayne NP and former Homestead AFB. Forages generally in small numbers on disposal land and Homestead ARS.
Wilson's plover	*Charadrius wilsonia*	Occurs along much of the Atlantic and Gulf coasts. Nests in various locations in coastal Florida including Florida Bay and the Florida Keys. Occasionally observed on Biscayne NP. Not reported, but could occur on rare occasions, on disposal land and Homestead ARS.
Worm-eating warbler	*Helmitheros vermivorus*	Nests throughout much of the eastern United States. Wintering and migrating species in south Florida. Occasional individuals observed at Biscayne NP during migration. Not reported, and low potential to occur, on disposal land and Homestead ARS.
Yellow-crowned night heron	*Nyctanassa violacea*	Nests in eastern United States, including Florida. Likely nesting in wetlands on the disposal land and Homestead ARS.

Source: **Florida Game and Fresh Water Fish Commission 1997, Rodgers et al. 1996, Denton and Godley 1999, Hilsenbeck 1993, PBS&J 1998b, Argonne National Laboratory 1997, BNP 1998, Howitt 1996.**

3.11.3.2 Projected Baseline Environment

Over the next 15 years, most development in south Miami-Dade County is generally assumed to occur west and north of former Homestead AFB in areas designated for development. Some growth could be expected to spill out of urbanized areas onto unprotected vacant and agricultural lands outside the Urban Development Boundary. Critical habitat and occurrence of federal and state species of concern are generally east, south, and southwest of the former base. Undeveloped and agricultural lands support species such as the eastern indigo snake and federally and state listed wading birds. Agricultural lands are marginal habitat for the eastern indigo snake, and wading birds use fields and associated drainage ditches for foraging. The development of these lands could reduce habitat availability for some species of concern.

Table 3.11-7. National Breeding Bird Survey Trend Analyses of Neotropical Migratory Bird Species in the ROI

Species Common Name[1]	Trends (% change per year)	
	1966–1979	1980–1996
Barn Swallow	4.2	–1.6
Brown-headed Cowbird	0.7	-.05
Chuck-will's-widow	–1.0	–0.8
Common Nighthawk	0.1	–3.0
Common Yellowthroat	0.7	–0.6
Eastern Kingbird	–1.2	–0.9
Great Crested Flycatcher	0.6	0.3
Pine Warbler	-5.2	-0.9
Prairie Warbler	–5.2	–0.9
Purple Martin	3.1	–2.0
White-eyed Vireo	0.2	0.2
Yellow-billed Cuckoo[2]	3.2	–3.1
Yellow Warbler	–0.1	0.9

Source: **Sauer et al. 1997, USFWS 1995, DeGraaf and Rappole 1995.**

Notes: [1] Only neotropical migratory bird species with trend analysis data available on the Breeding Bird Surveys Internet site and with more than 100 survey routes are included (**Sauer et al. 1997**).

[2] U.S. Fish and Wildlife Service Region 4 species of management concern (**USFWS 1995**).

Development in critical habitat and other important habitats, such as freshwater wetlands and mangrove swamps, is unlikely because of the governmental restrictions on development in wetlands. Reductions in the area of these habitats might occur, however, with increases in stormwater runoff that is discharged through canals to Biscayne Bay. Increased surface water flows could lower the water table, reducing the extent of wetlands east of the former base.

Population growth in the immediate vicinity of habitat areas will mean greater exposure to human activity, which could reduce the attractiveness of the areas east of the base for species of concern.

Table 3.11-8. Neotropical Migrant Land Birds Observed at Biscayne National Park, 1973–1998

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Osprey		✓		
Sharp-shinned hawk		✓		
Copper's hawk	✓			
Broad-winged hawk		✓		
American kestrel		✓		
Merlin			✓	
Peregrine falcon		✓		
Yellow-billed cuckoo		✓		
Mangrove cuckoo		✓		
Burrowing owl	✓			
Common nighthawk	✓			
Chuck-wills-widow		✓		
Whip-poor-will	✓			
Chimney swift	✓			
Ruby-throated hummingbird	✓			
Rufous hummingbird	✓			
Belted kingfisher			✓	
Yellow-bellied sapsucker		✓		
Eastern wood pewee	✓			
Least flycatcher	✓			
Eastern phoebe		✓		
Great crested flycatcher			✓	
Western kingbird	✓			
Eastern kingbird	✓			
Scissor-tailed flycatcher	✓			
Gray kingbird		✓		
Bell's vireo	✓			
White-eyed vireo				✓
Solitary vireo		✓		
Yellow-throated vireo	✓			
Red-eyed vireo		✓		
Black-whiskered vireo			✓	
Cedar waxwing		✓		
Veery	✓			
Gray-cheeked thrush	✓			
Swainson's thrush	✓			
American robin		✓		
Gray catbird			✓	
House wren		✓		
Blue-gray gnatcatcher				✓
Tree swallow				✓
Purple martin	✓			
Northern rough-winged swallow	✓			
Bank swallow		✓		
Barn swallow				✓
Ruby-crowned kinglet	✓			
Tennessee warbler	✓			

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Orange-crowned warbler		✓		
Nashville warbler	✓			
Northern parula			✓	
Yellow warbler		✓		
Magnolia warbler		✓		
Cape May warbler		✓		
Black-throated blue warbler			✓	
Black-throated gray warbler	✓			
Black-throated green warbler	✓			
Yellow-throated warbler		✓		
Pine warbler	✓			
Prairie warbler				✓
Palm warbler				✓
Blackpoll warbler			✓	
Black-and-white warbler			✓	
American redstart			✓	
Prothonotary warbler	✓			
Worm-eating warbler		✓		
Swainson's warbler	✓			
Ovenbird			✓	
Northern waterthrush		✓		
Louisiana waterthrush	✓			
Connecticut warbler	✓			
Common yellow-throat				✓
Yellow-breasted chat	✓			
Hooded warbler	✓			
Canada warbler	✓			
Savannah sparrow		✓		
Grasshopper sparrow		✓		
Dickcissel	✓			
Summer tanager	✓			
Scarlet tanager	✓			
Rose-breasted grosbeak	✓			
Blue grosbeak	✓			
Indigo bunting		✓		
Painted bunting		✓		
Northern oriole	✓			
Red-winged blackbird			✓	
Brown-headed cowbird	✓			
Bobolink		✓		
Total	**39**	**29**	**12**	7
Percent	45	33	14	8

Source: **BNP 1998, Finch 1991.**
Notes: [1] Rare = 10 or fewer records, uncommon = 11 to 100 records, common = 101 to 500 records, abundant = 500+ records.

Table 3.11-9. Water Birds and Birds of Prey Observed During Christmas Bird Counts at Biscayne National Park, 1979–1997

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Common loon		✓		
Pied-billed grebe		✓		
Horned grebe	✓			
Audubon's shearwater		✓		
Magnificent frigatebird			✓	
Northern gannet			✓	
Brown booby		✓		
Anhinga	✓			
Double-crested cormorant				✓
Brown pelican				✓
White pelican		✓		
Blue-winged teal		✓		
Northern pintail	✓			
Mottled duck	✓			
Black scoter		✓		
Fulvous whistling duck		✓		
Red-breasted merganser				✓
Tricolor heron			✓	
Little blue heron			✓	
Reddish egret	✓			
Great white heron		✓		
Great blue heron			✓	
Great egret		✓		
Snowy egret		✓		
Cattle egret		✓		
Green heron		✓		
Yellow-crowned night heron		✓		
Black crowned night heron	✓			
Wood stork	✓			
Glossy ibis	✓			
White ibis				✓
Roseate spoonbill	✓			
Black vulture	✓			
Turkey vulture				✓
Osprey		✓		
Bald eagle	✓			
Northern harrier		✓		
Sharp-shinned hawk		✓		
Cooper's hawk	✓			
Red-shouldered hawk		✓		
Broad-winged hawk		✓		
Red-tailed hawk	✓			
American kestrel		✓		

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Merlin	✓			
Peregrine falcon	✓			
Clapper rail	✓			
Common gallinule	✓			
American coot		✓		
Whimbrel		✓		
Greater yellowlegs	✓			
Spotted sandpiper		✓		
Willet			✓	
Ruddy turnstone				✓
Red phalarope	✓			
Short-billed dowitcher				✓
Red knot		✓		
Sanderling				✓
Western sandpiper			✓	
Least sandpiper				✓
Purple sandpiper	✓			
Dunlin			✓	
American oystercatcher	✓			
Gray plover				✓
Semipalmated plover				✓
Wilson's plover	✓			
Killdeer		✓		
Ring-billed gull				✓
Lesser black-backed gull	✓			
Great black-backed gull	✓			
Herring gull			✓	
Bonaparte's gull		✓		
Franklin's gull	✓			
Laughing gull				✓
Caspian tern	✓			
Royal tern				✓
Sandwich tern		✓		
Common tern	✓			
Forster's tern		✓		
Jager sp.	✓			
Pomarine jager		✓		
Black skimmer			✓	
Total Species	**28**	**29**	**10**	**14**
Percent	35	36	12	17

Source: **BNP 1998.**
Notes: [1] Rare = 10 or fewer records, uncommon = 11 to 100 records, common = 101 to 500 records, abundant = 500+ records.

Table 3.11-10. Water Birds and Birds of Prey Observed During Christmas Bird Counts at Everglades National Park, 1978–1998

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Red-throated loon	✓			
Common loon	✓			
Pied-billed grebe			✓	
Horned grebe		✓		
American white pelican				✓
Brown pelican			✓	
Great cormorant	✓			
Double-crested cormorant				✓
Anhinga			✓	
Magnificent frigatebird	✓			
American bittern	✓			
Least bittern	✓			
Great blue heron			✓	
Great white heron			✓	
Great egret				✓
Snowy egret				✓
Little blue heron				✓
Tricolor heron				✓
Reddish egret			✓	
Cattle egret			✓	
Green heron		✓		
Black-crowned night heron		✓		
Yellow-crowned night heron		✓		
White ibis				✓
Scarlet ibis	✓			
Glossy ibis		✓		
Roseate spoonbill			✓	
Wood stork			✓	
Greater flamingo		✓		
Fulvous whistling duck	✓			
Snow goose	✓			
Brant	✓			
Wood duck	✓			
Green-winged teal			✓	
American black duck	✓			
Mottled duck		✓		
Mallard	✓			
Northern pintail				✓
Blue-winged teal				✓
Northern shoveler			✓	
Gadwall	✓			
American widgeon				✓
Canvasback	✓			

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Redhead	✓			
Ring-necked duck			✓	
Greater scaup	✓			
Lesser scaup			✓	
Black scoter	✓			
Surf scoter	✓			
Oldsquaw	✓			
Hooded merganser	✓			
Red-breasted merganser			✓	
Ruddy duck		✓		
Black vulture			✓	
Turkey vulture			✓	
Osprey			✓	
Bald eagle		✓		
Northern harrier		✓		
Sharp-shinned hawk	✓			
Coopers hawk	✓			
Red-shouldered hawk			✓	
Broad-winged hawk	✓			
Short-tailed hawk		✓		
Swainson's hawk	✓			
Red-tailed hawk	✓			
American kestrel		✓		
Merlin	✓			
Peregrine falcon	✓			
Yellow rail	✓			
Clapper rail	✓			
King rail	✓			
Virginia rail	✓			
Sora	✓			
Purple gallinule	✓			
Common moorhen			✓	
American coot				✓
Limpkin	✓			
Black-bellied plover				✓
Snowy plover	✓			
Wilson's plover		✓		
Semipalmated plover			✓	
Piping plover	✓			
Killdeer			✓	
Black-necked stilt		✓		
American avocet			✓	
Greater yellowlegs			✓	
Lesser yellowlegs			✓	
Solitary sandpiper	✓			

Species	Relative Abundance[1]			
	Rare	Uncommon	Common	Abundant
Willet				✓
Spotted sandpiper			✓	
Whimbrel			✓	
Long-billed curlew	✓			
Marbled godwit			✓	
Ruddy turnstone			✓	
Red knot			✓	
Sanderling			✓	
Semipalmated sandpiper			✓	
Western sandpiper				✓
Least sandpiper				✓
Pectoral sandpiper	✓			
Dunlin				✓
Stilt sandpiper		✓		
Peep species				✓
Short-billed dowitcher				✓
Long-billed dowitcher	✓			
Sandpiper species				✓
Common snipe	✓			
Laughing gull				✓
Bonaparte's gull	✓			
Ring-billed gull			✓	
Herring gull		✓		
Lesser black-backed gull	✓			
Greater black-backed gull	✓			
Gull-billed tern		✓		
Caspian tern			✓	
Royal tern			✓	
Sandwich tern		✓		
Roseate tern	✓			
Common tern	✓			
Forster's tern			✓	
Black skimmer				✓
Total Species	**47**	**18**	**35**	**21**
Percent	39	15	29	17

Source: **Cornell Laboratory of Ornithology 2000.**

Notes [1] Rare = 100 or fewer records, uncommon = 101 to 500 records, common = 501 to 5,000 records, and abundant = 5,001+ records.

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3.12 CULTURAL RESOURCES

3.12.1 Introduction

Cultural resources described in this section include archaeological and architectural resources and traditional cultural resources.

3.12.1.1 Resource Definition

Cultural resources are districts, landscapes, sites, buildings, structures, or objects considered to be important to a culture, subculture, or community for scientific, traditional, religious or any other reason. Cultural resources listed on or eligible for nomination to the National Register of Historic Places (National Register) are afforded special consideration and protection.

Archaeological resources are locations where human activity has measurably altered the earth (e.g., hearths, foundations) or left deposits of physical remains (e.g., arrowheads, bottles). Federal laws and regulations may use the term "prehistoric" to refer to archaeological resources associated with Native Americans, particularly before contact with Euroamericans. This term also means cultural resources that predate the beginning of written records. In southern Florida, prehistoric archaeological resources range from isolated artifacts (e.g., shark tooth knives, conch-shell hammers, stone tools) to shell middens and mounds. The term "historic" includes any cultural resource that postdates Euroamerican contact with Native Americans. Historic archaeological resources in southern Florida include shipwrecks, cemeteries, trails, collapsed buildings, and a variety of other features.

Architectural resources are standing buildings, facilities, and other structures of historical, aesthetic, or scientific importance, including public buildings, churches, stores, theaters, residences, and architectural features such as fountains and entrance gates. On former Homestead AFB and in the surrounding area, all known surviving architectural resources are historic in age.

A historic landscape is a geographic area that includes related cultural and natural features. Historic landscapes are generally 50 years or more in age and can include agricultural landscapes, industrial landscapes, and traditional landscapes. Historic vernacular landscapes are those modified by human activity to reflect traditions, customs, or values in the everyday lives of people. More than one historic landscape can be defined for an area, representing changes in how people used the land.

Traditional cultural resources are resources associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Certain categories of traditional cultural resources, such as ancestral settlements or historic buildings, may be protected through their eligibility for the National Register. In this document, if a traditional cultural resource has been determined to be eligible for nomination to the National Register, it is called a traditional cultural property.

Archaeological or architectural resources usually must be at least 50 years old before they are afforded protection under federal law. However, certain structures or objects associated with more recent, exceptionally important historic events (e.g., the Cold War) also may be considered eligible for nomination to the National Register. Cultural resources are usually afforded protection in the context of existing knowledge about the region, culture, property type, object, or other set of characteristics represented by the resource.

3.12.1.2 Applicable Laws and Regulations

Following is a summary of laws and regulations related to the identification and preservation of cultural resources.

National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. Section 470), amended 1976, 1980, 1992. The NHPA established the National Register and outlined procedures for management of cultural resources on federal property. Section 110 requires action on the part of a federal agency to preserve historic properties owned or controlled by the agency, and Section 106 requires that federal agencies take into account the effects of any undertaking on historic properties. Procedures for meeting the requirement of the NHPA are codified in 36 CFR Section 800 (1999).

Archaeological and Historic Preservation Act of 1974 (16 U.S.C. Section 469). This act provides for the "preservation of historical and archaeological data threatened by dam construction or alterations of terrain."

Archaeological Resources Protection Act of 1979 (16 U.S.C. Section 470aa-47011). This act ensures the protection and preservation of archaeological sites on federal or Native American lands.

Executive Order 11593. This executive order directs land-holding federal agencies to identify and nominate historic properties to the National Register and requires that these agencies avoid damage to historic properties that might be eligible for the National Register.

Native American Graves Protection and Repatriation Act (25 U.S.C. Section 3001–3013). This act requires consultation with American Indian tribes prior to intentional excavation, or removal after inadvertent discovery, of human remains or certain objects of cultural importance on federal or Indian lands.

American Indian Religious Freedom Act (42 U.S.C. Section 1996). This act states that it is the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

Executive Order 13007, Indian Sacred Sites. This executive order directs agencies responsible for managing federal lands to "(1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites." The executive order also requires that reasonable notice be given for proposed actions or policies potentially restricting access to or adversely affecting sacred sites.

Executive Order 13084, Consultation and Coordination with Indian Tribal Governments. This executive order directs federal agencies to be guided by principles of tribal sovereignty and to provide a process for tribal input when formulating policies that significantly affect Indian tribal governments. It further orders agencies to review and streamline the waiver process for statutory and regulatory requirements for Indian tribal governments; and to cooperate with tribal governments in developing regulations that relate to tribal self-government, trust resources, and treaty or other rights. The executive order is designed to improve the internal management of the agency and does not create any right that is enforceable at law.

Memorandum for the Heads of Executive Departments and Agencies Regarding Government-to-Government Relations with Native American Tribal Governments. This document directs each executive

department and agency in the federal government to operate within a government-to-government relationship with federally recognized tribal governments; consult with tribal governments prior to taking actions affecting such governments; and assess the impact of plans, projects, programs, and activities on tribal trust resources and assure that tribal rights are considered during the consideration of such plans, projects, and programs.

Federal Aviation Administration Order 5050.4A, Airport Environmental Handbook (October 8, 1985). This order prescribes procedures for airport operators, sponsors, and others who are complying with federal laws, acts, and regulations invoked by proposed airport undertakings or actions. Section 47.e.(8) specifically addresses the requirements of NHPA and the Archaeological and Historic Preservation Act in the case of impacts to "historic, architectural, archaeological, and cultural resources."

Air Force Instruction 32-7065, Cultural Resources Management. This instruction implements Air Force Policy Directive 32-70 and sets guidelines for protecting and managing cultural resources on Air Force property in the United States and its territories and possessions.

Metropolitan Dade County Historic Preservation Ordinance (Ord. No. 81-13, Sections 1, 2-17-81). This ordinance designates historic properties, provides financial incentives for owners of historic properties, and generally promotes the preservation and appreciation of historic properties.

Florida Historic Resources Act (Florida Statutes, Annotated, Chapter 267, Sections .011 to .172). This statute addresses the identification, documentation, and preservation of cultural resources on state land.

3.12.1.3 Region of Influence

The ROI for cultural resources (**Figure 3.12-1**) was developed based on information generated by the Socioeconomics (Section 3.1), Noise (Section 3.5), and Land Use (Section 3.6) sections. It is defined as the area that could potentially be affected by actions directly associated with the Proposed Action and alternatives, the Area of Potential Effect (APE) as defined in 36 CFR 800. The APE includes areas subject to direct on-the-ground impacts from the development of former base property, areas affected by aircraft noise generally at levels of DNL 65 dB and higher, and areas that could be affected by secondary development. The ROI for development-related, ground-disturbing impacts (from both on-site and secondary development) is defined by Eureka Drive on the north, Biscayne National Park on the east, SW 376th Street/Ingram Highway on the south, and the eastern boundary of Everglades NP on the west. In addition, some information is provided on cultural resources in Biscayne and Everglades National Parks identified by the National Park Service.

3.12.2 Cultural Setting and Cultural History

The following sections summarize the history of southern Florida from prehistoric times through the Cold War.

3.12.2.1 Early Native American History

Paleoindian Stage (13000 B.C. to 8000 B.C.)

The climate of Florida 15,000 to 10,000 years ago was markedly drier than that of modern times. For this reason, the location of fresh water was of particular importance. Animals clustered around water sources, and people settled nearby to take advantage of both water and food. The people hunted large mammals and giant turtles, as well as smaller mammals such as deer and rabbits (**Milanich 1994**). At least by the

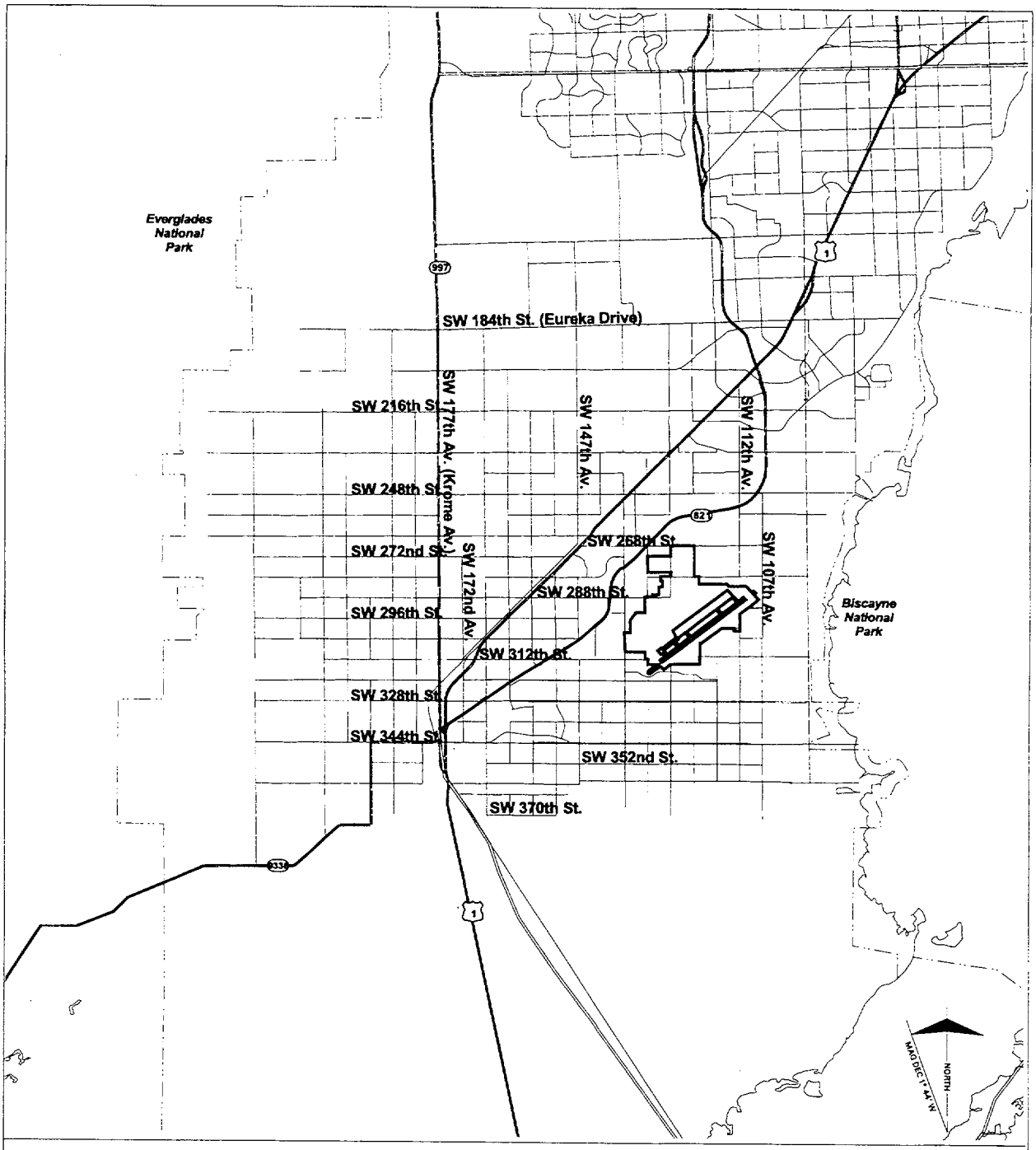

Figure 3.12-1
Region of Influence
for Cultural Resources

end of this period, people had expanded their source of livelihood to include fish and a wide variety of other animals (**Bense 1994**). There is at least one known Paleoindian site near Homestead ARS (**Milanich 1994**).

Archaic Stage (8000 B.C. to 1000 B.C.)

As the climate gradually became wetter about 8000 B.C., people expanded their settlement territory to coastal areas and along rivers (**Milanich 1994**). They were able to stay in one place longer and perform tasks that required more time. Canoes first appeared in Florida during the Archaic stage, and archaeological sites have a greater variety of tools. Other important changes included mound construction, development of large settlements, cultivation of plants, and long-distance trade (**Bense 1994**). Archaeologists are able to identify Archaic cultures from basketry, pottery, and tools made from stone, bone, wood, and shell (**Milanich 1994**). Two well- known sites in southern Florida that date to the Archaic stage are outside the ROI.

Glades (500 B.C. to A.D. 1500)

The Glades culture of southern Florida is differentiated from contemporary Native American cultures found in northern Florida by the relatively heavy reliance on water resources and less reliance on agriculture, including corn (**Milanich 1994**). Pottery tempered with sand and elaborately carved ceremonial artifacts also characterize this period. Toward the end of this period, the bow and arrow became more common. People lived along the coast and on hammocks rising from the surrounding marsh and sawgrass prairies. They may have moved seasonally among a series of established settlements. By the end of this period, some of the more socially complex societies were collapsing, resulting in reorganizations and population movements (**Bense 1994**). Several Glades sites are located near former Homestead AFB in southern Florida.

3.12.2.2 Recent American Indian History and Early Euroamerican History

European Stage (A.D. 1500 to 1821)

Written records during the 16th century fill in information that can be inferred from archaeological evidence. In 1513, Ponce de Leon made the first recorded landing in southern Florida, although he was probably preceded by shipwrecked sailors and possibly by slavers (**Bense 1994**). Ponce de Leon's first exploration and settlement (in 1521) in south Florida were followed in quick succession by a series of Spanish and then French explorers such as Cordoba (1517), Narvaez (1528), and de Soto (1539), while others made forays into other parts of what is now the southeastern United States.

One of the first effects of the European occupation felt by Native Americans was disease introduced by the Europeans and African slaves who came to North America. By 1700 A.D., Native American populations in Florida may have been reduced by as much as 90 percent by outbreaks of smallpox, mumps, measles, influenza, and pneumonia. Creeks from Alabama and Georgia immigrated to northern Florida, filling the population void, providing a labor source for the Spanish. Many Creeks eventually moved further south and linking up with escaped African slaves, became known as Seminoles, a term derived from the Spanish word for runaways. Some Seminoles adopted a mobile life as they raised cattle to supply Europeans with hides. Others operated large plantations with large herds and some even owned slaves (**Bense 1994**).

The Spanish made the greatest impact on Florida during the 16th, 17th, and 18th centuries A.D. They built forts to protect their trading ships and missions, and to consolidate their land claims while converting the

Native Americans to Christianity. Spain briefly lost control of Florida to England in 1763, but won it back in 1781. By the early 19th century, Spain had relinquished Florida to the United States (**Bense 1994**).

Even before Florida became a territory of the United States in 1821, the U.S. Army entered Florida from Georgia, pursuing escaped slaves. The army defeated the Seminoles during what came to be called the First Seminole War (1817–1818 A.D.) (**Division of Historical Resources 1998d**).

3.12.2.3 Modern Euroamerican and Native American History

American Stage (A.D. 1821 to 1917)

In 1821, the United States formally acquired Florida from Spain. Soon after, the policy of Indian removal decimated all but the most tenacious Native American populations from the southeastern United States. In Florida, two more wars were fought with the Seminoles (**Division of Historical Resources 1998d**), culminating in the escape of only about 300 people into the Everglades (**de Golia 1993**). The Seminoles who escaped the wars continued to live in their secluded communities, raising crops and trading skins and aquatic resources for metal and cloth products (**de Golia 1993**).

In the early 1800s, European-Americans and African-Americans moved into the territory left by the Indians. They established settlements—large and small farms or plantations, hamlets and towns—wherever resources would support them. Both enslaved and free African-Americans lived within a culture distinctive from that of European-Americans.

Dade County was incorporated in 1836, and Florida became the 27th state in 1845 (**Division of Historical Resources 1998c**). The Civil War changed both the economic and social organization of the southeast, including southern Florida. Traditional plantations gave way to sharecropping and tenant farming, fishing, trapping (especially plume birds), and salvaging shipwrecks (**de Golia 1993**, **Landrum 1990**). Near former Homestead AFB, settlers established farms along the rocky pineland ridge to the north. The immediate vicinity was too marshy with few plant or animal resources (**USAF 1994a**). Reclamation efforts in the Everglades region introduced canals to drain swamps, followed by farming. In many cases, these efforts were short lived, as weather, fires, and pollution of the fresh-water aquifer with salt water rendered the work ineffective (**de Golia 1993**).

Modern Era (A.D. 1918 to Present)

The modern Seminoles divide roughly along linguistic lines. The Muskogee-speaking Seminole Indians live on the Big Cypress Reservation near Alligator Alley (Highway 75), across the northern Cypress National Preserve, near Lake Okeechobee on the Brighton Reservation, and on the Seminole Reservation near Hollywood. The Hichiti-speaking Miccosukees live on the Miccosukee Reservation near the Big Cypress Reservation and in several small villages along and near the Tamiami Trail (Highway 41) (**Seminole Tribe of Florida 1998**, **Division of Historical Resources 1998a**, **de Golia 1993**).

During the 1920s, the construction of roads in southern Florida, including the Tamiami Trail between Tampa and Miami, increased contact between developers and other business people and the rural population, including the Seminoles. Florida's boom went bust, however, even before the rest of the nation began to feel the effects of the Great Depression (**Division of Historical Resources 1998a**). Not until World War II did the state begin to recover.

Everglades NP was created in 1934, although the park's boundaries were not fixed until 1958 (**de Golia 1993**). Biscayne NP began as a National Monument in 1968 and was expanded and made into a national park in 1980 (**Landrum 1990**).

The facility that would become Homestead AFB consisted of an isolated airstrip operated by Pan American Ferries, Inc. In 1942, the newly designated Homestead Army Air Field began operations as a stop on the air route from the United States to the Caribbean and Africa (**Patterson et al. 1997**). During the rest of World War II, Homestead Army Air Field supported a number of missions, including training pilots to fly the C-54 *Skymaster* from Burma to China. In 1945, a hurricane devastated its infrastructure to such an extent that it was placed on inactive status.

Reactivated in 1953, the base came to have an important role in the Cold War strategy of Strategic Air Command and, later, Tactical Air Command. In 1992, Hurricane Andrew further damaged the architectural resources of the base, demolishing all but one of the remaining pre-1945 structures and severely damaging much of the rest of the base. The damage was so extensive the Air Force determined Homestead AFB could not fulfill its active duty mission, and its active units were reassigned and deployed to other bases (**Patterson et al. 1997**).

3.12.3 Archaeological, Architectural, and Historic Landscape Resources

3.12.3.1 Existing Environment

Archaeological Resources

Information on archaeological resources was obtained from the National Register, the Florida Division of Historic Resources, Biscayne National Park, and the Miami-Dade Office of Community and Economic Development, Historic Preservation Division.

A reconnaissance-level survey of former Homestead AFB was conducted by NPS in 1986 as part of an interagency technical assistance agreement between NPS and Homestead AFB (**Parsons Corporation et al. 1992**). The reconnaissance survey was of the entire base to determine the need for and scope of any additional investigations necessary to discover significant cultural resources. The survey consisted of windshield and pedestrian inspection and archival research. Drainage ditches that transect the base provided views of the topsoil overlying the basal Miami Oolite, indicating that the topsoil was no more than 4 inches deep.

Based on what is known of the ground conditions at former Homestead AFB, coupled with the construction history of the base, the report concluded that there is virtually no probability for the discovery of significant archaeological sites on the installation (**Parsons Corporation et al. 1992**). The Florida State Historic Preservation Office (SHPO) concurred with this conclusion (**Percy 1993**). However, further investigations indicated that former Homestead AFB may have included hammocks or other slightly higher topography (**Carr 1998**). Grading and filling during base construction could have disturbed archaeological sites, but also could have left some or part of such deposits undisturbed (**Carr 1998**). There is a slight possibility that future construction could encounter previously unidentified subsurface archaeological deposits. Cleanup activities following Hurricane Andrew did not discover any archaeological resources on the former base.

A survey of a 3,500 acre tract developed by HUD directly adjacent to Homestead ARS identified no archaeological sites (**Swindell 1975**).

At least four National Register-eligible archaeological resources are within areas outside of former Homestead AFB that could be affected by development related to reuse of the former base. (**Table 3.12-1**). Within Biscayne National Park, the Sweeting Homestead and the Offshore Reefs Archaeological District are listed on the National Register. Sands Key Archaeological District has been nominated to the National Register. In addition, another 57 National Register-eligible archaeological resources have been identified. (**NPS 1998b**).

Table 3.12-1. Cultural Resources in the ROI

Property Type	Preservation Status			Location			
	NR Listed	NR Eligible	Locally Important	Within 65 dB Contour	South Miami-Dade County	Biscayne NP	Everglades NP
Archaeological Site	2	61			4	58	1
Archaeological District	3	1				2	2
Architectural Site	13	16	61	1	88	1	
Architectural District	1	2	1		1	3	
Cultural Landscape		1				1	
Total	**19**	**81**	**62**	**2**	**93**	**65**	**3**

Source: **NPS 1998c, Florida Heritage Magazine 1998, Metro-Dade County n.d.a, NPS 1998b, Cordell 1997.**
NR National Register of Historic Places

The portion of Everglades National Park within Miami-Dade County includes two National Register archaeological districts: the Shark River Slough Archaeological District and the Lake Archaeological District. The historic Anhinga Trail is also on the National Register.

Architectural Resources

Two destructive hurricanes have eliminated most architectural resources on former Homestead AFB that could have been eligible for the National Register based on their age and architectural merit. In 1945, the damage was so extensive that the base was placed on inactive status. In 1992, Hurricane Andrew further damaged the architectural resources of the base, demolishing all but one of the remaining pre-1945 structures. Coupled with the fact that there was no construction on the base between 1945 and 1952, this leaves only one architectural resource more than 50 years old. However, there are numerous structures dating to the Cold War era.

Two architectural inventories have been completed on former Homestead AFB. The first concentrated on structures constructed prior to 1945; six were identified (**Parsons Corporation et al. 1992**). All but one of these pre-1945 architectural resources were destroyed by Hurricane Andrew. The surviving structure, Building 121, is a 1942 maintenance shop that has been determined not to be eligible for the National Register (**Percy 1993**).

The second inventory, part of an Air Combat Command nationwide study, examined Cold War cultural material at former Homestead AFB (**Patterson et al. 1997**). The inventory identified all architectural resources that could be considered eligible for the National Register, with construction dates up until 1989 when the Cold War ended with the destruction of the Berlin Wall. This study identified two buildings and one set of documentation that are important to understanding the Cold War.

The documentary collection consists of drawing details for Nike Hercules and Hawk Missiles and missile sites. Although the documentation is currently stored in a building on former Homestead AFB, it can be curated in any appropriate location. Air Combat Command recommended the documents be copied for use by Homestead ARS and the originals be sent to a permanent curatorial facility for stewardship and conservation (**Patterson et al. 1997**).

Building 931 was the USAF Conference Center, built in 1974. It was the site of many top-level Air Force meetings and work groups where numerous policy decisions were developed and announced. It is located in the portion of former Homestead AFB that has been conveyed to the Department of Labor. The 1997 Air Combat Command Cold War survey (**Patterson et al. 1997**) considered this building to have exceptional importance and to be eligible for the National Register (**Patterson et al. 1997**). However, records at the Air Force Base Conversion Agency show that Building 931 is not eligible, nor was it ever considered potentially eligible (**Mendoza 1999**). Therefore, the transfer documents had no stipulations in them with regard to historic properties or their eligibility (**Mendoza 1999**). Building 931 and the documentary collection are the only cultural resources within the DNL 65 dB contour for current military and government operations at Homestead ARS.

There are 89 identified historic architectural resources in the ROI of South Miami-Dade County, not including those in Biscayne NP. Thirteen of these are National Register properties, and 15 are National Register-eligible. They include public and private buildings, a gate, a pool, and other structures. Miami-Dade County has listed another two architectural structures and one historic district (**Metro-Dade County n.d.a**), the City of Homestead has listed another 17 structures (**Research Atlantica 1994**), and the Florida SHPO lists 42 as having local importance. A survey of the 3,500 acre tract directly adjacent to Homestead ARS that was developed by HUD located no architectural resources (**Swindell 1975**). However, a number of architectural resources have been identified by local preservation efforts (**Florida Heritage Magazine 1998**, **Metro-Dade County n.d.a**, **Metro-Dade County 1981**).

In addition, Biscayne National Park includes the Boca Chita National Register Historic District, with 10 structures, and the National Register-nominated Stiltsville Historic District. A multiple property nomination for Biscayne National Park cultural resources, to be submitted to the National Register, will encompass several historic themes and site types (**NPS 1998b**). The National Register-eligible Fowey Rocks Lighthouse, owned by the U.S. Coast Guard, is also within the national park boundaries.

Historic Landscape Resources

Biscayne National Park has completed the first phase of a Cultural Landscape Inventory. The proposed Biscayne National Park maritime cultural landscape will be based on elements of varied historic activities and remains on the keys, within the bay, and along the reef tract. A Biscayne National Park historic or cultural landscape could include Boca Chita, an ethnographic landscape encompassing the varied activities and remains on the keys, or a maritime historic landscape incorporating the submerged landscape (**NPS 1998b**).

3.12.3.2 Projected Baseline Environment

Development in the vicinity of former Homestead AFB could, but is unlikely to, result in the discovery of archaeological deposits. Any higher terrain, such as a hammock or tree island, would have the potential for archaeological resources (**Ricisak 1998**). Future surveys could also identify additional archaeological sites. Sites with undetermined National Register status could be evaluated as eligible or not eligible for the National Register, which could have implications for future development plans. Areas with known dense or important sites could be designated as districts or zones by Miami-Dade County.

Most cultural resources must be over 50 years old to be considered eligible for the National Register. This means that an architectural feature built between 1949 and 1950 could become eligible by the year 2000; if built between 1950 and 1955, it could be eligible by the year 2005; and if built between 1955 and 1965, it could be eligible by the year 2015. Architectural resources that will become 50 years old could be considered eligible for the National Register, although none have been identified at this time.

The Air Combat Command Cold War survey (**Patterson et al. 1997**) is the only architectural survey that has been performed on former Homestead AFB that identified cultural resources that could reach 50 years of age before 2015. That survey identified the only theme that could encompass future eligibility of buildings at the former base, and its results were discussed above. Based on the results of the Air Combat Command survey, base history, and the destruction wrought by the hurricane of 1945 and Hurricane Andrew, it is extremely unlikely that there are any additional architectural resources on the former base that could become eligible for listing on the National Register in the future.

3.12.4 Traditional Cultural Resources

Natural features, spiritual locations, and some structures may not be addressed in historic preservation legislation for the following reasons: (1) their historic use cannot be documented; (2) the resource does not have an integral relationship to traditional cultural practices and beliefs; (3) the present condition is such that the relationships no longer survive; (4) the resource's boundaries cannot be delineated; or (5) the resource does not meet the National Register eligibility criteria, including those related to integrity and age. However, even though a traditional cultural resource may not be considered significant according to National Register criteria, it may still have importance to a particular group, such as a Native American tribe or band. In that case, traditional cultural resources may be protected, or access to resources ensured, according to the provisions of the Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and Executive Order 13007.

3.12.4.1 Existing Environment

The State of Florida's Division of Historical Resources has identified at least three cultural communities that could potentially be associated with traditional cultural resources in Florida: modern Seminole Indian groups, African-American communities, and Cuban-American communities (**Cuban Heritage Trail Magazine 1998**, **Florida Heritage Magazine 1998**, **Division of Historical Resources 1998b**).

Traditional Seminole resources could potentially include archaeological resources; locations of important historic events; sacred areas; sources of raw material used to produce tools and sacred objects; traditional hunting, gathering, or meeting areas; native plants or animals; prominent topographic features; and other elements of the natural or built environment. Native Americans may consider these resources essential for the persistence of their traditional culture. No traditional Seminole resources have been reported within the ROI, and the Seminole and Miccosukee Tribes have not reported any traditional Native American cultural resources within the ROI.

Although the African-American and Cuban-American communities have identified culturally important locations, none of these have been designated traditional cultural resources. The Florida Department of State, Division of Historic Resources, has compiled locations and historic events important to Florida's African-American history in *Black Heritage Trail Sites* (**Florida Heritage Magazine 1998**). Among those that are in Miami-Dade County are the birthplaces or residences of people important to the African-American community; gathering places such as churches, community centers, neighborhoods, and parks; locations of services such as a hospital, cemetery, school or orphanage; and theaters and museums (**Florida Heritage Magazine 1998**).

The state has also identified locations and properties important to Cuban-American history, including several in Miami-Dade County (**Cuban Heritage Trail Magazine 1998**). These include museums, a factory, plazas, and churches.

No traditional cultural resources are located within former Homestead AFB, and none are known to be within the ROI.

3.12.4.2 Projected Baseline Environment

No traditional cultural resources have been identified in the ROI that could be affected by projected baseline population growth and development.

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3.13 MINORITY AND LOW-INCOME POPULATIONS

3.13.1 Introduction

This section identifies minority and low-income populations that have the potential to be affected by the disposal and reuse of former Homestead AFB property.

3.13.1.1 Resource Definition

Minority populations include all persons identified by the Census of Population and Housing to be of Hispanic origin, regardless of race, and all persons not of Hispanic origin other than White (i.e., non-Hispanic persons who are Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, or other race).

The federal government maintains a government-to-government relationship with Native American tribes, and Native American populations and reservation lands are addressed separately, in addition to being included in the discussion of minority populations.

Low-income populations include persons living below the poverty level ($12,674 for a family of four in 1989, adjusted based on household size) as reported in the 1990 Census of Population and Housing (**GeoLytics 1996**). The percentage of low-income persons is calculated as a percentage of all persons for whom the Bureau of the Census determines poverty status, which is generally a slightly lower number than the total population.

3.13.1.2 Applicable Laws and Regulations

Executive Order 12898, Environmental Justice. The objectives of this executive order include identification of disproportionately high and adverse health and environmental effects on minority populations and low-income populations that could be caused by a proposed federal action. Accompanying Executive Order 12898 was a Presidential Transmittal Memorandum that referenced existing federal statutes and regulations, including NEPA, to be used in conjunction with the executive order. The Council on Environmental Quality issued *Environmental Justice Guidance Under NEPA* in December 1997.

Air Force guidance for implementation of the executive order is contained in the Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process, dated November 1997 (**USAF 1997**). The USDOT guidance is contained in DOT Order 5610.2, *Department of Transportation Order To Address Environmental Justice in Minority Populations and Low-Income Populations.*

3.13.1.3 Region of Influence

The demographic profile of the region provides the context within which the environmental justice analysis was conducted. In order to determine whether or not environmental impacts would disproportionately affect minority or low-income populations, it is necessary to establish an appropriate basis of comparison. This basis is the "region of comparison," which consists of the geopolitical units that encompass the impact footprint of the proposed project. The environmental justice analysis, therefore, uses this region of comparison to define the ROI (**Figure 3.13-1**). Most environmental effects from the Proposed Action and alternatives would be expected to occur in southern Miami-Dade County, south of Eureka Drive, which is the ROI for the environmental justice analysis.

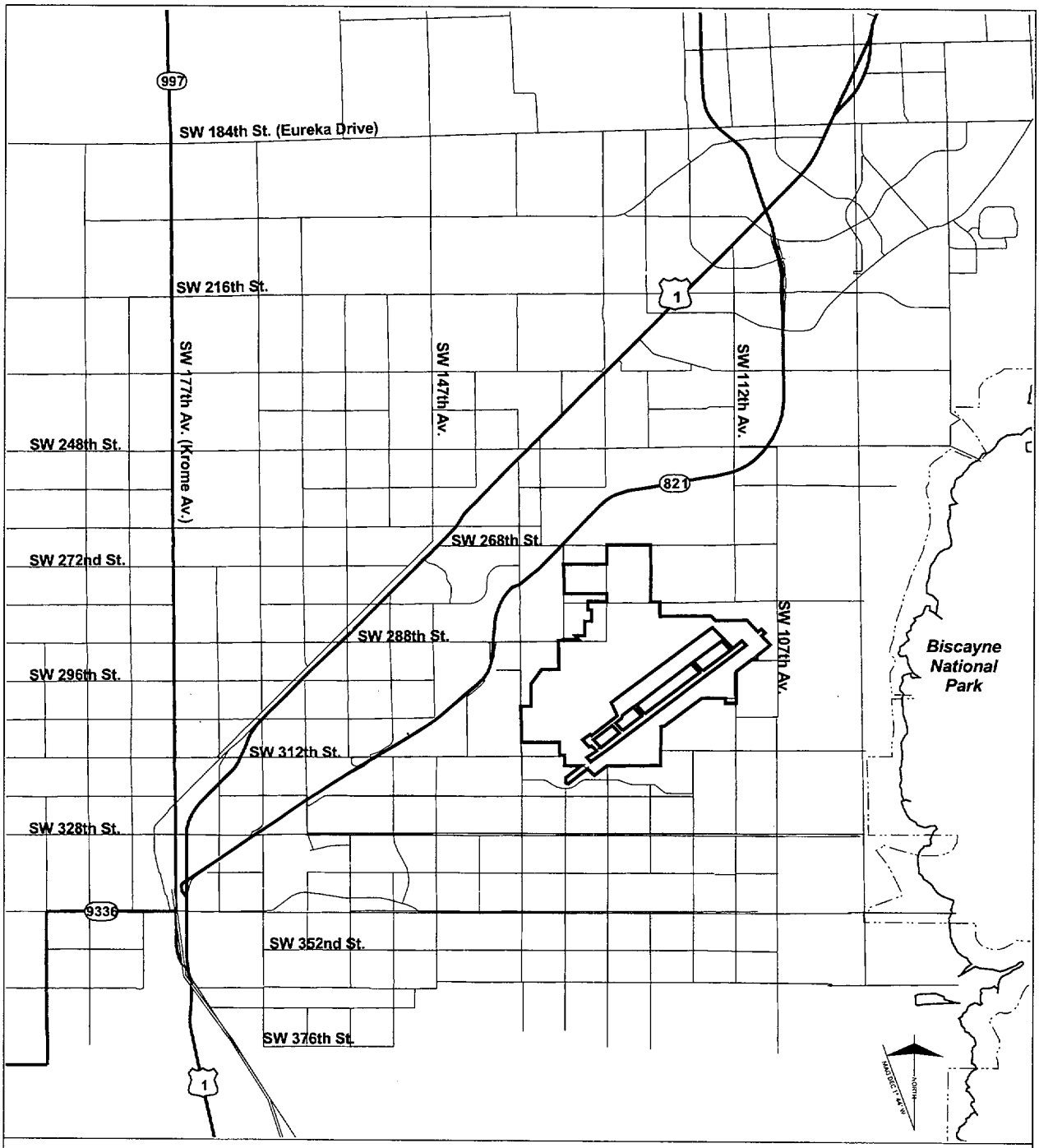


Figure 3.13-1
Region of Influence
for Environmental Justice Analysis

3.13.2 Existing Environment

Based upon the 1990 Census of Population and Housing, Miami-Dade County had a total population of 1,937,094, of which 1,349,031 (69.6 percent) were minority and 341,261 (17.9 percent) were low-income. Of the total population, 949,700 (49.0 percent) were persons of Hispanic origin. In addition, the Census reported persons not of Hispanic origin, of which 371,691 (19.2 percent were Black); 2,115 (0.1 percent) were American Indian, Eskimo, or Aleut; 23,163 (1.2 percent) were Asian or Pacific Islander; and 2,362 (0.1 percent) were of other races.

There are no Indian reservations located in the ROI. The Miccosukee Indian Reservation and portions of the Big Cypress Seminole Indian Reservation are located to the north in western Broward County.

There are no detailed current estimates (comparable to the 1990 Census) of minority populations or low-income populations for sub-county areas such as census tracts or block groups. Information from state and county government agencies and from the Miami-Dade County Public Schools suggests that the ethnic composition and the percentage of low-income population in the county have changed since the 1990 Census. Enrollment information provided by the Miami-Dade County Public Schools indicates that, between 1993 and 1997, the percentage of Hispanic students in the district increased from 48.0 percent to 51.4 percent, and in Region VI, which serves south Miami-Dade County, it increased from 40.1 percent to 48.9 percent (see Section 3.1.5 Public Education). In addition, Hurricane Andrew and the subsequent realignment of Homestead AFB to Homestead ARS have resulted in some reductions in economic activity in south Miami-Dade County. Housing assistance was made available after the hurricane, which resulted in housing becoming more affordable to persons with lower incomes, while military and civilian personnel receiving federal salaries and benefits left the area following realignment of the base.

Commercial vendors can also provide some current estimates of race and income status at the sub-county level, but these data are not compatible with current population estimates prepared by state and local agencies and it does not report Hispanic origin by race. Therefore, although the composition of the minority population and the low-income population in Miami-Dade County may have changed since 1990, the 1990 Census remains the only complete data source estimating minority populations.

To further assist in identifying minority and low-income populations in the ROI, contacts were made with local organizations representing migratory and seasonal farm workers, providers of housing for low-income persons, and organizations representing minority groups. The scoping process for the SEIS included sending public notification of scoping meetings in both English and Spanish to an extensive mailing list containing names of public and private organizations and individuals.

Migrant and seasonal farmworkers may be members of low-income populations and/or minority populations, and although this group is geographically dispersed/transient, individuals tend to experience common conditions of environmental exposure and effect. Migratory and seasonal workers in Miami-Dade County work primarily in farming row crops, fruit trees, and botanicals. The Coalition of Florida Farmworker Organizations represents migratory workers in the Homestead area.

Under the Federal Housing Act of 1937, as amended, and the Florida Housing Act, the City of Homestead Housing Authority operates housing programs with the goal of providing safe, decent, sanitary housing for low-income and indigent persons. The Homestead Housing Authority operates three housing projects under the U.S. Department of Agriculture Farmworker Housing program. One of these projects, the South Dade Center, is located at 13600 SW 312th Street in Homestead, southwest of the Homestead ARS runway. The project contains about 311 units. An estimated 2,400 persons reside in the

South Dade Center. Portions of this housing area are within the DNL 60 and 65 dB contours for existing military and government aircraft operations at Homestead ARS (see Figure 3.6-4).

3.13.3 Projected Baseline Environment

As noted above, the most recent detailed estimates of minority populations and low-income populations available for use in the environmental justice analysis are provided in the 1990 Census of Population. Although it appears that the percentage of minority populations and low-income populations in Miami-Dade County continues to increase, detailed demographic projections through 2015 are not available.

3.14 DEPARTMENT OF TRANSPORTATION ACT SECTION 4(f) LANDS

3.14.1 Introduction

This section summarizes publicly owned lands subject to the provisions of Section 4(f) of the Department of Transportation Act which may be affected by reuse of former Homestead AFB. Section 4(f) applies exclusively to approvals of transportation projects by the U.S. Department of Transportation, including any of its modal agencies such as the FAA. The FAA consults with the Department of the Interior on Section 4(f) determinations. Section 4(f) does not apply to approvals by other federal agencies such as the Air Force, nor to state or local approvals. It does not apply to projects that are not transportation projects, including reuse alternatives for former Homestead AFB that do not require USDOT or FAA approval.

3.14.1.1 Resource Definition

Publicly owned lands subject to the provisions of Section 4(f) include public parks, recreation areas, and wildlife and waterfowl refuges of national, state, or local significance. Land of historic sites of national, state, or local significance are also subject to Section 4(f), whether the land is publicly owned or privately owned. Any part of land subject to Section 4(f) is presumed to be significant unless the agency having jurisdiction makes a statement of insignificance relative to the entire land.

3.14.1.2 Applicable Laws and Regulations

Department of Transportation Act (49 U.S.C., Subtitle I, Section 303). This act, commonly known as DOT Section 4(f) or simply Section 4(f), mandates that special effort be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites in implementing transportation projects. The Secretary of Transportation may approve a transportation program or project requiring the use of lands protected under Section 4(f) only if (1) there is no prudent and feasible alternative to using that land, and (2) the program or project includes all possible planning to minimize harm to the affected land from the proposed use.

FAA Order 5050.4A, Airport Environmental Handbook. This order contains guidance on compliance with Section 4(f) of the DOT Act.

Airport Noise Compatibility Planning (14 CFR, Subchapter I, Part 150). This regulation contains compatible land use guidelines with respect to aircraft noise exposure that are relevant to most parks and recreation areas and to historic sites. These guidelines are supplemented for wildlife refuges and for national parks whose values and uses exceed common categories of park and recreational uses included in the guidelines.

Federal Highway Administration/Federal Transit Administration Constructive Use Guidance under 23 CFR 771.135. The FAA uses Federal Highway Administration/Federal Transit Administration guidance on constructive use to the extent relevant to FAA actions.

3.14.1.3 Region of Influence

The region of influence for Section 4(f) consideration is determined by the nature and extent of effects from any proposed transportation use associated with reuse of the disposal property at former Homestead AFB. The region of investigation (**Figure 3.14-1**) for characterizing the affected environment is defined as including south Miami-Dade County (south of Eureka Drive), Biscayne and Everglades NPs, Crocodile Lake NWR, Big Cypress National Preserve, Florida Keys National Marine Sanctuary, John Pennekamp Coral Reef State Park, Bill Baggs State Park, and Key Largo Hammocks State Botanical Site.

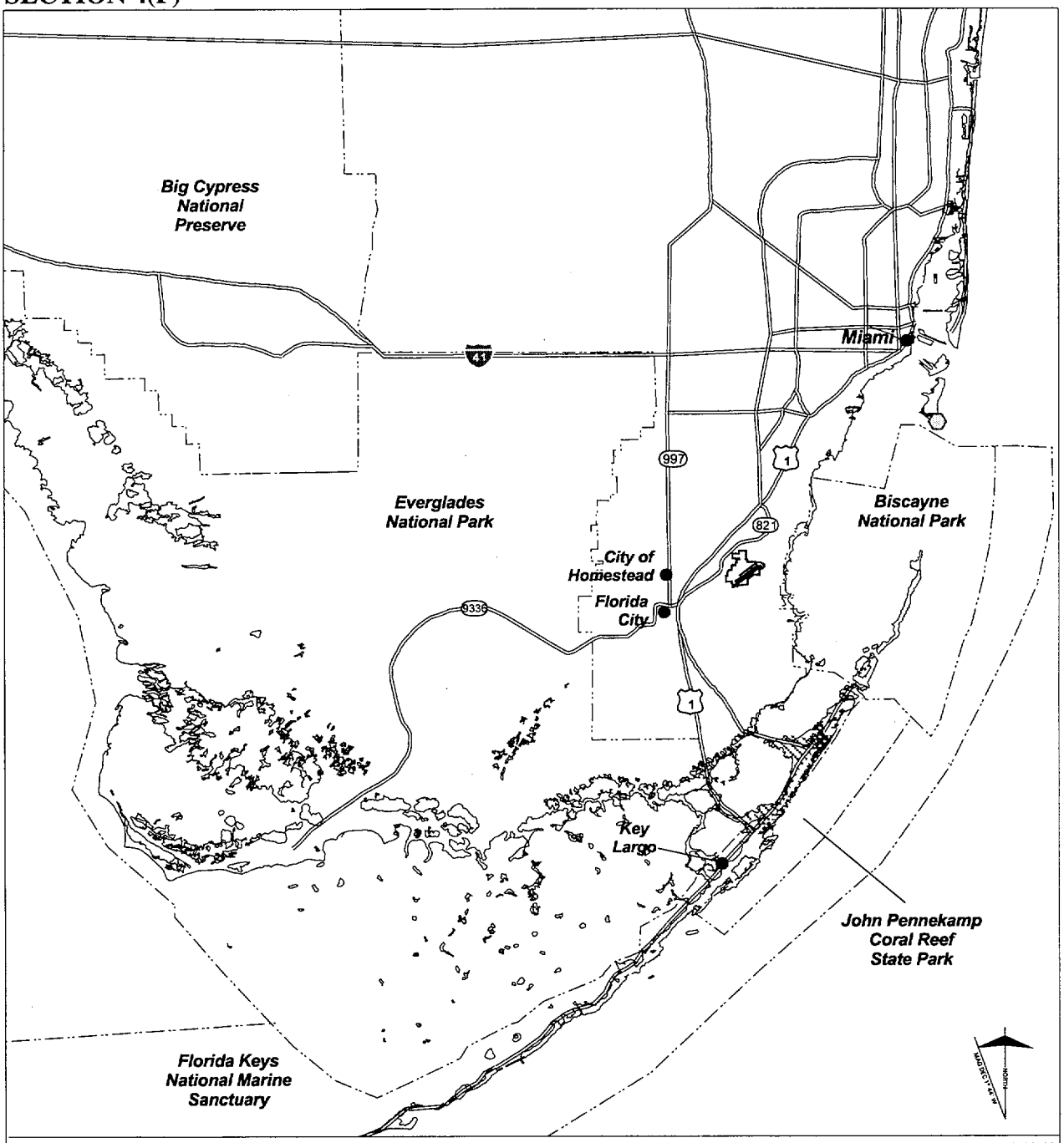


Figure 3.14-1
Region of Investigation for
DOT Act Section 4(f)

The area of focus for identifying and assessing impacts to public parks, recreation areas, refuges, and historic sites of local significance is comprised of the five Transportation Analysis Districts encompassing and surrounding former Homestead AFB.

3.14.2 Existing Environment

Section 3.6 of this SEIS provides detailed descriptions of the parks and refuges of national significance considered for the Section 4(f) analysis, including the two national parks, Crocodile Lakes NWR, Big Cypress National Preserve, and Florida Keys National Marine Sanctuary. John Pennekamp and Bill Baggs State Parks are also described in Section 3.6 as parks of state significance. That section discusses the values and management goals that each area's agency of jurisdiction has placed on the resources of the area. In addition to their recreation value, each of those areas contains and supports various important physical and biological resources identified for preservation in the agencies' management objectives. Physical resources include air quality, discussed in Section 3.8, and water resources, discussed in Section 3.10. The biological resources, including threatened, endangered, and other species of concern, are described in Section 3.11. These national and state parks and refuges are shown on Figure 3.14-1.

While nature is a principal value in the national parks, refuges, and preserves in the ROI, the local parks and recreation areas in the vicinity of former Homestead AFB can be generally characterized as urban or suburban parks for the use and enjoyment of nearby residents. **Figure 3.14-2** depicts local parks within the five TADs that include and surround the former base. There are no designated federal, state, or local wildlife or waterfowl refuges within the five TADs surrounding former Homestead AFB.

Historic resources are discussed in detail in Section 3.12. **Figure 3.14-3** shows the location of historic sites in the five TADs. The sites and their status relative to eligibility to the National Register or local register are listed in **Table 3.14-1**. Several of the sites are not independently eligible for listing on the National Register but are potential contributors to a National Register district.

In comments on the Draft SEIS, South Florida Water Management District submitted additional information on areas that it owns and manages in the vicinity of the region of influence for Homestead. These areas, described in Section 3.6, include the Southern Glades Wildlife and Environmental Area, Model Lands Basin, and Frog Pond/L31N Transition Lands. They were acquired for protection under the Save Our Rivers program because of their environmental sensitivity. They are not officially designated as public parks or wildlife refuges and do not specifically function as such. However, the Southern Glades and Model Lands Basin provide a wildlife corridor between the national parks and refuge, and the Southern Glades and Frog Pond/L31N Transition Lands allow various public recreational uses to the extent appropriate to the environmental sensitivity of the areas. While the applicability of DOT Section 4(f) to these SFWMD lands is uncertain, the FAA has included them within its 4(f) evaluation in Section 4.14.

3.14.3 Projected Baseline Environment

A portion of former Homestead AFB has been transferred to Miami-Dade County for a regional park (see Figure 3.14-2). The regional park is expected to be developed over the next 10 years and eventually provide a variety of recreational opportunities for residents in south Miami-Dade County, including playgrounds, picnic facilities, ball fields, and a stadium.

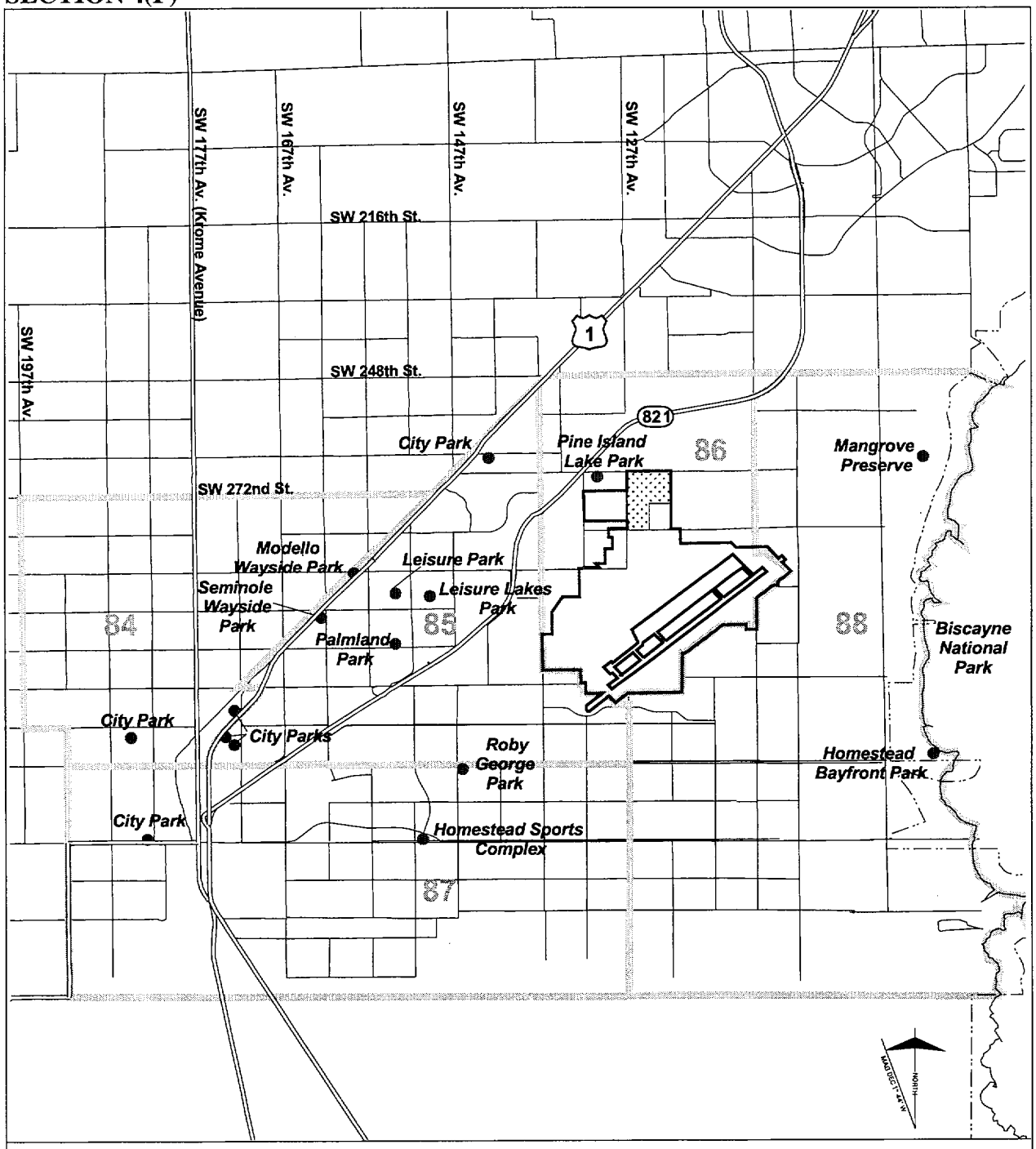
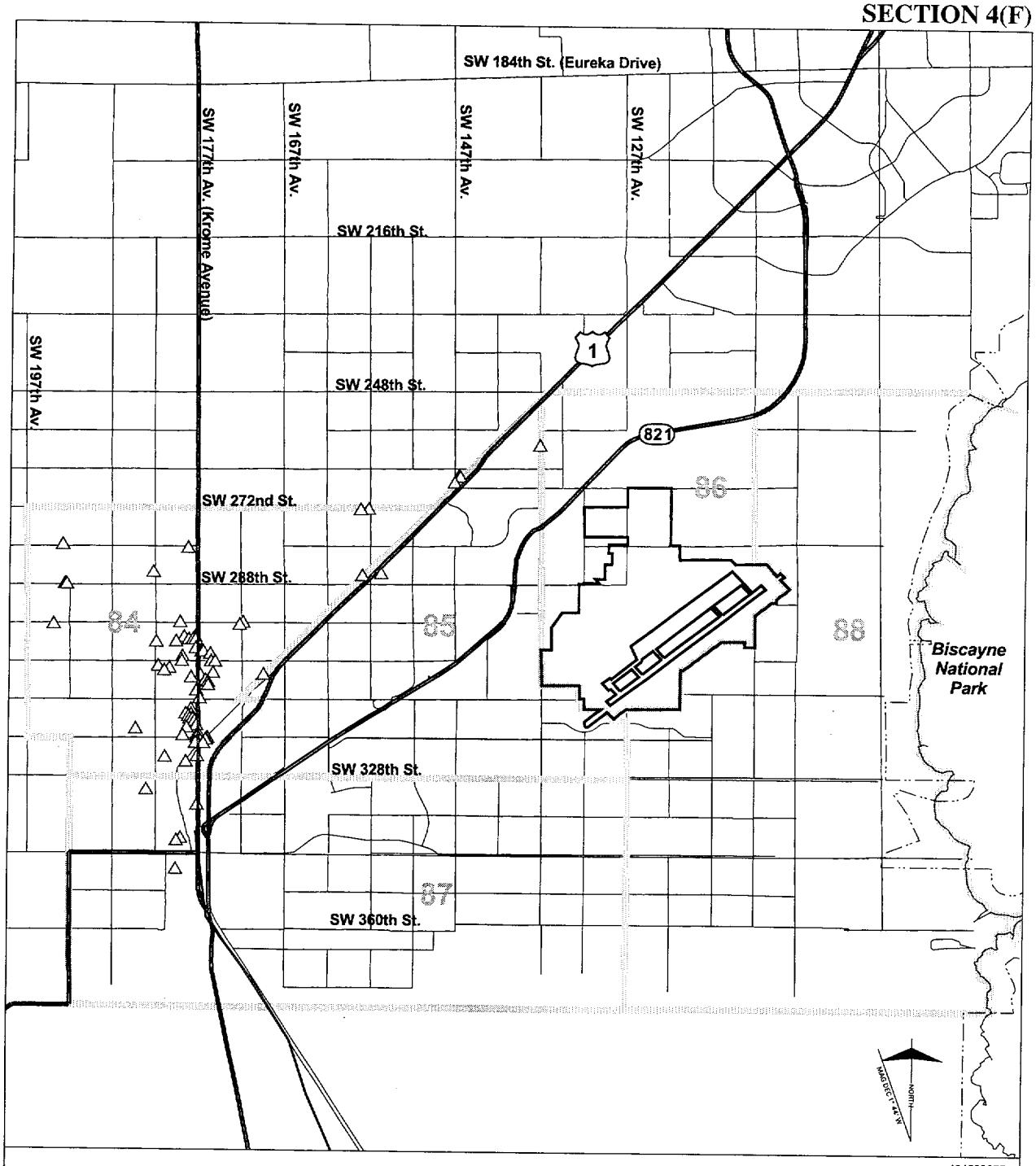


Figure 3.14-2
Parks in the Vicinity of
Former Homestead Air Force Base



LEGEND

- Former Homestead AFB
- Historic Site
- 84 Transportation Analysis District
- Major Road
- Street
- U.S. Highway
- State Highway

1 0 1
Scale in Miles

Derived from:
Florida Bureau of Historical Research n.d.,
Metro-Dade County 1992b

Figure 3.14-3
Historic Sites in the Vicinity of Former Homestead AFB

Table 3.14-1. Historic Sites in the Vicinity of Former Homestead AFB

Site Name	Year Built	Use	Status
107 Lucy Street	c1910	Private residence	Likely eligible for local register
1320 Old Dixie Highway	c1910	Private residence	Likely eligible for local register
15800 SW 272nd Street	c1940	Private residence	Eligible for local register
167 NW 16th Street	c1930	Private residence	Likely eligible for local register
17201 SW 296th Street	c1913	Private residence	Eligible for local register
1780 North Krome Avenue	1924	Private residence	Potential NR eligible
19201 SW 288th Street	c1939	Private residence	Eligible for local register
25900 SW 137th Avenue	c1930	Private residence	Eligible for local register
26549 SW 147th Avenue			Locally listed in Homestead
27200 SW 157th Avenue	c1929	Private residence	Eligible for local register
28800 SW 192nd Avenue	c1937	Private residence	Eligible for local register
327 SW 2nd Street	c1930	Private residence	Eligible for local register
680 NW 14th Street	c1936	Private residence	Eligible for local register
94 NW 5th Street	1914	Private residence	Likely eligible for local register
Acheson Residence	c1922	Private residence	Eligible for local register
Barnes, Anita House	1924	Private residence	Likely eligible for local register
Bird House	1937	Private residence	Eligible for local register
Blockhus, Carlyle House	c1920	Private residence	Likely eligible for local register
Bow, Lily Lawrence Library	1938	Library	NR eligible
Burton Chapel, First Presbyterian Church			Locally listed in Homestead
Burton, Joe House	1925	Private residence	Likely eligible for local register
Campbell, Doris L. & Vovis, Donna R. House	1925	Private residence	Likely eligible for local register
Campbell, Ruth House	1925	Private residence	Likely eligible for local register
Cano Residence	c1920	Private residence	Eligible for local register
Caribe Motel	c1920	Private residence	Eligible for local register
Caves, Albert & Carrie Belle Johnston Residence	c1923	Private residence	Eligible for local register
Champaigns	1912	Bank	Eligible for local register
Craven, Glynn E. House	c1930	Private residence	Likely eligible for local register
Dade Homestead Townhall	1917	City hall	NR eligible
Dandhasresdhi, Saner House	c1920	Private residence	Unknown
Davis, John and Dollie House	1930	Private residence	Likely eligible for local register
Deitz Residence	c1935	Private residence	Eligible for local register
Delk, Harris V. House	c1920	Private residence	Unknown
Faust, Thomas House	1926	Private residence	Potential NR eligible
First Baptist Church	1944	Religious temple	Eligible for local register
Florida Pioneer Museum	1904	Museum	Potential NR eligible
Frederick, John & Lois House	1924	Private residence	Likely eligible for local register
Fuchs Bakery	1913	Retail establishment	Potential NR eligible
Gadway, John F. House	c1930	Private residence	Likely eligible for local register
Hanson, Don House	1936	Private residence	Likely eligible for local register
Hausman, B. N. House	c1920	Private residence	Likely eligible for local register

Site Name	Year Built	Use	Status
Hillard, Dora House	c1920	Private residence	Likely eligible for local register
Institute of Food and Agricultural Sciences	c1931	Laboratory—research	Eligible for local register
Johnson, Robert B. House	1915	Private residence	Likely eligible for local register
Landmark Hotel, The	1913	Theater	Eligible for local register
Lee Residence	c1925	Private residence	Likely eligible for local register
Lichkai, Cheryl House	1930	Private residence	Likely eligible for local register
Lindeman/Johnson House	c1923	Private residence	NR eligible
Luther Chandler House			NR eligible
McMinn/Horne House	1920	Private residence	NR eligible
Moll, Melvin and Mildred House	1927	Private residence	Likely eligible for local register
Moody Residence			Locally listed in Homestead
Moody, William T. House	1925	Private residence	Likely contributor to NR district
Moore, Hal and Janice O. House	1906	Private residence	Likely eligible for local register
Morris, Victor B. House	c1930	Private residence	Likely eligible for local register
Naranja Store/Post Office			Locally listed in Homestead
Neva King Cooper Elementary School	1913	School	Potential NR eligible
Old Homestead City Hall	1917	City hall	Likely eligible for local register
Overton Residence	c1935	Private residence	Eligible for local register
Pavic, Iloma House	1926	Private residence	Likely eligible for local register
Peters, Russell House	1938	Private residence	Likely eligible for local register
Porvenir/Garcia House	1925	Private residence	Eligible for local register
Redd Residence	c1927	Private residence	Eligible for local register
Redland Hotel	1913	Hotel	Likely eligible for local register
Risberg, Robert and Andrea House	1926	Private residence	Likely eligible for local register
Rock Gate (Coral Castle)	1920	Commercial	Potential NR eligible
Rubens, Barbara House	c1930	Private residence	Likely eligible for local register
Seminole Theatre	1940	Theater	Potential NR eligible
Simmon's Bar	c1920	Commercial	Likely eligible for local register
Soto, Efrain House	c1920	Private residence	Likely eligible for local register
St. Paul Baptist Church	1942	Religious temple	Potential NR eligible
Super Transmissions	c1930	Commercial	Likely eligible for local register
U S Sand Blasting	1926	Terminal	Potential NR eligible
Victor House	c1921	Private residence	Eligible for local register
Whitney, Gerald T. House	1923	Private residence	Likely eligible for local register

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NR National Register

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4.0 Environmental Consequences

IN THIS CHAPTER

Chapter 4 describes the environmental impacts identified from the Proposed Action, Commercial Spaceport alternative, Mixed Use alternative, No Action alternative, and Independent Land Use Concepts. The chapter is divided into the same 14 resource topics used in Chapter 3:

- Socioeconomics (**Section 4.1**)
- Transportation (**Section 4.2**)
- Utilities (**Section 4.3**)
- Airspace and Safety (**Section 4.4**)
- Noise (**Section 4.5**)
- Land Use and Aesthetics (**Section 4.6**)
- Hazardous Materials, Hazardous Waste, and Petroleum Products (**Section 4.7**)
- Air Quality (**Section 4.8**)
- Earth Resources (**Section 4.9**)
- Water Resources (**Section 4.10**)
- Biological Resources (**Section 4.11**)
- Cultural Resources (**Section 4.12**)
- Minority and Low-Income Populations (**Section 4.13**)
- Department of Transportation Act Section 4(f) Lands (**Section 4.14**)

The information on each alternative includes:

- The direct and indirect impacts of the alternative estimated for 2000, 2005, 2015, and full buildout.
- The potential cumulative impacts of the alternative in combination with other future projects and developments in the region.
- Mitigation measures that might reduce or eliminate the impacts.

The results of some resource analyses are used in other resources. For example, employment and population estimates in Socioeconomics are used to estimate traffic in Transportation and Utilities consumption. Noise information is used in Land Use and Biological Resources. Findings in Water Resources also affect Biological Resources. Noise and Land Use information feeds into the analysis of impacts on Minority and Low-Income Populations.

Some of the interrelationships among resources are reflected in the summary of impacts by selected topics in **Section 2.9.2** of **Chapter 2**.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental effects that could result from disposal and subsequent reuse of 1,632 acres of surplus property at former Homestead AFB, referred to in the SEIS as the "disposal property." As described in Section 2.1, this is the remaining surplus property at the former base not already conveyed or proposed for conveyance. Chapter 4 describes analyzed impacts within the same 14 resource topics described in Chapter 3. Each section addresses the following alternatives, which are described in detail in Chapter 2:

- Proposed Action (commercial airport)
- Commercial Spaceport alternative
- Mixed Use alternative
- No Action alternative
- Independent land use concepts

The Draft SEIS examined three possible scenarios for the Mixed Use alternative: Market-Driven development, Collier Resources Company proposal, and Hoover Environmental Group plan. The Final SEIS also includes the joint Collier-Hoover proposal submitted during the comment period on the Draft SEIS. The Collier-Hoover proposal is apparently intended by the proponents to replace both the original Collier proposal and the original Hoover plan, but those two scenarios have been retained in the Final SEIS for comparison. Each section in this chapter addresses the Market-Driven scenario first, followed by the Collier-Hoover proposal, and then the original Collier and Hoover plans.

The impacts described in this chapter represent a best estimation of the consequences of conveying ownership of the disposal property to public or private entities for reuse. The reuse developments analyzed below are not being proposed by the Air Force or FAA and would not be implemented by those agencies. Rather, the Air Force and FAA have largely relied on plans developed by Miami-Dade County, other proposals received for reuse of former base property, and other studies and discussions to devise a reasonable estimation of what could occur subsequent to property conveyance. This is done to provide Air Force and FAA decision makers with an understanding of the reasonably foreseeable environmental consequences of alternative federal decisions.

Because the environmental impacts described in this chapter would stem from the actions of others, and the level of planning that has been accomplished varies among alternatives, the quantitative estimates presented in this SEIS should be considered nominal. The actual reuse details may ultimately differ somewhat as planning progresses. However, given uncertainties about future events, the effects described in this chapter present the most likely range of consequences that might be anticipated from the reuse of the disposal property at former Homestead AFB. Among the factors that could affect the outcome of development plans are the approvals required under Chapter 288 of the Florida Statutes and permits required for surface water management. These requirements are described in Section 2.2.6.

The discussion of each alternative includes direct and indirect impacts, cumulative impacts, and mitigation measures. For the Proposed Action, there is also a discussion of possible future expansion of the commercial airport to include a second runway. Similarly, the analysis of the Commercial Spaceport alternative discusses the possibility of a combined Commercial Spaceport/Airport. Three time frames are presented to reflect the progress of reuse development: 2000, 2005, and 2015. In addition, the analysis examines the potential for full buildout beyond 2015.

As the analysis attempts to project potential environmental consequences farther into the future, the ability to accurately predict impacts becomes more difficult. Impacts in 2015 are more difficult to predict than those in 2005, and full buildout could be in the distant future and extremely difficult to predict with a high level of confidence. Among the factors that are difficult to project into the far future are the precise nature and pace of the development of a commercial airport for the Proposed Action, the evolution of commercial space launch technology for the Commercial Spaceport alternative, future technological changes that could affect air pollutant and noise emissions, and other unpredictable events that may change the future baseline or affect the environmental consequences.

The impacts of each alternative are compared against the baseline conditions described in Chapter 3. In some cases, this baseline is represented by current conditions in the region of influence. In other circumstances, the baseline has been projected into the future to reflect changes expected to occur, independent of the reuse of the disposal property at former Homestead AFB. For example, population and development in south Florida will continue to grow whether or not the former base property is developed. As discussed in Section 2.1.3, there are various forecasts of the expected magnitude of that growth. For the purposes of this SEIS, a moderate growth forecast has been used to estimate the baseline population and level of development in 2000, 2005, and 2015. Each reuse alternative is then added to the baseline growth to assess the impacts. In addition, the analysis of cumulative impacts considers the effects of each alternative in combination with a more aggressive, high-growth population forecast for Miami-Dade County. This provides an estimation of the total effect of reuse of former Homestead AFB in combination with other, unrelated growth and development. Baseline conditions could not be projected across all resources for full buildout, because of the uncertainty of its timing and because forecasts are not generally available beyond 20 years into the future.

As another example of how the projected baseline is used, some of the surplus property at former Homestead AFB has already been transferred to other entities for reuse (see Section 2.1), and their reuse plans are in various stages of implementation. The realization of those plans for the previously conveyed property is considered part of the future baseline because it is not affected by the decisions that will emerge from this SEIS.

Although this chapter is organized in 14 resource sections, it is acknowledged that these resources are interrelated to a substantial degree. In recognition of those interrelationships, each resource topic relies upon the findings of relevant other analyses. For example, the population changes projected in the Socioeconomics analysis are reflected in projected traffic changes in the Transportation analysis, which are subsequently reflected in the emissions estimates of the Air Quality analysis. As another example, the same population changes can be expected to generate a need for additional housing, which would affect Land Use and increase Utilities demand, thereby affecting Water Resources, which, in turn, may impact Biological Resources.

4.1 SOCIOECONOMICS

4.1.1 Introduction

Socioeconomic impacts associated with implementation of the Proposed Action and alternatives are discussed in five major areas: (1) economic activity (employment and earnings), (2) population, (3) housing, (4) public services (government structure, public education, fire protection, police protection, and health services), and (5) public finance.

Most of the impacts identified would be related to either direct or indirect employment associated with reuse of former Homestead AFB property. Direct jobs are defined as on-site reuse–related jobs within the boundaries of the former base. Indirect jobs would be off site but related to or stimulated by reuse activities. These could include, for example, jobs with businesses that provide supplies to on-site developers, or wholesale food distributors who supply on-site restaurants. Another type of indirect job is one created by the personal expenditures of employees working on the former base property. Those employees and their families would spend their earnings on such items as food and clothing and stimulate employment as a result.

The analysis of some socioeconomic impacts is based on population, which can be affected by development if that development stimulates population migration. Migratory-related effects are associated with persons who would move into the area primarily in response to the reuse of former Homestead AFB and resulting job opportunities.

As described in Section 2.1.3, there are a number of potential sources of workers who could fill the jobs (direct and indirect) created by the Proposed Action and alternatives. They include (1) new entrants into the labor force, (2) unemployed persons residing in south Miami-Dade County, (3) workers in-migrating to Miami-Dade County to fill specialized jobs or hoping to find employment at the former base (who would be likely to take up residence in the south part of the county), (4) employed persons residing in south Miami-Dade County who commute to jobs in the north part of the county and who could change their place of work, and (5) persons (employed and unemployed) currently residing and working in north Miami-Dade County who could relocate their place of residence and take jobs in the south part of the county. A small percentage of jobs could also be filled by Broward or Monroe County residents.

Based on a moderate level of baseline growth, the number of employees in south Miami-Dade County, south of Eureka Drive, is estimated to increase by more than 20,000 workers between 2000 and 2015. For the county as a whole, the number is 117,000. This increased labor pool would provide the primary source of workers for reuse-related jobs. It is reasonable to assume that new entrants into the labor force in the south county would prefer (all other things being equal) to take employment close to their place of residence rather than commute long distances.

The estimated number of unemployed workers who could fill reuse-related jobs was based on the 1997 unemployment level. The unemployment rate in Miami-Dade County at that time was 7 percent and had not fallen below 5 percent in well over a decade. It was assumed that the unemployment rate could fall as low as 5 percent if more jobs were available. This led to an estimated 2 percent of the workers in the labor force of south Miami-Dade County available to fill jobs created by reuse of former Homestead AFB. Since 1997, the unemployment rate for the county has declined to 6 percent (**Bureau of Labor Statistics 2000**). For comparison, unemployment rates for the state as a whole and for the nation were both close to 4 percent (**Bureau of Labor Statistics 2000**). Therefore, estimating that 2 percent of the labor force would be available from the unemployed labor pool continues to be a reasonable assumption. In December 1999, there were an estimated 51,651 unemployed persons in Miami-Dade

County (**Bureau of Labor Statistics 2000**). The SEIS assumes that between 1,095 and 1,550 reuse-related jobs could be filled by unemployed persons.

In-migration of some workers (and their dependents) into the county could occur to fill specific labor skill requirements and also because some workers might be attracted to the area in search of employment.

Some workers who currently commute north from their homes in the south county may take a job closer to home. There are more jobs per housing unit in the north part of Miami-Dade County than in the south (**Miami-Dade County 1998e**). The projected baseline estimates there will be an average of 0.8 jobs per housing unit in the south county by 2015, compared to about 1.4 jobs per housing unit in the north part of the county. The number of persons per housing unit is projected to be 2.82 in the south and 2.56 in the north. This difference between the north and south county areas likely means that the south part of the county is more of a bedroom community, and many residents there commute to work at places in the north part of the county or outside the county. It is anticipated that some of those commuters would take jobs closer to their places of residence if they had the opportunity, in order to reduce transportation time and cost. To estimate the number that might take jobs associated with the reuse of former Homestead AFB, it was assumed that the ratio between employment and housing units in south Miami-Dade County could reasonably increase from 0.80 to 1.0 by 2015. Because those people already reside in the southern part of the county, they would not create any population-related impacts (such as construction of new housing).

Finally, some workers currently living in the northern part of Miami-Dade County may relocate to the south county if employment opportunities are there. This could lead to some redistribution of population within the region. People who migrated south to take reuse-related jobs would stimulate housing construction and increase community service requirements in the south county.

4.1.2 Economic Activity

This section estimates employment effects associated with on-site development (direct employment), related off-site jobs (indirect employment), and jobs associated with other projected future development (cumulative employment). **Table 4.1-1** shows projected baseline and total estimated reuse-related employment associated with each alternative in Miami-Dade County as a whole and in the south county, for 2000, 2005, and 2015. Estimated reuse-related employment is also shown for full buildout, but no baseline projections are available for that milestone because of the uncertainty of when that could occur.

The projected baseline employment assumes a moderate growth rate in Miami-Dade County. Under this projection, employment is forecast to increase from 1,125,612 jobs in 1995 to 1,281,878 in 2015, a net increase of 156,266 jobs. Based on projections generated by Miami-Dade County for Transportation Analysis Zones in the county, most of these jobs (83 percent) are expected to be located in the northern part of the county (north of Eureka Drive). Of the 26,781 new jobs projected for the area south of Eureka Drive, over 64 percent are expected to occur in and around the City of Homestead and Florida City.

Table 4.1-1. Projected Baseline and Reuse-Related Employment in Miami-Dade County and the South County Region

Alternative	2000	2005	2015	Full Buildout
Miami-Dade County Baseline	1,164,679	1,203,745	1,281,878	NA
Proposed Action	0	4,527	27,546	38,454
Commercial Spaceport	0	4,405	10,065	13,017
Mixed Use	0	3,726–7,023	8,922–14,679	13,948–24,477
No Action	0	0	0	0
South County Baseline	48,378	55,074	68,464	NA
Proposed Action	0	3,637	23,191	32,716
Commercial Spaceport	0	3,532	8,472	10,939
Mixed Use	0	3,320–9,039	7,848-15,843	12,350-23,091
No Action	0	0	0	0

Source: SAIC.
Note: Employment for alternatives is in addition to baseline.
NA Not available

Table 4.1-2 shows projected baseline earnings for Miami-Dade County as a whole and for the south county under each alternative. Reuse-related earnings from both direct and indirect employment are shown for each alternative. Again, no baseline is available for full buildout.

Table 4.1-2. Projected Baseline and Reuse-Related Earnings in Miami-Dade County and the South County Region

Alternative	2000 (million)	2005 (million)	2015 (million)	Full Buildout (million)
Miami-Dade County Baseline	$33,706	$34,836	$37,097	NA
Proposed Action	$0	$131	$799	$1,116
Commercial Spaceport	$0	$129	$295	$381
Mixed Use	$0	$106–203	$259–425	$405–695
No Action	$0	$0	$0	$0
South County Baseline	$1,400	$1,594	$1,981	NA
Proposed Action	$0	$105	$673	$950
Commercial Spaceport	$0	$103	$248	$321
Mixed Use	$0	$94–243	$228–459	$358–670
No Action	$0	$0	$0	$0

Source: SAIC.
NA Not available

4.1.2.1 Proposed Action

Employment. Under the Proposed Action, the total direct and indirect reuse-related employment in 2015 is estimated at 27,546 jobs. This includes 13,187 direct, on-site jobs and 14,359 indirect jobs located off-site. These numbers do not include employment associated with activities on the retained and previously

conveyed property, which are included in the projected baseline. The reuse-related employment would represent 2.5 percent of the 1995 employment level for Miami-Dade County.

About 84 percent of the reuse-related jobs are expected to be located in south Miami-Dade County (23,191 of 27,546). This would represent about 56 percent of the south Miami-Dade County baseline employment level of 41,683 in 1995 and 34 percent of the projected baseline in 2015.

Total reuse-related employment of 27,546 jobs would be the equivalent of 3.5 years of employment growth for the entire county over and above that projected for 1995 through 2015 under baseline conditions. The total number of jobs attributable to implementation of the Proposed Action would represent 2 percent of total countywide employment in 2015 and contribute 18 percent over and above the projected growth in jobs during the period 1995 through 2015.

In the case of south Miami-Dade County, reuse-related employment of 23,191 jobs would equate to over 17 years of baseline growth. Employment from the Proposed Action would represent 34 percent of baseline employment in 2015 and contribute 87 percent over and above the projected growth in baseline jobs between 1995 and 2015.

Based on the development potential of the disposal property (considering factors such as zoning, land use, floor area ratio), total employment (direct and indirect) at full buildout could increase to 38,454 jobs, with 32,716 (85 percent) likely to be located in south Miami-Dade County. This would include all the direct jobs and about 73 percent of the indirect jobs.

The direct employment includes on-site operations jobs and construction jobs. On-site operations jobs are estimated to be 2,070 in 2005, rising to 12,777 in 2015 and 17,459 at full buildout. Construction jobs are estimated at 141 in 2005, increasing to 410 by 2015. Construction jobs could not be estimated for full buildout. Indirect jobs associated with on-site development of the Proposed Action and related secondary development are estimated to be 2,316 in 2005, rising to 14,359 by 2015 and 20,995 at full buildout. These estimates include businesses that might relocate from elsewhere in the region to the vicinity of the airport because of changes in accessibility, convenience, and development trends in the region.

No additional employment has been estimated in connection with spending by visitors to the region who enter through the airport. For the purposes of this analysis, it is assumed that passengers coming into the airport would be visiting the area for tourism, business, and other attractions already existing in the region. They would have come to the region anyway but through another airport. Some exceptions might occur if the new airport provided lower priced service or provided service to locations not already served. Without the new airport, most visitors would be expected to select other airports or other means of transportation to travel to the local area. These passenger-related jobs are assumed to be included in the baseline projections as part of the regional growth anticipated for the area.

In 2015, about 1,377 of the reuse-related jobs in the south county are assumed to be filled by persons migrating to the area from outside the county, and about 3,247 are assumed to relocate to south Miami-Dade County from the north. By full buildout, this could increase to 1,923 migrating into the south county and 4,601 workers relocating from the north.

Earnings. Under the Proposed Action, earnings associated with total reuse-related employment are estimated to reach $131 million in 2005, $799 million in 2015, and $1,116 million by full buildout. Earnings attributable to on-site jobs would comprise an estimated $60 million in 2005, $372 million in 2015, and $508 million at full buildout. The remainder would be generated by off-site jobs. These earnings do not include employment on the retained and conveyed property.

Baseline earnings in Miami-Dade County were estimated to total $26,853 million in 1995. The contribution of $799 million associated with reuse-related jobs in 2015 would represent 2.5 percent of the 1995 earnings for the county. Most (estimated 84 percent) of reuse-related earnings would be associated with workers in south Miami-Dade County. This estimated level of earnings ($673 million) would represent 56 percent of the baseline earnings of $1,206 million in the south county area in 1995.

Under moderate employment growth reflected in the projected baseline, earnings in Miami-Dade County in 2015 could reach an estimated $37,097 million. This would represent an increase of $4,522 million over the 1995 level of $32,575 million. The estimated earnings associated with the Proposed Action would represent 2 percent of total countywide earnings in 2015 and contribute 18 percent over and above the projected growth in earnings during the period 1995 through 2015. Earnings in southern Miami-Dade County in 2015 under the projected baseline could reach $1,981 million, an increase of $775 million over the 1995 level of $1,206 million. The estimated earnings attributable to the Proposed Action ($673 million) would represent 34 percent of baseline earnings in 2015 and contribute 87 percent over and above the projected growth in baseline earnings during the period 1995 through 2015.

Total reuse-related earnings (direct and indirect) at full buildout could reach $1,116 million. Of this total, $950 million (85 percent of the total) are estimated to be associated with workers residing in the southern part of the county.

Cumulative Impacts

Other unrelated developments could occur in Miami-Dade County concurrently with the Proposed Action. It is not possible to identify all the specific development projects that are likely to be initiated during this time period, but an indication of the growth that might occur can be inferred from employment projections prepared by the Miami-Dade County Planning Department, which are higher than the projected baseline. The following paragraphs discuss how the higher level of growth forecast by the county could affect employment and earnings by 2015, when the difference from the moderate-growth baseline would be greatest. Estimates could not be generated for full buildout because forecasts are not available that far into the future.

The county's high-growth projections forecast total employment in Miami-Dade County at 1,403,563 jobs in 2015 (**Miami-Dade County 1998e**). This is an increase of 277,951 jobs over the 1,125,612 jobs estimated for 1995. The majority (94 percent) of the jobs are forecast to be located in the northern part of the county (**Miami-Dade County 1998e**). In the south county, employment is projected by the county to increase by 39,393 jobs from 41,683 in 1995 to 81,076 in 2015. This includes 2,839 jobs projected by the county for former Homestead AFB.

The 27,546 jobs currently estimated for the Proposed Action in the SEIS would represent 2 percent of cumulative baseline employment countywide in 2015 and contribute 10 percent of the projected growth in jobs over the period 1995 through 2015. In the south county, the estimated 23,191 reuse-related jobs would represent 29 percent of cumulative employment in 2015 and contribute 59 percent of the projected growth in jobs in south Miami-Dade County over the period 1995 through 2015. If all reuse-related jobs are assumed to be additional to the county's forecast (except the 2,389 on-site jobs already accounted for by the county), cumulative employment in the south county could be 9,938 higher than with a moderate level of growth. Alternatively, some of the reuse-related jobs may be accounted for in growth projected for the northern part of the county but which might actually occur in the south county. That is, it is possible that not all the jobs attributable to the Proposed Action would be additional to those projected in the high-growth forecasts.

Based on these employment projections, total earnings in Miami-Dade County could reach $40,619 million in 2015. This would represent an increase of $8,044 million over the $26,853 million estimated for 1995. In south Miami-Dade County, earnings could increase by $1,140 million from $1,206 million in 1995 to $2,346 million in 2015.

Under these assumptions, the earnings associated with reuse-related jobs would represent 2 percent of cumulative baseline earnings countywide in 2015 and contribute 10 percent of the projected growth in earnings over the period 1995 through 2015. In the southern portion of Miami-Dade County, the earnings of reuse-related workers (direct and indirect) could reach $673 million in 2015. This would represent 29 percent of cumulative earnings in 2015 and contribute 59 percent of the projected growth in earnings in south Miami-Dade County over the period 1995 through 2015.

Mitigation Measures

The estimated increases in employment and earnings from the Proposed Action are considered a beneficial impact, especially in light of the economic distress experienced since 1992, from which the southern part of Miami-Dade County has not fully recovered. The ability of existing south county workers to benefit from the more skilled (and higher paid) employment opportunities may depend on the availability of job training. Miami-Dade County could establish training programs geared toward aviation and other high-skill jobs for workers near former Homestead AFB.

Possible Future Expansion

Activity levels at the proposed airport could increase substantially with the addition and full utilization of a second runway. It is possible that employment (both direct and indirect) and earnings could double over levels projected for 2015. However, this is not expected to be a prospect until the middle of the century or beyond. A second runway is not within the scope of the property disposal actions addressed in this SEIS.

4.1.2.2 Commercial Spaceport Alternative

Employment. The Commercial Spaceport alternative is estimated to generate 10,065 direct and indirect jobs by 2015, including 5,128 on-site, direct jobs and 4,937 off-site, indirect jobs. These numbers do not include employment on the retained and conveyed property. Reuse-related employment would represent 1 percent of the 1995 employment level for the county.

Most (estimated 84 percent) of the jobs would be located in south Miami-Dade County, which is projected to receive 8,472 of the 10,065 jobs. This would represent 20 percent of the baseline employment level of 41,683 in the south county in 1995.

The total reuse-related employment would be equivalent to 1.3 years of employment growth for the entire county over and above that projected for 1995 through 2015 under the projected baseline and 6.3 years of baseline growth in the south county area. The total number of jobs estimated for the Commercial Spaceport alternative would represent less than 1 percent of total countywide employment in 2015 and contribute 6 percent over and above the projected growth in jobs during the period 1995 through 2015. An increase of 8,472 jobs in the southern part of the county would represent 12 percent of baseline employment in 2015 and contribute 32 percent over and above the projected growth in baseline jobs during the period 1995 through 2015.

Total employment (direct and indirect) at full buildout could number 13,017 jobs, with about 84 percent located in south Miami-Dade County.

On-site operations jobs are estimated to number 2,094 in 2005, rising to 4,984 in 2015 and 6,600 at full buildout. Construction jobs are estimated at 167 in 2005 and 144 in 2015 (no estimates could be generated for full buildout). Indirect employment is estimated to contribute 2,144 jobs in 2005, rising to 4,937 by 2015 and 6,417 at full buildout. Approximately 68 percent of the indirect jobs are expected to be located in south Miami-Dade County.

It is likely that a portion of the total reuse-related jobs would not be filled by persons currently residing in Miami-Dade County and there would be some in-migration to the county, estimated at 503 workers by 2015 and 651 by full buildout. The estimated number of re-use related jobs is not considered large enough to stimulate appreciable migration from the northern part of the county to the south.

Earnings. Under the Commercial Spaceport alternative, earnings associated with total reuse-related employment are estimated to reach $129 million in 2005, $295 million in 2015, and $381 million at full buildout. These earnings do not include those associated with employment on the retained and conveyed property. The reuse-related earnings would represent about 1 percent of the 1995 earnings level for the county and less than 1 percent of countywide earnings in 2015. It would contribute about 6 percent over and above the projected growth in earnings between 1995 and 2015.

An estimated 84 percent of the earnings are assumed to be associated with workers in the south county. Earnings of $248 million in 2015 would represent 20 percent of the 1995 baseline for the south county and 13 percent of projected baseline earnings in 2015. This would contribute 32 percent over and above the projected growth in baseline earnings during the period 1995 through 2015.

Total reuse-related earnings associated with full buildout could reach $381 million. Of this total, it is estimated that $321 million (84 percent) would be associated with workers residing in south Miami-Dade County.

Combined Commercial Spaceport/Airport

If a combined Commercial Spaceport/Airport were developed at former Homestead AFB, total reuse-related employment could number 22,182 jobs in 2015. This would represent 2 percent of the 1995 employment level for the county. Most (estimated 84 percent) of the jobs would likely be located in south Miami-Dade County, where they could represent 44 percent of the baseline employment level in 1995.

The total reuse-related employment of 22,182 jobs would be the equivalent of 2.8 years of employment growth for the entire county over and above the projected baseline. It would represent 2 percent of total countywide employment in 2015 and contribute 14 percent over and above the projected growth in jobs during the period 1995 through 2015.

In southern Miami-Dade County, an estimated 18,522 jobs in 2015 would be the equivalent of 13.8 years of baseline growth and represent 27 percent of baseline employment in 2015. It would contribute 69 percent over and above the projected growth in baseline jobs during the period 1995 through 2015.

Total employment associated with full buildout of the combined Commercial Spaceport/Airport is estimated to number 23,744 jobs, 19,870 (84 percent) of which would likely be located in south Miami-Dade County.

Reuse-related employment could result in an estimated 1,109 workers migrating to the area by 2015 and 1,187 by full buildout. No relocation of workers from the north county to the south is estimated for the combined Commercial Spaceport/Airport.

It is estimated that earnings associated with this employment could reach $641 million in 2015, most (84 percent) in south Miami-Dade County. These earnings would represent 2 percent of total countywide earnings in 2015 and contribute 14 percent over and above the projected growth in earnings during the period 1995 through 2015. In the south county, estimated reuse-related earnings would represent 27 percent of baseline earnings in 2015 and contribute 69 percent over and above the projected growth in baseline earnings during the period 1995 through 2015. Total reuse-related earnings associated with full buildout could reach $686 million, 84 percent of which is assumed to be associated with workers residing in the south county.

Cumulative Impacts

Cumulatively, employment could increase to 1,403,563 jobs countywide and 81,076 in the south county area by 2015, based on Miami-Dade County high-growth forecasts. In the southern portion of Miami-Dade County, a total of 8,472 jobs attributable to the Commercial Spaceport alternative would represent about 11 percent of forecast cumulative employment in 2015 and contribute 22 percent of the projected growth in jobs over the period 1995 through 2015.

Under high growth, cumulative earnings in Miami-Dade County are estimated to reach $40,619 million in 2015, with an increase in earnings in south Miami-Dade County to $2,346 million in 2015. The earnings associated with total reuse-related jobs would represent less than 1 percent of cumulative baseline earnings countywide in 2015 and contribute about 4 percent of the projected growth in earnings over the period 1995 through 2015. In the southern portion of the county, the earnings of reuse-related workers could reach $248 million in 2015. This would represent 11 percent of cumulative earnings in 2015 and contribute 22 percent of the projected growth in earnings in south Miami-Dade County over the period 1995 through 2015.

The development of a combined Commercial Spaceport/Airport could increase employment to 1,425,745 jobs countywide (99,598 in the south county) and $41,260 million in earnings ($3,781 million in the south county) in 2015.

Mitigation Measures

The estimated increases in employment attributable to implementation of the Commercial Spaceport alternative are considered to be a beneficial impact. As described for the Proposed Action, the availability of job training offered by either Miami-Dade County or the spaceport developer/operator could increase the ability of local workers to take advantage of reuse-related employment opportunities.

4.1.2.3 Mixed Use Alternative

The Mixed Use alternative includes a range of potential developments represented by a Market-Driven scenario, the Collier-Hoover proposal, the original Collier proposal, and the original Hoover plan (**CRC/HEG 2000**, **Collier Resources Company 1999**, **Hoover Environmental Group 1999**). Up through 2015, the employment levels estimated for the Collier-Hoover proposal are higher than for the Market-Driven scenario. At full buildout, employment associated with the Market-Driven scenario could be substantially higher, but this would likely only be realized far into the future.

There are a number of potential effects associated with implementation of the Collier-Hoover proposal that would differ from the Market-Driven scenario and original Collier proposal. These differences relate to assumptions made about where visitors to the plan's aquarium would come from. The Hoover Environmental Group has estimated that the aquarium could attract 1.5 million visitors annually. For analysis purposes, it has been assumed that 70 percent of those visitors would not be residents of Miami-Dade County, based on the experience of other aquariums in the country. Of the 30 percent who would be residents of Miami-Dade County, 80 percent are assumed to reside in the northern portion of the county and 20 percent in south Miami-Dade County, based on general population distribution in the county.

It is assumed that the aquarium would comprise a major tourist attraction that could add to the number of tourists currently choosing Miami-Dade County as a destination. It is assumed that 90 percent of the out-of-county visitors to the aquarium would have visited Miami-Dade County whether or not there were an aquarium there and would include a visit to the aquarium as part of their visit. Ten percent of the out-of-county visitors are assumed to be attracted to the county by the new aquarium. Even those who might have come to Miami-Dade County without the aquarium present might not necessarily come to the south part of the county. As a consequence, the development of an aquarium in Homestead could result in a redistribution of tourist-related spending within the county (from north to south) even though tourist spending countywide might not increase substantially.

Employment and earnings for the four scenarios included in this alternative were estimated using the same multipliers and methods used for the Proposed Action and alternatives. The Collier-Hoover proposal, as well as the original Collier proposal, contained employment projections, which were used in the analysis. For the other scenarios, employment was estimated based on the land uses included in each scenario. Earnings were calculated as a function of employment.

Employment

Market-Driven Development. Under this scenario, total reuse-related employment in 2015 (direct and indirect) is estimated at 9,287 jobs. The on-site direct jobs would number 4,607, with the remaining 4,680 comprising indirect jobs located off site. (These numbers do not include employment associated with the retained and conveyed property.) This would represent less than 1 percent of the 1995 employment level for the county. Most (estimated 89 percent) would be expected to be located in south Miami-Dade County, which is assumed to receive 8,254 of the total of 9,287 reuse-related jobs. This would represent 20 percent of the baseline employment level in 1995.

A total of 9,287 jobs would be the equivalent of 1.2 years of employment growth for the entire county over and above that for 1995 through 2015 under the projected baseline. It would represent less than 1 percent of total countywide employment in 2015 and contribute 6 percent over and above the projected growth in jobs during the period 1995 through 2015. In the case of south Miami-Dade County, reuse-related employment of 8,254 jobs would equate to 6.2 years of baseline growth. It would represent 12 percent of baseline employment in 2015 and contribute 31 percent over and above the projected growth in baseline jobs during the period 1995 through 2015.

On-site operations jobs are estimated at 1,657 in 2005, rising to 4,411 in 2015 and 12,052 at full buildout. Construction jobs are estimated at 214 in 2005 and 196 in 2015 (no estimates could be generated for full buildout). Indirect employment associated with the Market-Driven scenario is assumed to contribute 1,855 jobs in 2005, rising to 4,680 by 2015 and 12,425 at full buildout. About 78 percent of the indirect jobs in 2015 are assumed to be located in south Miami-Dade County.

Total employment associated with full buildout could number 24,477 jobs, based on the potential of the property to accommodate development. Of this total, 21,721 jobs (89 percent) could be located in south Miami-Dade County. However, considering market conditions, it is unlikely that full buildout could be achieved until well into middle of the 21st century.

Collier-Hoover Proposal. Under this proposal, total reuse-related employment in 2015 (direct and indirect) associated with development is estimated at 12,357 jobs countywide. The on-site direct jobs would number 5,486, with the remaining 6,871 comprising indirect jobs located off site. This would represent 1.1 percent of the 1995 employment level for the county. (These numbers do not include the employment associated with the retained and previously transferred property.)

South Miami-Dade County could receive 13,764 jobs by 2015, which would represent 33 percent of the baseline employment level in 1995. The number of reuse-related jobs projected for south Miami-Dade County (13,764) exceeds those projected for the county as a whole (12,357) to reflect an assumed redistribution of tourist and related expenditures from the north to the south part of the county. As more of the tourist spending could be attracted to the south part of the county by the presence of a world-class aquarium at Homestead, some tourism-related jobs currently in the northern part of the county might be lost and replaced with jobs closer to the Homestead area.

A total of 12,357 jobs is the equivalent of 1.6 years of employment growth for the entire county over and above that projected under 1995 through 2015 baseline conditions. In the case of south Miami-Dade County, reuse-related employment of 13,764 jobs equates to 10.3 years of baseline growth. It would represent 1.0 percent of total countywide employment in 2015 and contribute 7.9 percent over and above the projected growth in jobs during the period 1995 through 2015. In the south county, reuse-related employment would represent 20 percent of baseline employment in 2015 and contribute 51 percent over and above the projected growth in baseline jobs during the period 1995 through 2015.

Under the Collier-Hoover proposal, on-site operations jobs are estimated at 2,234 in 2005, rising to 5,381 in 2015 and 10,069 at full buildout. Construction jobs are estimated at 329 in 2005 and 105 in 2015 (no estimates could be generated for full buildout). Indirect employment is estimated to contribute 3,737 jobs in 2005, rising to 6,871 by 2015 and 11,683 at full buildout. This reflects an estimated 2,683 jobs relocated from the north county to the south county due to the attraction of the aquarium. In south Miami-Dade County, 5,850 indirect jobs could be generated by 2005, 8,278 by 2015, and 12,014 at full buildout. Total reuse-related employment in south Miami-Dade County at full buildout could number 22,083.

Original Collier Proposal. Total reuse-related employment in 2015 with the original Collier Resources Company proposal (direct and indirect) is estimated at 8,922 jobs. The on-site direct jobs are estimated to number 4,077, with the remaining 4,845 comprising indirect jobs located off site. This would represent less than 1 percent of the 1995 employment level for Miami-Dade County. (These numbers do not include employment associated with the retained and conveyed property.) Most of the reuse-related jobs (88 percent) would be expected to be located in the south county, which is estimated to receive 7,848 of the total of 8,922 reuse-related jobs. This would represent 19 percent of the baseline employment level in 1995.

A total of 8,922 jobs would be the equivalent of 1.1 years of employment growth for the entire county over and above that estimated for 1995 through 2015 under the projected baseline. It would represent less than 1 percent of total countywide employment in 2015 and contribute 6 percent over and above the projected growth in jobs during the period 1995 through 2015. In south Miami-Dade County, reuse-related employment of 7,848 jobs would equate to 5.9 years of baseline growth. It would represent

11 percent of baseline employment in 2015 and contribute 29 percent over and above the projected growth in baseline jobs during the period 1995 through 2015.

On-site operations jobs for the original Collier proposal are estimated at 1,912 in 2005, rising to 4,005 in 2015 and 6,810 at full buildout. Construction jobs are estimated at 199 in 2005 and 72 in 2015 (no estimate could be generated for full buildout). Indirect employment associated with implementation of the Collier Resources proposal is estimated to contribute 1,905 jobs in 2005, rising to 4,845 by 2015 and 7,138 at full buildout. About 78 percent of the indirect jobs are expected to be located in south Miami-Dade County.

Total employment associated with full buildout of the Collier proposal could number 13,948 jobs. Of this total, it is projected that 89 percent could be located in south Miami-Dade County.

Original Hoover Plan. Under the original Hoover Environmental Group plan, total reuse-related employment in 2015 (direct and indirect) is estimated at 14,679 jobs countywide. The on-site direct jobs are estimated to number 6,819, with the remaining 7,860 comprising indirect jobs located off site. This would represent 1.3 percent of the 1995 employment level for the county. (These numbers do not include employment associated with the retained and previously transferred property.)

South Miami-Dade County could receive an estimated 15,843 jobs in 2015, which would represent 38 percent of the baseline employment level in 1995. Like the Collier-Hoover proposal, the number of reuse-related jobs projected for south Miami-Dade County (15,843) exceeds those projected for the county as a whole (14,679) because of the assumed redistribution of tourist and related expenditures from the north to the south part of the county.

A total of 14,679 jobs countywide would be the equivalent of 1.9 years of employment growth for the entire county over and above that estimated for 1995 through 2015 under the projected baseline. It would represent 1.2 percent of total countywide employment in 2015 and contribute 9.4 percent over and above the projected growth in jobs during the period 1995 through 2015. In the case of south Miami-Dade County, reuse-related employment of 15,843 jobs would equate to 11.9 years of baseline growth. It would represent 23 percent of baseline employment in 2015 and contribute 56 percent over and above the projected baseline growth in jobs during the period 1995 through 2015.

Under the original Hoover plan, on-site operations jobs are estimated at 2,550 in 2005, rising to 6,510 in 2015 and 10,910 at full buildout. Construction jobs are estimated at 497 in 2005 and 309 in 2015 (no estimates could be generated for full buildout). Indirect employment is estimated to contribute 3,976 jobs in 2005, rising to 7,860 by 2015 and 11,982 at full buildout. In south Miami-Dade County, 5,992 indirect jobs could be generated by 2005 and 9,024 2015. Total employment in south Miami-Dade County at full buildout could number 23,091.

The estimated range of employment among the four scenarios varies considerably (see Table 4.1-1), with the Market-Driven scenario showing the slowest growth but the most potential at full buildout, and the original Hoover plan, if implemented as envisioned, showing the highest employment in the near term.

Earnings

Market-Driven Development. This scenario could reach almost $106 million in 2005, $263 million in 2015, and $695 million at full buildout. These estimates do not include earnings associated with the retained and conveyed property. Direct on-site employment is estimated to contribute about $46 million in 2005, $123 million in 2015, and $335 million at full buildout. The remainder of the estimated earnings

would be generated by indirect jobs. This contribution would represent less than 1 percent of the earnings level for the county and contribute 6 percent over and above the projected growth in earnings during the period 1995 through 2015.

Approximately 89 percent of the earnings are assumed to be associated with reuse-related workers located in south Miami-Dade County. This level of earnings ($234 million in 2015) would represent 20 percent of the baseline earnings of $1,206 million in the area in 1995. It would represent 12 percent of baseline earnings in 2015 and contribute 31 percent over and above the projected growth in baseline earnings during the period 1995 through 2015.

Total reuse-related earnings associated with full buildout of the Market-Driven scenario could reach $695 million, $615 million of which (89 percent) are estimated to be associated with workers residing in south Miami-Dade County.

Collier-Hoover Proposal. Total earnings estimated for the Collier-Hoover proposal could reach $182 million in 2005, $358 million in 2015, and $631 million at full buildout. (These estimates do not include earnings associated with employment on the retained and previously transferred property.) Of this, direct on-site employment would contribute about $65 million in 2005, $157 million in 2015, and $293 million at full buildout. The remainder of the estimated earnings would be generated by indirect jobs. The contribution would represent 1.1 percent of the earnings level for the county and contribute 8 percent over and above the projected growth in earnings during the period 1995 through 2015.

In 2015, approximately $399 million in earnings are projected to be associated with reuse-related workers located in south Miami-Dade County. This is higher than the total countywide earnings because the increase in employment in the south county is projected to be higher as indirect jobs are drawn away from the northern part of the county. This level of earnings would represent 33 percent of the baseline earnings of $1,206 million in the area in 1995. It would represent 20 percent of baseline earnings in 2015 and contribute 51 percent over and above the projected growth in baseline earnings during the period 1995 through 2015. Total reuse-related earnings associated with workers residing in south Miami-Dade County at full buildout could reach $641 million.

At an estimated 1.5 million visitors per year, the proposed Collier-Hoover aquarium would have similar visitation as the aquariums in other cities (e.g., National Aquarium in Baltimore, Tennessee Aquarium in Chattanooga, and New England Aquarium). An analysis conducted by International Design for the Environment Associates, Inc. of the economic impact of the National and Tennessee Aquariums in the early 1990s estimated that they generated between $128 and $134 million in spending (both for operations and visitor spending) at visitor levels similar to those estimated in the Collier-Hoover proposal (**CRC/HEG 2000**).

With 1.5 million visitors, the Collier-Hoover proposal could generate estimated annual visitor expenditures of approximately $197 million. Of that, about $182 million could represent expenditures that would have otherwise been made in north Miami-Dade County. This includes an estimated $28 million by north county residents who visit the aquarium and $154 million by out-of-county visitors who elect to spend at least a portion of their visit at the aquarium.

Original Collier Proposal. Earnings estimated for the original Collier Resources Company proposal could reach $116 million in 2005, $259 million in 2015, and $405 million at full buildout. (These estimates do not include earnings associated with the retained and conveyed property.) Of this, direct on-site employment is estimated to contribute about $56 million in 2005, $117 million in 2015, and $198 million at full buildout. The remainder of the earnings are assumed to be generated by indirect jobs.

This contribution would represent less than 1 percent of the earnings for the county and contribute 6 percent over and above the projected growth in earnings during the period 1995 through 2015.

Approximately 88 percent of the earnings are assumed to be associated with reuse-related workers located in south Miami-Dade County. This level of earnings ($228 million in 2015) would represent 19 percent of the baseline earnings of $1,206 million in the area in 1995. It would represent 11 percent of baseline earnings in 2015 and contribute 29 percent over and above the projected growth in baseline earnings during the period 1995 through 2015.

Total reuse-related earnings associated with full buildout of the original Collier proposal could reach $405 million, $358 million of which (88 percent) would likely be associated with workers residing in south Miami-Dade County.

Original Hoover Plan. Total earnings estimated for the original Hoover Environmental Group plan could reach $203 million in 2005, $425 million in 2015, and $665 million at full buildout. (These estimates do not include earnings associated with employment on the retained and conveyed property.) Of this, direct on-site employment is estimated to contribute about $74 million in 2005, $190 million in 2015, and $318 million at full buildout. The remainder of the estimated earnings would be generated by indirect jobs. The total contribution would represent 1.3 percent of the earnings for the county and contribute 9 percent over and above the projected growth in earnings during the period 1995 through 2015.

In 2015, approximately $459 million in earnings are assumed to be associated with reuse-related workers located in south Miami-Dade County. This is higher than projected for total earnings because indirect jobs are projected to be drawn from the northern part of the county. This level of earnings would represent 38 percent of the baseline earnings of $1,206 million in the area in 1995. It would represent 23 percent of baseline earnings in 2015 and contribute 59 percent over and above the projected growth in baseline earnings during the period 1995 through 2015. Total reuse-related earnings associated with workers residing in south Miami-Dade County at full buildout could reach $670 million.

The Collier-Hoover proposal projects the highest earnings of all the alternatives in 2005, and the Market-Driven scenario projects the lowest. By 2015, the Collier-Hoover proposal is projected to have higher earnings than the Commercial Spaceport alternative but lower than the Proposed Action. At full buildout, the Market-Driven scenario and Collier-Hoover proposal could have similar earnings potential.

Cumulative Impacts

Assuming a high level of population growth, cumulative employment with implementation of the Mixed Use alternative could increase up to 1,403,563 countywide and 81,076 in the south county by 2015. The 8,992 to 14,679 jobs estimated for the Mixed Use alternative in 2015 (12,357 for the Collier-Hoover proposal) would represent about 1 percent of cumulative employment countywide and contribute 3 to 5 percent of the projected growth in jobs over the period 1995 through 2015. In the southern portion of the county, the estimated 7,776 to 15,834 reuse-related jobs (13,764 for the Collier-Hoover proposal) would represent 10 to 20 percent of cumulative employment in 2015 and contribute 20 to 40 percent of the projected growth in jobs in south Miami-Dade County over the period 1995 through 2015. Project-related earnings of $259–425 million ($358 million for the Collier-Hoover proposal) in 2015 would represent about 1 percent of countywide cumulative earnings of $40,619 million in 2015. Earnings of $228 to 459 million ($399 million for the Collier-Hoover proposal) associated with the project in the south county would represent 10 to 20 percent of cumulative earnings of $2,346 million in 2015.

Mitigation Measures

The estimated increases in employment and earnings under this alternative are considered beneficial. As described for the Proposed Action, job training could be furnished by Miami-Dade County or the developer to enable local workers to take advantage of employment opportunities in the R&D and other office and industrial developments.

4.1.2.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property. Activities would continue on the retained and conveyed properties. Employment on the retained property is assumed to remain essentially constant through 2015. Direct employment on the conveyed properties is expected to increase by approximately 350 jobs above the 1995 level of about 100 jobs. Such changes in employment would be minor and would not have a measurable impact on employment or earnings locally or regionally.

4.1.2.5 Independent Land Use Concepts

Among the independent land use concepts, it is likely that a number could be incorporated in the reuse alternatives described above. Employment effects associated with these independent land use concepts are considered subsumed under the reuse alternatives addressed above. Agricultural use or a cemetery would likely generate very low levels of employment. Other uses (corrections complex, film/television production studio, theme park, world teleconference center) could generate measurable employment opportunities, but it is unlikely that the employment would exceed the levels projected for the Proposed Action.

4.1.3 Population

Based on a review of historical employment and unemployment data for Miami-Dade County, and the magnitude and types of jobs that could be created by reuse of former Homestead AFB, it is anticipated that most new reuse-related jobs would be filled by persons already residing in the region at the time. These workers would come primarily from the pool of available labor, or might be workers currently living in the southern part of the county but commuting to the north county who would take a job closer to home. A few might commute from residences in other parts of the county or outside the county. A portion of the new jobs created would probably be filled by people who would migrate into Miami-Dade County and who, along with their dependents, would represent "new" population. There also may be some relocation of workers and their dependents from the northern to the southern part of the county. This estimated in-migrating and relocating population is used to identify the additional demand for housing and public services.

Under the moderate population growth forecasts adopted to represent future baseline conditions, the population of Miami-Dade County is projected to increase from 2,056,789 persons in 1995 to 2,530,604 in 2015, a net increase of 473,815 persons. This is an average annual rate of change over the period of 1 percent.

Approximately 16 percent of the increase in population is forecast to be in the southern part of Miami-Dade County (south of Eureka Drive). Of the 76,375 additional population projected for the south county, over 64 percent of the growth is expected to occur in and around the City of Homestead and Florida City. Population for the City of Homestead is projected to rise from 23,190 in 1995 to 63,532 in

2015, while the population of Florida City is forecast to increase from 4,898 to 13,278 over the same time period.

The population effects associated with implementation of the Proposed Action and alternatives would be intimately tied to the creation of jobs and especially the jobs filled by workers (and their accompanying family members) who relocate into the area. In the sections that follow, estimates of total reuse-related population are presented first, followed by a discussion of the in-migrating population. "Reuse-related population" consists of all workers filling either direct or indirect jobs generated by reuse of former Homestead AFB disposal property, plus their household members. "In-migrating and relocating population" refers to those workers and their households who would move to the local area to take a reuse-related job and who would not live in the area otherwise. For analysis purposes, all in-migrating population is assumed to take up residence in south Miami-Dade County, although some people may locate in other areas. In-migration to other areas is anticipated to be negligible.

Table 4.1-3 shows the estimated baseline and in-migrating population under the Proposed Action and alternatives for 2000, 2005, 2015, and full buildout. Baseline population projections are not available for full buildout because of the uncertainty and variability of the time frame and limitations in available forecasts. Table 4.1-3 presents estimated reuse-related in-migration for Miami-Dade County as a whole and for the south county. Estimates for the south county that exceed those for the county as a whole reflect workers and their families relocating from the north to the south part of the county.

Table 4.1-3. Projected Baseline Population and Reuse-Related In-Migration in Miami-Dade County and the South County Region

Alternative	2000	2005	2015	Full Buildout
Miami-Dade County Baseline	2,175,243	2,293,697	2,530,604	NA
Proposed Action	0	518	3,156	4,407
Commercial Spaceport	0	504	1,153	1,492
Mixed Use	0	426–805	1,023–1,682	1,597–2,805
No Action	0	0	0	0
South County Baseline	182,324	201,414	239,592	NA
Proposed Action	0	518	10,597	14,951
Commercial Spaceport	0	504	1,153	1,492
Mixed Use	0	426–805	1,023–1,682	1,597–2,805
No Action	0	0	0	0

Source: SAIC.
NA Not available

4.1.3.1 Proposed Action

Under the Proposed Action, a total of 10,375 persons are anticipated to be associated with reuse-related employment either as workers or their families in 2005, increasing to 63,126 in 2015 and 88,124 at full buildout. Population associated with activities on the retained and conveyed properties are not included in those numbers. Of the total reuse-related population, 8,335 persons are assumed to reside in south Miami-Dade County in 2005, 53,146 in 2015, and 74,974 at full buildout.

In 2005, the Proposed Action is projected to attract 518 people, including workers and dependents, from outside Miami-Dade County who would migrate into the county, increasing to 3,156 in 2015 and 4,407 at

full buildout. All are expected to locate in the southern part of the county. In addition, another 7,441 are anticipated to relocate from the northern part to the southern part of the county by 2015, increasing to 10,544 at full buildout. These projections would result in an increase of 10,597 in the population of south Miami-Dade County, south of Eureka Drive, by 2015 and 14,951 by full buildout.

Population in Miami-Dade County was estimated to total 2,056,789 persons in 1995, with 163,235 persons located in the southern portion of the county (**Miami-Dade County 1998e**). A reuse-related increase of 3,156 persons in the year 2015 would represent 0.2 percent of the total 1995 county population, the equivalent of 0.1 year of population growth. It would represent 0.1 percent of total county population in 2015 and contribute 0.7 percent of the projected population growth over the period 1995 through 2015.

For south Miami-Dade County, an increase of 10,597 in population in 2015 would represent 6.5 percent of the 1995 population and equate to 2.8 years of population growth above the projected baseline. The in-migrating and relocating population would represent 4 percent of baseline population in 2015 and contribute 14 percent of the projected population growth over the period 1995 through 2015. This in-migration/relocation is estimated to increase the population of the City of Homestead by 4.2 percent and Florida City by 1.2 percent. These numbers indicate a relatively small effect on overall county population, but a noticeable redistribution in population growth to the southern portion of Miami-Dade County.

Cumulative Impacts

The Miami-Dade County Planning Department's high-growth projections forecast a population of 3,030,495 in 2015 (**Miami-Dade County 1998e**). This would be an increase of 973,706 over the 2,056,789 persons estimated for 1995. By 2015, the southern part of the county would still only represent about 13 percent of the population in the county. However, 25 percent of the county's population increase over the period 1995 through 2015 would occur in the southern part of the county. The population in southern Miami-Dade County is projected to increase by 243,782, from 163,235 in 1995 to 407,017 in 2015.

Without reuse of former Homestead AFB, the high-growth projections forecast an increasing move toward a bedroom community in south Miami-Dade County, with an increasing percent of the population commuting to employment outside their area of residence. The Proposed Action could have the effect of offsetting some of that imbalance between the location of employment opportunities and residential areas by providing jobs closer to south county residents.

Under the high-growth forecasts, the ratio of jobs to population between 1995 and 2015 is projected to decrease from 0.55 to 0.46 in the county as a whole and from 0.26 to 0.20 in the south county (**Miami-Dade County 1998e**). This implies that there would be sufficient labor available in the southern part of the county to fill reuse-related jobs. If the ratio were to remain constant, for example, there would be a pool of over 22,000 workers living in the south county in 2015 but working elsewhere. Therefore, it would not be expected that workers would relocate from the northern parts of the county to take jobs at former Homestead AFB. A limited number of in-migrants (estimated at 3,156) could still be expected to be attracted to the region to fill specialized jobs or just to respond to the employment opportunities.

This total in-migrating population attributable to the Proposed Action under high-growth conditions would represent 0.1 percent of the cumulative population in Miami-Dade County in 2015 and contribute 0.3 percent of the projected population growth over the period 1995 through 2015. In the southern portion of Miami-Dade County, the additional population would represent 0.8 percent of the cumulative

population in 2015 and contribute 4.4 percent of the projected population growth in south Miami-Dade County over the period 1995 through 2015.

Mitigation Measures

Population increases are not in and of themselves environmental impacts that require mitigation. They can result in impacts on other resources, such as housing and public services, which are addressed in subsequent sections.

The possibility of a buffer zone between former Homestead AFB and Biscayne National Park could reduce the opportunities for residential development, and thereby the potential for population growth, in areas included in the buffer. Population growth would be limited to unprotected areas, which could lead to higher densities within the Urban Development Boundary or development in other locations. However, much of the area being considered for a potential buffer is already publicly owned or otherwise protected from development. Development of privately owned property outside the UDB is currently limited to one residence per 5 acres. A buffer that retained the same permitted level of development would not affect development in the short term but could constrain future expansion of the UDB (e.g., into the Urban Expansion Area). If the buffer prohibited any additional development, a small amount of low-density residential development would no longer be able to occur in the affected area.

Possible Future Expansion

The possibility that an expanded airport could double airport-related employment could result in additional in-migration and relocation of over 10,000 job holders to the south Miami-Dade County area, increasing the population by an estimated 23,000. These are only gross estimates and actual in-migration could differ substantially depending on conditions at the time of the expansion.

4.1.3.2 Commercial Spaceport Alternative

Under the Commercial Spaceport alternative, it is estimated that 10,094 people, comprised of workers and their families, could be associated with reuse-related employment by 2005, increasing to 23,066 by 2015 and 29,831 by full buildout. The population associated with the retained and conveyed properties is not included in the above numbers. Of the total reuse-related population, 8,094 persons are assumed to reside in south Miami-Dade County in 2005, increasing to 19,415 by 2015 and 25,069 by full buildout.

An estimated 504 people could migrate into the county by 2005 under this alternative, increasing to 1,153 by 2015 and 1,492 by full buildout. All would be expected to move to the south part of the county. In 2015, this would represent 0.1 percent of the total county population. A total in-migrating population of 1,153 persons would be the equivalent of less than 0.1 year of population growth for the entire county as projected over the period 1995 through 2015. It would represent 0.1 percent of total county population in 2015 and contribute 0.2 percent of the projected population growth over the period 1995 through 2015.

For south Miami-Dade County, in-migration of 1,153 persons in 2015 (no population relocation from the north county to the south is anticipated) would represent 0.7 percent of the 1995 population. It would also equate to 0.3 year of population growth above that projected for baseline growth in the 1995 to 2015 time period. It would represent 0.5 percent of 2015 baseline population in the south county and contribute 1.5 percent of the projected population growth over the period 1995 through 2015. The in-migration is estimated to increase the population of the City of Homestead by 0.4 percent and Florida City 0.1 percent in 2015.

Combined Commercial Spaceport/Airport

Population associated with a combined Commercial Spaceport/Airport could include 50,834 people by 2015. This does not include the workers and their families associated with retained and conveyed properties.

An estimated 2,541 people could be expected to migrate into Miami-Dade County by 2015. This would represent 0.1 percent of the total county population and be the equivalent of 0.1 year of population growth for the entire county as projected over the period 1995 through 2015. The total in-migrating population attributable to a combined Commercial Spaceport/Airport would represent 0.1 percent of total county population in 2015 and contribute 0.5 percent of the projected population growth over the period 1995 through 2015.

All of the in-migrating population would be expected to locate in the southern part of the county. In 2015, this would represent 1.6 percent of the population in the south county in 1995 and be the equivalent of 0.7 year of population growth. It would represent about 1 percent of baseline population in the south county in 2015 and contribute 3 percent of the projected population growth over the period 1995 through 2015 in that area. The estimated effect on the City of Homestead would be to increase population by 0.8 percent, and in Florida City it could increase the population by 0.2 percent in 2015.

Cumulative Impacts

The Miami-Dade County high-growth projections forecast a population of 3,030,495 persons in 2015 (**Miami-Dade County 1998e**). The estimated in-migrating population attributable to the Commercial Spaceport alternative would be 0.04 percent of the cumulative population in Miami-Dade County in 2015 and contribute 0.1 percent of the projected population growth over the period 1995 through 2015. In the southern portion of the county, this additional population would represent 0.3 percent of the cumulative population in 2015 and contribute 0.5 percent of the projected population growth over the period 1995 through 2015.

With a combined Commercial Spaceport/Airport, the estimated in-migration could be 0.1 percent of the cumulative population in Miami-Dade County in 2015 and contribute 0.3 percent of the projected population growth over the period 1995 through 2015. In the southern portion of the county, this would represent 0.6 percent of cumulative baseline population in 2015 and contribute 1.0 percent of the projected population growth over the period 1995 through 2015.

Mitigation Measures

As with the Proposed Action, population increases attributable to this alternative would not, by themselves, have environmental impacts. Potential impacts on related resources such as housing and public services and are addressed in subsequent sections.

If a buffer area between the Commercial Spaceport and Biscayne NP were established, it could constrain population growth in protected areas, as discussed for the Proposed Action, but the reuse-related population growth is expected to be less under this alternative, and the impact would likely be negligible.

4.1.3.3 Mixed Use Alternative

The four scenarios examined for this alternative could differ in their effects on population. Under the Market-Driven scenario, a total of 8,539 persons, including workers and their families, are estimated to

be associated with reuse of former Homestead AFB by 2005, increasing to 21,283 by 2015 and 56,093 by full buildout. These numbers do not include the population associated with retained and conveyed properties. Of the total reuse-related population, 7,604 are assumed to reside in south Miami-Dade County in 2005, 18,916 in 2015, and 49,777 at full buildout. No in-migration would be expected to occur if the reuse of the former Homestead AFB property were to rely on latent demand. With some incentives and outside stimulation, a modest number of in-migrants could be attracted to the area. For analysis purposes, it was assumed in-migration could total up to 426 in 2005, increasing to 1,063 by 2015 and 2,805 by full buildout.

With the Collier-Hoover proposal, a total of 14,438 persons, including workers and their families, are projected to be associated with reuse of former Homestead AFB by 2005, increasing to 28,318 by 2015 and 49,849 by full buildout. An estimated 19,280 persons would be expected to reside in south Miami-Dade County in 2005, 31,542 in 2015, and 50,607 at full buildout. A modest number of in-migrants could be attracted to the south county. For analysis purposes, it was assumed in-migration could total up to 719 in 2005, increasing to 1,418 by 2015 and 2,496 by full buildout.

Based on the employment projections in their proposal, an estimated 9,204 persons, including workers and their families, could be associated with the original Collier Resources Company development by 2005, increasing to 20,446 by 2015 and 27,635 by full buildout. Of this total, 8,246 could be expected to reside in south Miami-Dade County in 2005, 17,985 in 2015, and 25,002 at full buildout. No in-migration would be expected to occur if the development relied on existing labor supply. For analysis purposes, it was assumed that a small number of in-migration could occur, which was estimated at 461 in 2005, increasing to 1,023 by 2015 and 1,597 by full buildout.

Under the original Hoover plan, a total of 16,095 persons, including workers and their families, are estimated to be associated with reuse of former Homestead AFB by 2005, increasing to 33,640 by 2015 and 52,461 by full buildout. An estimated 20,715 persons would be expected to reside in south Miami-Dade County in 2005, 36,307 in 2015, and 52,917 at full buildout. A modest number of in-migrants could be attracted to the area. For analysis purposes, it was assumed in-migration could total up to 805 in 2005, increasing to 1,682 by 2015, and 2,624 by full buildout.

Cumulative Impacts

The total in-migrating population potentially attributable to the Mixed Use alternative would likely be no more than 0.1 percent of the cumulative population in Miami-Dade County high-growth forecast for 2015 and contribute less than 0.2 percent of the projected population growth over the period 1995 through 2015. In the southern portion of the county, this would represent up to 0.4 percent of the cumulative population in 2015 and contribute up to 0.7 percent of the projected population growth over the period 1995 through 2015.

Mitigation Measures

As with the other alternatives, the effects of any population increases attributable to reuse of former Homestead AFB would be reflected in impacts on housing and public services, addressed in subsequent sections. With the small population increases identified for this alternative, the establishment of a buffer would have a negligible effect.

4.1.3.4 No Action Alternative

Under the No Action alternative, population in the ROI would be expected to remain as forecast for the projected baseline. A higher growth level as forecast by the Miami-Dade County Planning Department could increase the population to 3,030,495 in the county as a whole and 407,017 in the south county by 2015 even without reuse of the former base property.

4.1.3.5 Independent Land Use Concepts

The independent land use concepts are not anticipated to affect population in the ROI, beyond the impacts projected for the Proposed Action and other reuse alternatives.

4.1.4 Housing

With the population growth assumed in the moderate-growth baseline, housing in Miami-Dade County is forecast to increase from 812,767 units in 1995 to 980,172 units in 2015, a net increase of 167,405 housing units. This would be an average annual rate of change over the period of 0.9 percent. Of the countywide baseline increase in housing between 1995 and 2015, 17 percent is expected to be located in the southern part of the county (south of Eureka Drive). Over 67 percent of that increase would likely occur in and around the City of Homestead and Florida City.

The housing effects associated with implementation of the Proposed Action and alternatives would be intimately tied to increases in population. All of the reuse-related population increase is assumed to occur in south Miami-Dade County. **Table 4.1-4** presents baseline and estimated reuse-related housing for the Proposed Action and alternatives in the south county for 2000, 2005, 2015, and full buildout.

Table 4.1-4. Projected Baseline and Reuse-Related Housing in Miami-Dade County and the South County Region

Alternative	2000	2005	2015	Full Buildout
South Miami-Dade County Baseline	63,796	70,892	85,083	NA
Proposed Action	0	188	3,854	5,436
Commercial Spaceport	0	183	419	543
Mixed Use	0	155–293	372–612	502–1,020
No Action	0	0	0	0

Source: SAIC.
NA Not available

4.1.4.1 Proposed Action

Under the Proposed Action, new housing would need to be constructed in south Miami-Dade County to accommodate in-migrating persons and persons relocating from the north part of the county. This does not include housing demand associated with the retained and conveyed properties. Housing stock in south Miami-Dade County was estimated to total 56,700 in 1995. Reuse-related demand in south Miami-Dade County could amount to 188 units by 2005, 3,854 units by 2015, and 5,436 by full buildout. The 2015 level would equate to 2.7 years of growth over the period 1995 through 2015. About 1,848 of the new housing units needed by 2015 in the south county would be attributable to direct, on-site jobs. By

full buildout, these jobs could generate a demand for another 620 units. The remaining increase in housing would be attributable to indirect jobs.

It is projected that, under a moderate population growth scenario, southern Miami-Dade County in 2015 would contain 85,083 housing units. This exhibits an increase of 28,383 units over the 1995 level of 56,700 units. The reuse-related housing demand could represent an additional demand of 4.5 percent above the baseline housing in 2015 and contribute an additional 13.6 percent to the projected growth in housing unit demand over the period 1995 through 2015.

An estimated 973 of these new housing units would be expected to be built in the City of Homestead by 2015. This would comprise 3.8 percent of the projected baseline housing of 25,480 units in the corresponding year. In Florida City, 57 reuse-related housing units are estimated to be needed by 2015. This would comprise 1.2 percent of the housing stock of 4,675 in the corresponding year.

Cumulative Impacts

Miami-Dade County high-growth forecasts project housing stock will number 1,145,515 units in 2015 (**Miami-Dade County 1998e**). This would be an increase of 165,343 units over the projected baseline. About 12 percent of the housing stock is forecast to be located in the southern part of the county in 2015. However, 25 percent of the countywide increase in housing is projected to occur in the southern part of the county, from 56,700 units in 1995 to 140,567 units in 2015. An increase of 3,854 housing units by 2015 attributable to the Proposed Action would represent 0.8 percent of the cumulative housing in 2015 and contribute 4.6 percent of the projected cumulative growth in demand for housing in south Miami-Dade County over the period 1995 through 2015.

Mitigation Measures

No mitigation measures are suggested in housing. The establishment of a buffer between HST and Biscayne NP could preclude housing from being developed in the protected area. Currently, low-density residential development is permitted at one unit per 5 acres outside the UDB. It is not known whether a buffer would allow that level of development to continue or prohibit all future development. In any case, housing supply is not expected to be measurably affected.

Possible Future Expansion

It is conceivable that the increase in demand for housing attributable to airport growth could double if HST were to expand to a second runway in the future.

4.1.4.2 Commercial Spaceport Alternative

Total housing demand for the Commercial Spaceport alternative to accommodate in-migrating persons is estimated to number 183 units in 2005, increasing to 419 units in 2015, and 543 units by full buildout. A reuse-related demand for 419 housing units in 2015 would represent 0.7 percent of the 1995 stock in south Miami-Dade County. This would be the equivalent of 0.3 years of growth in housing stock in the south county over the period 1995 through 2015. The reuse-related housing demand could represent an additional demand of 0.5 percent over baseline and contribute an additional 1.5 percent to the projected growth in housing unit demand over the period 1995 through 2015. About half of the increased demand would be attributable to direct, on-site jobs and the remainder to indirect jobs.

The number of housing units in the City of Homestead is estimated to increase by 89 units under this alternative. This would comprise 0.3 percent of the projected baseline housing of 25,480 units in 2015. In Florida City, four additional housing units could be needed by 2015. This would comprise 0.1 percent of the housing stock of 4,675 in the corresponding year.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport could generate an increase in demand for 923 housing units by 2015. The reuse-related housing demand (all of which is assumed to occur in the south county) would represent an additional demand of 1.1 percent above baseline housing in 2015 and contribute an additional 3.3 percent to the projected growth in housing unit demand over the period 1995 through 2015. At full buildout, housing demand could increase to 989 units.

Of the 923 additional housing units estimated for 2015, 193 would be expected to be located in the City of Homestead. This would comprise 0.8 percent of the projected baseline housing of 25,480 units in 2015. Nine of the additional units would be expected to be located in Florida City. This would comprise 0.2 percent of the housing stock of 4,675 in 2015.

Cumulative Impacts

The Miami-Dade County high-growth forecast would add another 55,484 units in the southern part of the county over the projected baseline in 2015 (**Miami-Dade County 1998e**). The estimated demand for housing units attributable to implementation of the Commercial Spaceport alternative would represent 0.3 percent of the cumulative housing units projected for the southern part of the county in 2015 and contribute 0.5 percent of the projected cumulative growth in demand for housing over the period 1995 through 2015. The estimated increase in demand for housing units associated with a combined Commercial Spaceport/Airport would represent 0.7 percent of the cumulative housing in 2015 and contribute 1.1 percent of the projected cumulative growth in south Miami-Dade County over the period 1995 through 2015.

Mitigation Measures

No mitigation measures for housing are suggested for this alternative. The effects on housing supply of establishing a buffer between the Commercial Spaceport and Biscayne NP would be negligible.

4.1.4.3 Mixed Use Alternative

The Mixed Use alternative could result in a modest level of in-migration that could result in an increase in the demand for housing. For the Market-Driven scenario, this could involve up to 155 units in 2005, 387 units in 2015, and 1,020 units by full buildout, not including demand associated with the retained and conveyed properties. About half would be attributable to direct on-site jobs. This reuse-related housing demand in the southern part of Miami-Dade County could represent an additional demand of 0.5 percent to baseline housing in 2015 and contribute an additional 1.4 percent to the projected growth in housing unit demand over the period 1995 through 2015. An estimated increase of 80 housing units in the City of Homestead would comprise 0.3 percent of the projected baseline housing of 25,480 units in 2015. In Florida City, four additional housing units would comprise 0.1 percent of the housing stock of 4,675 in the corresponding year.

The Collier-Hoover proposal could result in an increase in demand of up to 262 housing units in 2005, 514 units in 2015, and 906 units by full buildout. Almost half would be attributable to direct on-site jobs.

This reuse-related housing demand in the southern part of Miami-Dade County could represent an additional demand of 0.6 percent to baseline housing in 2015 and contribute an additional 1.8 percent to the projected growth in housing unit demand over the period 1995 through 2015. An estimated increase of 92 housing units in the City of Homestead would comprise 0.4 percent of the projected baseline housing of 25,480 units in 2015. In Florida City, four additional housing units would comprise 0.1 percent of the housing stock of 4,675 in the corresponding year.

The original Collier Resources Company proposal could result in an increase in demand of up to 167 housing units in 2005, 372 units in 2015, and 502 units by full buildout. About half would be attributable to direct on-site jobs. This reuse-related housing demand in the southern part of Miami-Dade County could represent an additional demand of 0.4 percent to baseline housing in 2015 and contribute an additional 1.3 percent to the projected growth in housing unit demand over the period 1995 through 2015. An estimated increase of 73 housing units in the City of Homestead would comprise 0.3 percent of the projected baseline housing of 25,480 units in 2015. In Florida City, three additional housing units would comprise 0.1 percent of the housing stock of 4,675 in the corresponding year.

The original Hoover Environmental Group plan could result in an increase in demand of up to 293 housing units in 2005, 612 units in 2015, and 954 units by full buildout. About half would be attributable to direct on-site jobs. This reuse-related housing demand in the southern part of Miami-Dade County could represent an additional demand of 0.7 percent to baseline housing in 2015 and contribute an additional 2.1 percent to the projected growth in housing unit demand over the period 1995 through 2015. An estimated increase of 113 housing units in the City of Homestead would comprise 0.4 percent of the projected baseline housing of 25,480 units in 2015. In Florida City, five additional housing units would comprise 0.1 percent of the housing stock of 4,675 in the corresponding year.

Cumulative Impacts

The Miami-Dade County high-growth forecasts project another 55,484 housing units in the southern part of the county above that estimated for the projected baseline by 2015 (**Miami-Dade County 1998e**). The increase in demand for housing units attributable to the Mixed Use alternative would represent 0.3 to 0.4 percent of the cumulative housing units in 2015 and contribute 0.4 to 0.7 percent of the projected cumulative growth in demand for housing over the period 1995 through 2015.

Mitigation Measures

No mitigation measures for housing are suggested for this alternative. The impacts of a buffer, if one were established, on housing supply would be as described under the Proposed Action.

4.1.4.4 No Action Alternative

Housing under the No Action alternative is assumed to remain as projected for baseline conditions. Cumulative growth could add an additional 55,484 housing units to south Miami-Dade County if the county's high-growth forecasts were achieved (**Miami-Dade County 1998e**).

4.1.4.5 Independent Land Use Concepts

Any housing demand associated with the independent land use concepts would not exceed demands projected for the Proposed Action and alternatives.

4.1.5 Public Services

The public services analysis addresses local government employment, public education, fire protection, police protection, and health care services. The analysis of impacts to government structure addresses the potential change in the need for government personnel employed by Miami-Dade County, the City of Homestead, and Florida City as a result of reuse-related population changes. Public service factors based on existing ratios of government personnel to total population in these areas were used to project potential future demand. Total baseline and reuse-related government personnel for the Proposed Action and alternatives in Miami-Dade County as a whole and in the south county are presented in **Table 4.1-5.**

Table 4.1-5. Projected Baseline and Reuse-Related Government Personnel in Miami-Dade County, City of Homestead, and Florida City

Alternative	2000	2005	2015	Full Buildout
Miami-Dade County Baseline	22,514	23,740	26,192	NA
Proposed Action	0	6	33	46
Commercial Spaceport	0	6	12	16
Mixed Use	0	4–9	11–17	10–37
No Action	0	0	0	0
City of Homestead Baseline	301	360	527	NA
Proposed Action	0	1	18	34
Commercial Spaceport	0	1	3	3
Mixed Use	0	0–1	1–3	2–5
No Action	0	0	0	0
Florida City Baseline	67	82	121	NA
Proposed Action	0	2	15	32
Commercial Spaceport	0	2	6	8
Mixed Use	0	2–4	5–8	8–17
No Action	0	0	0	0

Source: SAIC.
NA Not available

For the public education analysis, changes in enrollments affecting Miami-Dade County Public Schools were derived from reuse-related population effects described in Section 4.1.3 (Population). Enrollments in Miami-Dade County Public Schools in the 1996–97 school year comprised 16.2 percent of the total population of the county. This percentage was used to estimate enrollments based on anticipated population growth. The associated increase in teachers was based on a countywide ratio of 19.6 students per teacher. Reuse-related increases in enrollments in Miami-Dade County Schools represent those persons expected to move into the county from elsewhere due to the project (in-migrants), all of whom are anticipated to live in the southern part of the county. The reuse-related enrollment effects shown for south Miami-Dade County schools reflect both persons moving into the county from elsewhere and persons relocating to south Miami-Dade County from the north county. Enrollment effects due to people relocating could require reassignment of teachers and resources from the north county to the south county. Projected baseline and reuse-related enrollment for the Proposed Action and alternatives in Miami-Dade County as a whole and in the south county is presented in **Table 4.1-6.**

Table 4.1-6. Projected Baseline and Reuse-Related School Enrollment in Miami-Dade County and the South County Region

Alternative	2000	2005	2015
Miami-Dade County Baseline	352,607	371,808	410,211
Proposed Action	0	84	511
Commercial Spaceport	0	82	187
Mixed Use	0	69–131	166–273
No Action	0	0	0
South County Baseline	29,555	32,649	38,838
Proposed Action	0	84	1,718
Commercial Spaceport	0	82	187
Mixed Use	0	69–131	166–273
No Action	0	0	0

Source: SAIC.

The Miami-Dade County Fire Rescue Department serves the unincorporated portions of the county, as well as certain incorporated communities, including Homestead and Florida City. The fire protection analysis focuses on potential changes in the number of firefighters that would be needed in south Miami-Dade County. Projected changes in the required number of firefighters employed by the Miami-Dade County Fire Rescue Department were derived from reuse-related population effects described in Section 4.1.3. A factor of 0.7 firefighters per 1,000 persons, reflecting the 1998 ratio for the department's service area, has been used to estimate the increased need for firefighting personnel resulting from the project (**Moore 1998**).

The police protection analysis addresses reuse-related changes in the number of sworn officers needed in Homestead and Florida City and in the unincorporated areas of south Miami-Dade County. The two cities have their own police departments, and the Miami-Dade County Police Department serves the unincorporated portions of the county. A factor of 2.77 sworn officers per 1,000 persons has been used to estimate the increased need for sworn officers in unincorporated south Miami-Dade County, based on the estimated existing ratio for all of unincorporated Miami-Dade County (**Alvarez 1998**). A factor of 2.71 sworn officers per 1,000 persons has been used for the City of Homestead and 4.68 sworn officers per 1,000 persons for Florida City, based on existing ratios in these communities (**Bowe 1998**). The results are summarized in **Table 4.1-7** for the projected baseline and Proposed Action and alternatives.

With regard to health services, population-based service factors were used in calculating additional demand due to reuse-related population growth, based on the existing number of health care professionals in Miami-Dade County (6,031 doctors, 1,351 dentists, 13,526 registered nurses, and 3,842 practical nurses) (**Agency for Health Care Administration 1998**). Factors of 2.9 doctors per 1,000 persons; 0.64 dentists per 1,000 persons; 6.6 registered nurses per 1,000 persons; and 1.8 licensed practical nurses per 1,000 persons were used to calculate total personnel for the projected baseline and the Proposed Action and alternatives, which are summarized in **Table 4.1-8**.

Table 4.1-7. Projected Baseline and Reuse-Related Sworn Officers in the City of Homestead, Florida City, and the Balance of Miami-Dade County

Alternative	2000	2005	2015	Full Buildout
City of Homestead Baseline	88	105	154	NA
Proposed Action	0	0	5	7
Commercial Spaceport	0	0	0	1
Mixed Use	0	0	0	1
No Action	0	0	0	0
Florida City Baseline	32	39	58	NA
Proposed Action	0	0	<1	0
Commercial Spaceport	0	0	0	2
Mixed Use	0	0	0	2
No Action	0	0	0	0
Balance of Miami-Dade County Baseline	384	413	451	NA
Proposed Action	0	2	23	34
Commercial Spaceport	0	2	3	8
Mixed Use	0	2	4	7
No Action	0	0	0	0

Source: SAIC.
NA Not available
<1 Less than 1.

Table 4.1-8. Projected Baseline and Reuse-Related Increase in Demand for Health Care Professionals in Miami-Dade County and the South County Region

Alternative	2000	2005	2015	Full Buildout
Miami-Dade County Baseline	25,311	26,689	29,445	NA
Proposed Action	0	6	37	37
Commercial Spaceport	0	6	14	16
Mixed Use	0	4–9	5–19	5–31
No Action	0	0	0	0
South County Baseline	2,121	2,344	2,788	NA
Proposed Action	0	6	123	173
Commercial Spaceport	0	6	14	16
Mixed Use	0	4–9	5–19	5–31
No Action	0	0	0	0

Source: SAIC.
NA Not available

4.1.5.1 Proposed Action

Government Structure. Combining direct and secondary project effects, the total increased need for government personnel from the Proposed Action (excluding the retained and transferred property) by 2015 is projected to be 33 employees for the government of Miami-Dade County (based on a service

ratio of 10.35 personnel per 1,000 persons), 18 employees for the City of Homestead (based on a service ratio of 8.29 personnel per 1,000 persons), and 15 employees in Florida City. This represents a 0.1 percent increase over the projected baseline requirement in 2015 in Miami-Dade County, 3.4 percent in the City of Homestead, and 12.4 percent in Florida City. Compared to a government employment in 1995, it represents a 0.2 percent increase for Miami-Dade County, 7.5 percent increase for the City of Homestead, and 27.8 percent increase for Florida City. Projected growth would also result in an increased need for facilities and equipment utilized by reuse-related government employees. Full buildout could generate a need for an additional 13 government personnel for Miami-Dade County, 7 personnel for the City of Homestead, and 5 personnel for Florida City.

Public Education. Combining direct and secondary project effects, the total increase in students in Miami-Dade County Public Schools from the Proposed Action (excluding the retained and transferred property) is projected to be 511 students associated with in-migrating households by 2015, creating a need for 27 additional teachers. This equates to a 0.1 percent addition to the 2015 baseline.

In south Miami-Dade County schools, there would be a total increase of 1,718 students and related demand for 88 teachers by the year 2015. This enrollment increase represents a 4.4 percent addition to the 2015 baseline. Of the 1,718 student reuse-related effect in the south county, 511 students would be in-migrants requiring new hiring of teachers and 1,207 students would relocate from the north county, which could create the need for reassignment of teachers from north county to south county schools. It is not possible to predict how the enrollment changes would be distributed across the 300 schools in the county.

Countywide, the combined enrollment effect of the Proposed Action through 2015 would be 0.2 percent of 1996–97 enrollments. Under a moderate growth scenario baseline, enrollments in Miami-Dade County Schools in 2015 would number 410,211 students without the project. This represents an increase of 69,307 students over the 1996–97 level of 340,904 pupils. The Proposed Action would equate to an additional 0.1 years of projected baseline growth over the 1997 to 2015 period.

For south Miami-Dade County, the enrollment effect of the Proposed Action through 2015 would be 6.5 percent over and above the 1996–97 enrollments. Under the moderate growth scenario baseline, enrollments in south Miami-Dade County schools in 2015 would number 38,838 students without the project. This represents an increase of 12,377 students over the 1996–97 level of 26,460 pupils. The Proposed Action would equate to an additional 2.5 years of projected baseline growth over the 1997 to 2015 period. Full buildout could create the need for an additional 10 new teachers, as well as the potential for reassignment of 36 teachers from north county to south county schools.

Fire Protection. Combining direct and secondary project effects, the total increased need for additional firefighters from the Proposed Action in south Miami-Dade County (excluding the retained and transferred property) is projected to be eight firefighters by 2015. Of this total, one firefighter would be needed in the City of Homestead, less than one in Florida City, and seven in the balance of south Miami-Dade County. This represents a 2.3 percent addition in the City of Homestead and a 3.1 percent addition in the balance of south Miami-Dade County in 2015. The reuse-related need for firefighters in south Miami-Dade County represents demand created by both in-migrating and relocating population. As a result, six of the eight firefighters needed could potentially be reassigned from the north county to the south county based on the number of individuals relocating, whereas two of the needed firefighters would represent potential new hires based upon the number of in-migrants to the county. The reuse-related growth would also result in an increased need for administrative and support personnel, as well as facilities and equipment utilized by the department in the south county.

The reuse-related effects represent a 4.9 percent increase for the City of Homestead over projected baseline growth of 24 firefighters between 1998 and 2015. The reuse-related effect in the balance of south Miami-Dade County represents a 7.2 percent increase over the 17 firefighters needed to accommodate the baseline growth between 1998 and 2015. Full buildout could result in the need for one additional firefighter in the City of Homestead and two in the balance of south Miami-Dade County.

Police Protection. Combining direct and secondary project effects, the total increased need for sworn officers from the Proposed Action in 2015 (excluding the retained and transferred property) is projected to be five sworn officers in the City of Homestead, less than one sworn officer in Florida City, and 23 sworn officers in unincorporated south Miami-Dade County. This would represent a 7.1 percent increase in the number of sworn officers in the City of Homestead and 6 percent increase in sworn officers in the unincorporated area of the county. Reuse-related growth would also result in an increased need for administrative and support personnel, as well as facilities and equipment. Full buildout could create a need for an additional two sworn officers in the City of Homestead, less than one in Florida City, and 11 in unincorporated south Miami-Dade County.

Health Care Services. Combining direct and secondary project effects, the total increased need for medical professionals countywide from the Proposed Action (excluding the retained and transferred property) is projected to be 9 doctors, 2 dentists, 20 registered nurses, and 6 practical nurses by 2015 due to persons in-migrating into the county. This represents 0.2 percent of the current number of medical professionals in the county and represents a 0.1 percent addition to the 2015 baseline need. This projected growth would also result in increased needs for administrative and support personnel, hospital, office, and clinic facilities, and equipment and supplies. Reuse-related persons relocating from the north to the south parts of the county could result in a redistribution of medical professionals within the county involving approximately 21 doctors, 5 dentists, 47 registered nurses, and 13 licensed practical nurses.

The reuse-related demand in Miami-Dade County would be over and above the baseline growth of 1,144 doctors, 256 dentists, 2,566 registered nurses, and 729 practical nurses forecast for 1998 to 2015. The reuse-related demand in south Miami-Dade County would be over and above the 184 doctors, 41 dentists, 415 registered nurses, and 118 licensed practical nurses needed between 1998 and 2015.

Full buildout could create the need for an additional 12 doctors, 2 dentists, 28 registered nurses, and 8 licensed practical nurses in south Miami-Dade County.

Many medical services are provided by private practitioners and (private) for-profit and not-for-profit hospitals and clinics. Some of these providers could be expected to expand their services or locate new facilities in the county in response to increased economic activity and related population growth.

Cumulative Impacts

The Miami-Dade County high-growth forecasts would increase the need for public services above 1998 baseline levels. The cumulative effect is estimated to result in an additional 9,591 government personnel, 7,670 teachers, and 10,512 health care professionals by 2015 in the county and 163 firefighters and 540 sworn officers in the balance of the county. The demands generated by the Proposed Action would represent less than 1 percent of this cumulative growth.

Mitigation Measures

No mitigation measures are suggested to reduce impacts from the Proposed Action on public services.

Possible Future Expansion

Expansion of HST and associated population effects could double the increased demand for government workers, teachers, firefighters, sworn officers, and health care professionals over that generated by the Proposed Action.

4.1.5.2 Commercial Spaceport Alternative

Government Structure. Combining direct and secondary project effects, the total increased need for government personnel from the Commercial Spaceport alternative (excluding the retained and transferred property) by 2015 is projected to be 12 employees for the government of Miami-Dade County, 3 employees for the City of Homestead, and 6 employees in Florida City. This represents less than 0.1 percent of the projected baseline requirement in 2015 in Miami-Dade County, 0.6 percent in the City of Homestead, and 5.0 percent in Florida City. It represents less than 0.1 percent of 1998 local government personnel levels for Miami-Dade County, 1.3 percent for the City of Homestead, and 11.1 percent for Florida City. Reuse-related growth would also result in an increased need for facilities and equipment utilized by reuse-related government employees. Full buildout could create the need for an additional four government personnel in Miami-Dade County, less than one employee in the City of Homestead, and two personnel in Florida City.

Public Education. Combining direct and secondary project effects, the total increase in students in Miami-Dade County Public Schools from the Commercial Spaceport alternative (excluding the retained and transferred property) is projected to be 187 students associated with in-migrating households by 2015, which would require an additional 10 teachers. All of these students would be expected to attend south county schools. Countywide, these students represent less than 0.1 percent in addition to the 2015 baseline number, whereas they represent 0.5 percent in addition to the south county 2015 baseline need.

Countywide, the combined enrollment effect of the Commercial Spaceport alternative through 2015 would be less than 0.1 percent of 1996–97 enrollments and equate to less than 0.1 additional years of projected baseline growth over the 1997–2015 period. For south Miami-Dade County, the enrollment effect of the Commercial Spaceport alternative through 2015 would be 0.7 percent above the 1996–97 enrollments. This would equate to an additional 0.3 years of projected baseline growth over the 1997–2015 period. Full buildout could result in an additional 55 students and an associated need for 2 teachers in south Miami-Dade County schools.

Fire Protection. Combining direct and secondary project effects, the total increased need for additional firefighters from the Commercial Spaceport alternative in south Miami-Dade County (excluding the retained and transferred property) is projected to be less than one firefighter by 2015. Full buildout could result in another two firefighters in south Miami-Dade County.

Police Protection. Combining direct and secondary project effects, the total increased need for sworn officers from the Commercial Spaceport alternative in 2015 (excluding the retained and transferred property) is projected to be less than one sworn officer in the City of Homestead, less than one sworn officer in Florida City, and three sworn officers in unincorporated south Miami-Dade County. Full buildout could increase the need for one additional sworn officer in the City of Homestead, 2 in Florida City, and 5 sworn officers in unincorporated south Miami-Dade County.

Health Care Services. Combining direct and secondary project effects, the total increased need for medical professionals countywide from the Commercial Spaceport alternative (excluding the retained and transferred property) is projected to be four doctors, less than one dentist, eight registered nurses,

and two practical nurses by 2015. Full buildout could increase the need two additional registered nurses. The reuse-related growth could also result in an increased need for administrative and support personnel, medical facilities, equipment and supplies.

Private practitioners, private for-profit and private not-for-profit medical facilities could also be expected to expand their services or locate new facilities in the county in response to increased economic activity and related population growth.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport could result in a need for 26 additional employees for the government of Miami-Dade County, 4 additional employees for the City of Homestead, and 13 additional employees for Florida City in 2015. This represents an increase of 0.1 percent over 1998 local government personnel working for Miami-Dade County, 1.7 percent increase for the City of Homestead, and 24.1 percent increase for Florida City. Full buildout could create the need for an additional two government personnel for Miami-Dade County, one government personnel for the City of Homestead, and one personnel for Florida City.

Public Education. A combined Commercial Spaceport/Airport is projected to increase school enrollment by 412 students, which would require an additional 21 teachers. All of these students would be expected to attend south county schools. Countywide, these students would represent 0.1 percent in addition to the 2015 baseline and represent 1 percent of the south county baseline. At full buildout, this could increase by an additional 29 students, requiring one additional teacher.

Fire Protection. A combined Commercial Spaceport/Airport is projected to require an additional two firefighters by 2015 in south Miami-Dade County. This represents less than a 2 percent addition to baseline levels in south Miami-Dade County in 2015. The additional growth at full buildout would increase the need by less than one firefighter.

Police Protection. A combined Commercial Spaceport/Airport is projected to generate a requirement for one sworn officer in the City of Homestead, less than one sworn officer in Florida City, and 6 sworn officers in unincorporated south Miami-Dade County. Full buildout could increase the need by less than one sworn officer in the City of Homestead and Florida City and one sworn officer in unincorporated south Miami-Dade County.

Health Care Services. A combined Commercial Spaceport/Airport is projected to generate a need for 8 doctors, 2 dentists, 16 registered nurses, and 4 practical nurses by 2015. This represents 0.1 percent of the current level in the county and a 0.1 percent increase to the 2015 baseline. Full buildout could increase the need by one additional registered nurse.

Cumulative Impacts

The Miami-Dade County high-growth forecasts would increase the need for public services above the 1998 baseline levels, involving 9,591 additional government personnel, 7,670 additional teachers, and 10,512 additional health professionals by 2015 in the county and 163 additional firefighters and 540 additional sworn officers in the balance of the county. The demands generated by the Commercial Spaceport alternative, with or without a joint-use airport, would represent less than 1 percent of the cumulative growth.

Mitigation Measures

No mitigation measures are suggested to reduce impacts from the Commercial Spaceport alternative on public services.

4.1.5.3 Mixed Use Alternative

Government Structure. Combining direct and secondary project effects, the total increased need for government personnel from the Mixed Use alternative (excluding the retained and transferred property) by 2015 is projected to range from 11 to 17 employees for the government of Miami-Dade County, 1 to 3 employees for the City of Homestead, and 5 to 8 employees for Florida City. This represents less than 0.1 percent of the projected baseline requirement in 2015 in Miami-Dade County, 0.2 to 0.6 percent in the City of Homestead, and 4 to 7 percent in Florida City. It also represents less than 0.1 percent of 1998 local government personnel levels for Miami-Dade County, 0.4 to 1.3 percent for Homestead, and 9 to 15 percent for Florida City. Reuse-related growth would also result in an increased need for facilities and equipment utilized by reuse-related government employees. Full buildout could generate a need for an additional 5 to 18 government personnel by Miami-Dade County, 1 to 2 personnel by the City of Homestead, and 3 to 9 personnel by Florida City.

Public Education. Combining direct and secondary project effects, the total increase in students in Miami-Dade County Public Schools from the Mixed Use alternative (excluding the retained and transferred property) is projected to range from 166 to 273 students, which would require an additional 8 to 13 teachers. All of these students would be expected to attend south county schools. Countywide, these students would represent less than 0.1 percent increase to the 2015 baseline and 0.4 to 0.7 percent increase to the south county baseline in 2015.

For south Miami-Dade County, the enrollment effect of the Mixed Use alternative through 2015 could range from 0.6 to 1.0 percent over 1996–97 enrollments. The project would equate to an additional 0.2 to 0.4 years of projected baseline growth over 1997 to 2015. Full buildout could add another 94 to 282 students and require an additional 4 to 15 teachers.

Fire Protection. Combining direct and secondary project effects, the total increased need for additional firefighters from the Mixed Use alternative in south Miami-Dade County (excluding the retained and transferred property) is projected to be one firefighter by 2015. Full buildout could add a requirement for an additional two firefighters in south Miami-Dade County.

Police Protection. Combining direct and secondary project effects, the total increased need for sworn officers from the Mixed Use alternative in 2015 (excluding the retained and transferred property) is projected to be less than one sworn officer in the City of Homestead and Florida City and up to three sworn officers in unincorporated south Miami-Dade County. Reuse-related growth would also result in an increased need for administrative and support personnel, as well as facilities and equipment utilized by the department's personnel. Full buildout could increase the need for one additional sworn officer by the City of Homestead, two in Florida City, and up to seven sworn officers in unincorporated south Miami-Dade County.

Health Care Services. Combining direct and secondary project effects, the total increased need for medical professionals countywide from the Mixed Use alternative (excluding the retained and transferred property) is projected to be 1 to 5 doctors, less than one dentist, 3 to 11 registered nurses, and 1 to 3 practical nurses by 2015. For each of the four categories of medical professionals, the need created by the Mixed Use alternative through 2015 would be less than 0.1 percent of the current level in the county and

represents less than a 0.1 percent addition to the 2015 baseline. The reuse-related growth could also result in an increased need for administrative and support personnel, medical facilities, equipment and supplies. Full buildout could increase the need by up to 5 doctors, 2 dentists, 12 registered nurses, and 3 licensed practical nurses. Private practitioners, private for-profit and private not-for-profit medical facilities could also be expected to expand their services or locate new facilities in the county in response to increased economic activity and related population growth.

Cumulative Impacts

The Miami-Dade County high-growth forecasts could increase the need for public services above the 1998 baseline levels by 9,591 government personnel, 7,670 teachers, and 10,512 health care professionals by 2015 in the county and 163 firefighters and 540 sworn officers in the balance of the county. The added demands generated by the Mixed Use alternative would represent substantially less than 1 percent of the cumulative growth.

Mitigation Measures

No mitigation measures have been identified for public service impacts of the Mixed Use alternative.

4.1.5.4 No Action Alternative

Under the No Action alternative, public services are assumed to remain as projected for baseline conditions but could increase due to cumulative growth.

4.1.5.5 Independent Land Use Concepts

Public service impacts of the independent land use concepts would not exceed the effects reported for the Proposed Action and alternatives.

4.1.6 Public Finance

This section addresses local government public finances for Miami-Dade County, the City of Homestead, and Florida City. Public revenues and expenditures of local governments within Miami-Dade County, and especially within south Miami-Dade County in and around the City of Homestead and Florida City, could potentially be affected by reuse-related changes in economic activity. In the recent past, revenues in Miami-Dade County exceeded expenditures by 11.5 percent in FY96, with total revenues of $2.137 billion and total expenditures of $1.916 billion (see Table 3.1-9) (**Metro-Dade County 1997b**). In the City of Homestead, revenues in FY96 approximated expenditures (see Table 3.1-10), with revenues of $28.671 million and expenditures of $29.02 million, creating a 1.2 percent shortfall (**City of Homestead 1997**). In Florida City, revenues and expenditures were also about equal in FY96 (see Table 3.1-11) (**City of Florida City 1997**).

4.1.6.1 Proposed Action

County and municipal revenue sources would potentially increase as a result of the Proposed Action. For example, property taxes attributable to taxable new development, service charges and fees paid by new businesses, and sales taxes paid by the increased numbers of job-holders. Potentially offsetting these gains would be payment of the local share of public expenditures required to build and operate a commercial airport, and public expenditures that would be needed to provide public services for off-site land development and serve the additional population that may come in to the county as a result of the

Proposed Action. Capital and operating expenditures for public infrastructure such as roads, water and wastewater systems, parks, and schools, and expenditures for general government services, fire and police protection, health care, and social services may increase.

The Proposed Action would likely improve the jobs/housing balance in south Miami-Dade County and could create the type of development in and around the airport area (e.g., commercial and industrial uses) that is often sought by local governments because of its ability to improve both the local economy and the tax base. Because of the potential magnitude of new jobs and increases in public revenues, it is highly probable that the project would generate long-term benefits for public finance. However, local public expenditures would be required to build and operate the commercial airport and to provide infrastructure improvements and services to new businesses and residents, offsetting at least a portion of the potential revenues.

Cumulative Impacts

Changes in local government revenues and expenditures would be expected to result from cumulative population and job growth and related land development, business and household activities, and expenditures. Under the Miami-Dade County high-growth forecasts, the rate of population growth in south Miami-Dade County could continue to substantially outpace the growth in jobs, and the difference is projected to grow even larger over the next 20 years. If this disparity between employment and population were to occur, increased planning would need to be done by local governments to ensure that public resources were available to provide needed infrastructure and services to new development and increased population. Increases in annual public expenditures would need to be budgeted so that they were matched by similar increases in public revenues. The Proposed Action could improve the employment-population balance in south Miami-Dade County and increase public revenues.

Mitigation Measures

The impacts of the Proposed Action on public finance are anticipated to be beneficial, and no mitigation measures are suggested. The establishment of a buffer between HST and Biscayne NP could reduce potential future increases in revenues from property taxes, assuming that future residential and other types of development would not take place within the buffer.

Possible Future Expansion

It is possible that future expansion could double the level of employment and population increase estimated for full buildout of the Proposed Action. It is expected that changes in revenues and expenditures would increase proportionately.

4.1.6.2 Commercial Spaceport Alternative

County and municipal revenue sources would potentially increase under the Commercial Spaceport alternative. For example, property taxes attributable to taxable new development, service charges and fees paid by new businesses, and sales taxes paid by the increased numbers of job-holders would be expected to increase. The magnitude of the local public investment related specifically to on-site development of this alternative is not known. Potentially offsetting the gains would be payment of public expenditures that would be needed to provide public services for off-site land development and serve additional population that may come into the county. Capital and operating expenditures for public infrastructure such as roads, water and wastewater systems, parks, and schools, and expenditures for general government services, fire and police protection, health care, and social services may increase.

The Commercial Spaceport alternative would likely improve the jobs/housing balance in south Miami-Dade County through the addition of jobs-producing land uses that are generally sought by local governments because of their ability to improve both the local economy and the tax base. Because of the potential magnitude of new jobs and increases in public revenues, it is highly probable that this alternative would generate long-term benefits for public finance. However, local public expenditures would be needed to provide infrastructure improvements and services to new businesses and residents, offsetting at least a portion of the potential revenues.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport would further increase revenues. However, the amount of public investment would also likely be higher due to the requirement to develop commercial airport facilities.

Cumulative Impacts

Cumulative impacts of this alternative would be substantially the same as reported for the Proposed Action.

Mitigation Measures

The impacts of the Commercial Spaceport alternative on public finance are anticipated to be beneficial, and no mitigation measures are suggested. The potential effects of a buffer on property tax revenues would be as described under the Proposed Action.

4.1.6.3 Mixed Use Alternative

County and municipal revenue sources would potentially increase as a result of the Mixed Use alternative. For example, property taxes attributable to taxable new development, service charges and fees paid by new businesses, and sales taxes paid by the increased numbers of job-holders would be expected to increase. Potentially offsetting these gains would be public expenditures that would be needed to provide public services for off-site land development and serve any additional population that may come to south Miami-Dade County as a result of the Mixed Use alternative. Capital and operating expenditures for public infrastructure such as roads, water and wastewater systems, parks, and schools, and expenditures for general government services, fire and police protection, health care, and social services may increase. This alternative would create fewer jobs than the Proposed Action but may also require fewer local public expenditures for its development.

Cumulative Impacts

Under the high level of growth forecast by Miami-Dade County, population in the south county would be expected to substantially outpace the growth in jobs. Depending on which scenario was developed, the Mixed Use alternative could include fewer jobs and provide more housing than the Proposed Action or Commercial Spaceport alternative. In that event, its offsetting effect on the imbalance between employment and population would be less. Increased planning would be needed by local governments to ensure that public resources are available to provide needed infrastructure and services to new development and new population. In addition, any increases in annual public expenditures would need to be budgeted so that they were matched by similar increases in public revenues.

Mitigation Measures

The impacts of the Mixed Use alternative on public finance are anticipated to be beneficial, and no mitigation measures are suggested. The potential effects of a buffer on property tax revenues would be as described under the Proposed Action.

4.1.6.4 No Action Alternative

Under the No Action alternative, potential public revenues and expenditures associated with reuse of the disposal property at former Homestead AFB would not take place. Baseline growth in south Miami-Dade County would create taxable new development, service charges and fees paid by new businesses, and sales taxes paid by the increased numbers of job-holders. Potentially offsetting these gains would be public expenditures that would be needed to provide public services to the additional population that may come to south Miami-Dade County under baseline conditions. Capital and operating expenditures may increase for public infrastructure such as roads, water and wastewater systems, parks, and schools, and expenditures for general government services, fire and police protection, health care, and social services. These conditions would be further aggravated if the county's high-growth forecasts were achieved. In the south county, potential improvements in the jobs/housing balance that could be realized under the reuse alternatives, and the associated fiscal benefits, would not occur.

4.1.6.5 Independent Land Use Concepts

Without specific information on the individual independent land uses, it is not possible to predict their impacts on public finance. However, they are not likely to differ substantially from the Proposed Action and other reuse alternatives.

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4.2 TRANSPORTATION

4.2.1 Introduction

Reuse-related effects on roadway traffic were assessed by estimating the number of trips generated by each land use, considering the expected number of employees, visitors, residents, and service vehicles associated with construction and other on-site activities for the Proposed Action and each alternative. The principal trip-generating land uses included airport, industrial, commercial, educational, recreational, residential, and military uses.

The analysis is based on estimated reuse-related peak-hour trips, distributed on the local road network; existing data on roadway capacities and traffic volumes; and standards established by state and local transportation agencies. Standard analysis techniques of trip generation, trip distribution, and traffic assignment were used. Trip generation was based on applying the trip rates from the Institute of Transportation Engineers *Trip Generation Manual, 5th Edition* to the proposed land uses to forecast peak-hour trips. Level of service standards were based upon the *Florida Level of Service Standards and Guidelines Manual for Planning* (**FDOT 1995**) prepared by Florida Department of Transportation. Roadway improvements necessary to mitigate the impacts of reuse-related traffic would be in conformance with the local comprehensive plan, unless otherwise noted.

For each alternative, primary access to former Homestead AFB is assumed to be by three existing roadways: SW 288th Street (also called Bougainville Boulevard), Coral Sea Boulevard, and Florida Avenue. In addition, the Proposed Action includes one proposed roadway, Homestead Parkway. The Homestead Parkway would be a proposed extension of Bougainville Boulevard to the northeast corner of the base and off base to intersect SW 112th Avenue (see Figure 2.2-1).

A summary of the estimated total daily trips generated by activities at former Homestead AFB under the Proposed Action and alternatives is shown in **Table 4.2-1**.

Table 4.2-1. Summary of Total Daily Trips Generated at Former Homestead AFB

Reuse Alternative	2000	2005	2015	Full Buildout
Proposed Action	5,412	12,454	52,118	76,101
Commercial Spaceport Alternative	5,362	13,055	24,490	31,574
Mixed Use Alternative				
Market-Driven Development	5,362	12,203	26,339	62,034
Collier-Hoover Proposal	5,362	27,509	47,123	66,644
Original Collier Proposal	5,362	23,532	39,154	46,496
Original Hoover Plan	5,362	34,741	56,448	75,842
Projected Baseline/No Action Alternative	5,362	5,952	7,517	9,094

Source: SAIC.
Note: Includes trips for retained and previously conveyed areas.

The analysis of impacts on emergency evacuation during a hurricane evacuation considered several factors in the determination of roadway capacity and total travel time. The major roadways leading out of the area to the north are U.S. Highway 1 and Florida's Turnpike. U.S. Highway 1 is a four-lane divided highway, and Florida's Turnpike is a four-lane expressway. Assuming these two roadways are the major links for travel in the northern direction, the four northbound lanes will be heavily used during an evacuation.

It is assumed that the four northbound lanes have a capacity of 2,000 passenger cars per hour per lane. Two lanes (one each direction) are planned to be added to Florida's Turnpike by 2005, so the evacuation capacity will be increased by 2,000 vehicles per hour. The analysis in the SEIS is based on the projected population of the area and the assumption that there will be an average of three persons per vehicle during an evacuation.

In the event of a nuclear accident at the Turkey Point Nuclear Power Plant, all persons within at least a 10 mile radius would need to be evacuated. The main roadways leading out of this area are U.S. Highway 1, Krome Avenue, Florida's Turnpike, SW 107th Avenue north of SW 328th Street, SW 137th Avenue north of SW 328th Street, SW 328th Street east of SW 137th Avenue, and SW 344th Street east of U.S. Highway 1.

The evacuation travel time was estimated using the same assumptions used to estimate hurricane evacuation time. The population within 10 miles of Turkey Point is estimated to have been 133,644 in 1995. For the future baseline projections, this population was assumed to grow at the same rate as the total south Miami-Dade County population. It was also assumed that there will be ten main lanes available for evacuation in 2000, with eleven lanes available in 2005 and 2015, due to the widening of Florida's Turnpike.

4.2.2 Proposed Action

Roadways

The peak-hour traffic generation of the Proposed Action in combination with the projected baseline on the former base is estimated to be 773 trips in 2000, 1,577 trips in 2005, 6,103 trips in 2015, and 9,246 at full buildout. **Table 4.2-2** shows the estimated traffic conditions on key roadways in the area in 2000, 2005, and 2015, due to the traffic generated by the Proposed Action. Full buildout could not be analyzed because projected baseline trip estimates are not available to add to the Proposed Action trips. Without a total traffic volume, including baseline and proposed trips, level of service cannot be determined. Trips associated with reuse-related secondary development were also estimated, based on an estimated increase in employment in south Miami-Dade County of 3 percent in 2005 and 15 percent in 2015.

Considering direct trips from on-site areas, traffic associated with secondary development, and the projected increase in baseline traffic, LOS was calculated for roads in the ROI. Several roads are projected to have volumes in excess of the acceptable service capacity by 2015 (see Section 3.2 for description of minimal acceptable LOS in the ROI). These are shown on **Figure 4.2-1**. SW 137th Avenue from SW 268th Street to SW 288th Street is anticipated to experience an unacceptable LOS by 2005 under the projected baseline, but this problem would be corrected by a scheduled road improvement before 2015. The LOS for 2015 in Table 4.2-2 reflects that expected upgrade. Sections of U.S. Highway 1, Krome Avenue, SW 127th Avenue, SW 268th Street, and SW 288th Street are projected to experience unacceptable LOS by 2015, also under the projected baseline.

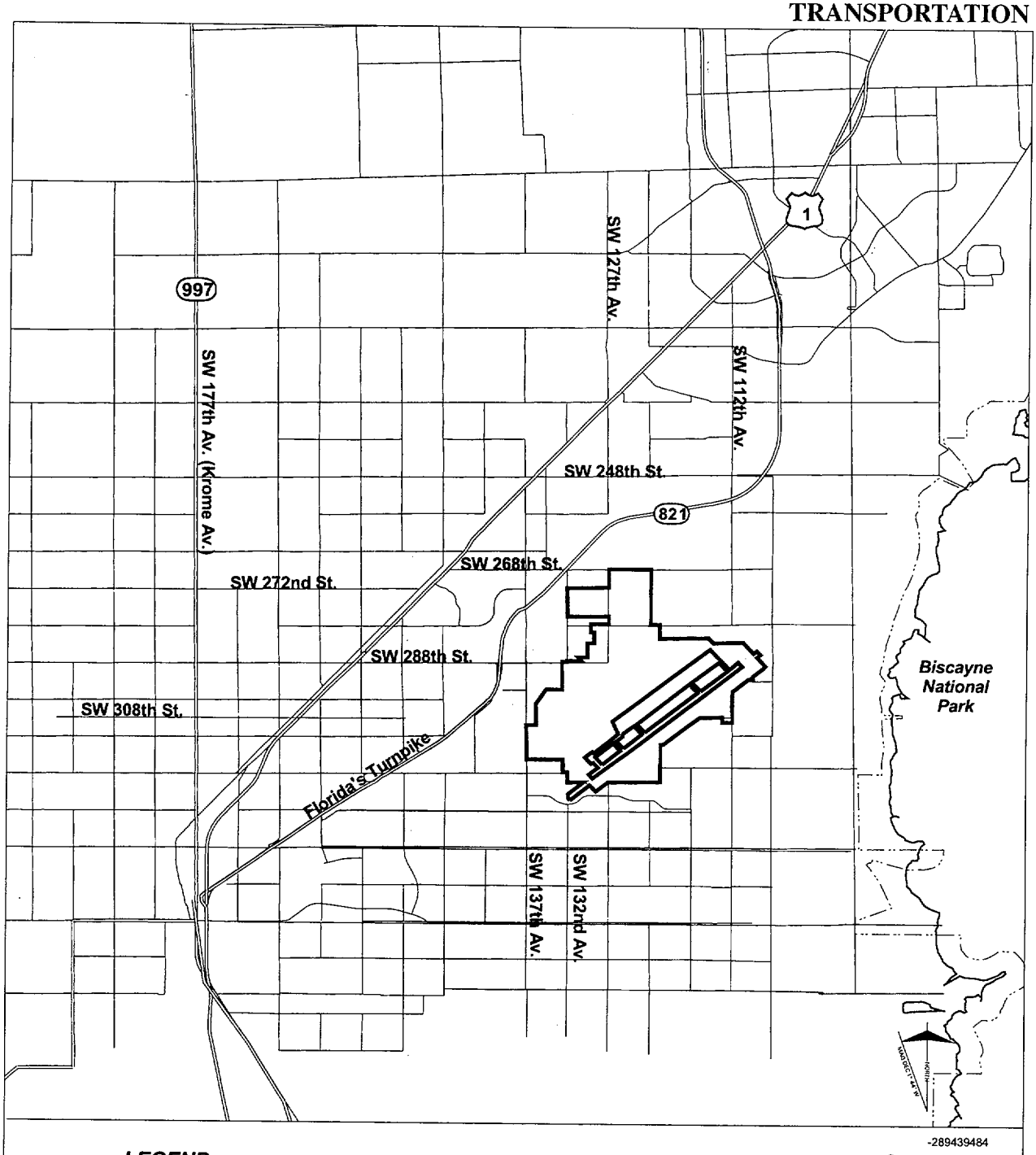
As discussed in Section 3.2 and shown in Table 4.2-2, portions of U.S. Highway 1 will be operating above capacity, although they will not exceed minimum acceptable LOS, under the projected baseline. The Proposed Action is estimated to have the most effect on the portion of this highway between SW 112th Avenue and SW 308th Street. In portions of this area, trips associated with the Proposed Action could increase peak-hour traffic by 25 percent. In some segments, this could cause LOS to degrade to unacceptable levels, while in others, an existing unacceptable situation would be further aggravated.

Table 4.2-2. Estimated Increase in Peak-Hour Traffic Volumes and LOS on Key Roads—Proposed Action

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action[1]	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	215	A	B	1682	B	C
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	109	A	A	721	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	63	A	A	563	B	B
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	188	B	B	1177	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	146	A	A	894	A	B
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	113	A	A	718	B	B
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	124	F	F	876	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	109	C	C	704	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	157	E	E	889	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	161	E	E	908	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	113	B	B	641	B	C
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	115	B	B	709	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	88	B	B	520	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	33	B	C	212	C	E
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	32	B	B	200	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	14	C	C	80	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	43	B	B	264	C	D
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	21	A	A	179	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	97	D	D	781	D	D
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	130	B	B	1178	B	C
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	205	B	B	2086	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	A	393	A	C	1854	B	E
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	65	B	B	400	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	187	D	F	1122	B	C
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	40	B	B	237	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action[1]	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Proposed Action
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	227	B	B	1506	B	C
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	223	B	B	1473	B	C
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	109	C	C	633	C	D
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	349	B	B	1832	B	F
SW 288th Street	from SW 137th Ave to FL Turnpike	0	D	D	310	D	D	1680	D	F
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	185	C	C	1015	C	D
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	8	B	B	46	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	8	B	B	55	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	63	D	D	390	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	8	A	A	46	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	8	A	A	46	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	3	A	A	18	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	8	A	A	48	A	A

Source: SAIC; **FDOT 1995**.
Note: [1] Does not include an estimated 50 daily trips associated with the Proposed Action because associated peak hour volumes could not be estimated.
LOS Level of Service



LEGEND

- Former Homestead AFB
- National Park Boundary
- Street
- Major Road
- U.S. Highway
- State Highway

1 0 1 2
Scale in Miles

Derived from:
Metro-Dade County 1998a,
Metro-Dade County n.d.b.

Figure 4.2-1
Roadway Segments that
May Exceed Service Capacity

The segment of Krome Avenue between SW 248th Street and SW 272nd Street is projected to decline from LOS C to an unacceptable level E by 2015, due to the Proposed Action. A segment of SW 127th Avenue from the site to SW 268th Street is anticipated to be the most affected, declining from LOS B to LOS E in 2015. SW 288th Street between SW 132nd Avenue and Florida's Turnpike could also be substantially affected, declining from LOS B (in one segment) and D to LOS F with the increased traffic estimated for the Proposed Action.

Emergency Evacuation

The total travel time during a hurricane evacuation was estimated based on the assumed roadway capacity and vehicle occupancy. Travel time does not include mobilization time or queuing delay time. The Florida Division of Emergency Management has determined that Miami-Dade County has a clearance time of 10 to 15 hours, depending on the category of the approaching hurricane (**Department of Community Affairs 1999**). The estimated total travel time is shown in **Table 4.2-3**. The estimates are somewhat less than the total clearance time and are reasonable based on the fact that they do not include mobilization and queuing time.

Table 4.2-3. Estimated Hurricane Evacuation Travel Time by Reuse Alternative

Alternative	Total Travel Time (hours)		
	2000	2005	2015
Projected Baseline/No Action	7.6	6.7	8.0
Proposed Action	7.6	6.7	8.3
Commercial Spaceport	7.6	6.7	8.0
Mixed Use	7.6	6.7	8.0

An estimate of "evacuation capacity" can be determined based on the assumption that there will be four main lanes available for evacuation in 2000 and five lanes available in 2005. In 2000 and 2005/2015, the evacuation capacity of the roadway system is estimated to be 8,000 vehicles per hour and 10,000 vehicles per hour, respectively.

Only a slight variation in the total travel time needed for evacuation was found among the three alternatives. Most of the change in evacuation time is reflected in the projected baseline (the decline in 2005 reflects planned road improvements). The Proposed Action is estimated to have virtually no effect on evacuation time in 2000 and 2005. By 2015, it could increase total evacuation travel time by about 20 minutes.

Table 4.2-4 presents estimated travel time to evacuate the 10 mile area around Turkey Point in the event of an accident at the nuclear power plant.

The main variation in travel time shown in Table 4.2-4 is attributable to the projected baseline population growth. It is assumed that the four- and six-lane highways have a capacity of 1,800 passenger cars per hour per lane. The two lanes planned to be added to Florida's Turnpike by 2005 will increase the evacuation capacity by 1,800 vehicles per hour.

These calculations do not include the time involved with reporting the incident, ordering the evacuation, or lost time as vehicles enter the system. The analysis reports on how long it would take all evacuating vehicles to proceed through the roadway system.

Table 4.2-4. Estimated Evacuation Travel Time in Event of an Accident at Turkey Point Nuclear Power Plant

Alternative	Total Travel Time (hours)		
	2000	2005	2015
Projected Baseline/No Action	3.6	3.6	4.2
Proposed Action	3.6	3.6	4.4
Commercial Spaceport	3.6	3.6	4.2
Mixed Use	3.6	3.6	4.2–4.3

Cumulative Impacts

If the high population growth projected by Miami-Dade County for the south county area were to occur (at a 4.6 percent growth rate), the volume of traffic in the ROI could more than double between 1995 and 2015. As LOS declined on some roadways, travelers would tend to find alternate routes. Overall reductions in LOS could be expected, but it is difficult to predict how traffic would redistribute itself and the effects on LOS of specific roads. Regional roadways would be the most likely to be adversely affected, since people tend to use these roadways preferentially until traffic flow is seriously impeded. For example, segments of U.S. Highway 1 that are projected to decline from LOS D and E in 2000 to F in 2015 with the Proposed Action would be further degraded with accelerated growth. Some roadways currently operating at LOS A and B, particularly arterials, could decline to LOS E and F much sooner than 2015.

Estimated traffic increases from reuse-induced population growth in south Miami-Dade County could contribute an additional 1 to 2 percent over projected high-growth traffic volumes. While this would be a small increase, the effect on a seriously strained roadway network would be adverse.

Mitigation Measures

LOS could be improved on road segments estimated to be adversely affected by the Proposed Action by widening the roads (adding lanes) and thereby increasing capacity. The following improvements would achieve acceptable service levels on the affected road segments:

- Widen U.S. Highway 1 between SW 112th Avenue and SW 308th Street from four to six lanes. This will likely be needed whether or not the Proposed Action is implemented, to accommodate baseline growth.
- Widen Krome Avenue between SW 248th Street and SW 272nd Street from two to four lanes.
- Widen SW 127th Avenue between SW 268th Street and the former base from two to four lanes.
- Widen SW 288th Street between SW 132nd Avenue and Florida's Turnpike from four to six lanes.

Improvement of mass transit service to the Homestead area could reduce traffic congestion and degradation of level of service. This could be considered in certain key areas, such as along U.S. Highway 1, in response to baseline growth, even without reuse of former Homestead AFB. By itself, the proposed commercial airport would not be likely to reach levels of traffic sufficient for mass transit mitigations for 10 to 15 years.

A higher level of population growth in the region, as considered in the cumulative impact analysis, could exert sufficient pressure on local roadways to warrant earlier mitigation through mass transit options,

perhaps as early as the 2005 time frame. This need would be largely generated by overall population growth rather than the proposed airport.

Possible Future Expansion

Possible expansion of HST could result in more than double the amount of direct traffic to and from the airport, based on the estimated additional employment and passenger levels. However, it is not possible to estimate the effect of this expansion on LOS of roadways in the ROI for several reasons. The timing of the possible expansion is not known; therefore, the future baseline population and related traffic volumes on local roadways cannot be estimated. If an expansion occurred, it would not be expected to occur within the planning horizon of current long-range transportation plans. Therefore, future roadway improvements that might be made in response to regional growth are not known. New mass transit systems (indicated schematically in the ALP) and other changes could radically alter commuting patterns in the future. These uncertainties prevent a meaningful analysis at this time. Further environmental impact analysis would have to address these transportation issues at the time construction of a second runway was actually proposed.

4.2.3 Commercial Spaceport Alternative

Roadways

The peak-hour traffic generation of the Commercial Spaceport alternative in combination with projected baseline traffic is estimated to be 773 trips in 2000, 1,628 trips in 2005, 3,115 trips in 2015, and 4,060 trips at full buildout. Trips associated with spaceport-related secondary development were also estimated, based on a potential increase in employment in south Miami-Dade County of 2 percent in 2005 and 5 percent in 2015. **Table 4.2-5** shows estimated traffic conditions on specific roadways in the ROI in 2000, 2005, and 2015.

Several roads are projected to have volumes in excess of the acceptable service capacity by 2015. Sections of SW 137th Avenue could experience an unacceptable LOS by 2005, but this problem is expected to be corrected by a scheduled road improvement before 2015. Sections of U.S. Highway 1 are projected to reach unacceptable LOS by 2005 (between SW 112th Avenue and SW 137th Avenue) or 2015 (SW 147th Avenue to SW 157th Avenue), but this is expected to occur under the projected baseline as well. SW 288th Street between SW 137th Avenue and Florida's Turnpike is projected to decline to LOS E with the additional traffic generated by this alternative.

Emergency Evacuation

As shown in Table 4.2-3, the Commercial Spaceport alternative is estimated to increase total evacuation travel time in the event of a hurricane by only a few minutes. Table 4.2-4 shows that evacuation time for the Turkey Point Nuclear Power Plant would not be affected.

Combined Commercial Spaceport/Airport

The peak-hour traffic generation of a combined Commercial Spaceport/Airport in combination with the projected baseline is estimated to be 773 trips in 2000, 2,860 trips in 2005, and 5,544 trips in 2015. With inclusion of secondary traffic, the same roadway segments would be expected to experience unacceptable LOS as described above, but earlier. Specifically, sections of SW 137th Avenue would experience unacceptable LOS by 2005, but this would be corrected by 2015 with the improvements already planned.

Table 4.2-5. Estimated Increase in Peak-Hour Traffic Volumes and LOS on Key Roads—Commercial Spaceport Alternative

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	220	A	B	669	B	B
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	105	A	A	260	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	56	A	A	215	B	B
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	192	B	B	433	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	151	A	B	332	A	B
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	116	A	A	268	B	A
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	116	F	F	317	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	103	C	C	246	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	155	E	E	304	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	160	E	E	312	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	113	B	B	220	B	B
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	116	B	B	258	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	87	B	B	182	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	30	B	C	71	C	C
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	29	B	B	68	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	14	C	C	28	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	41	B	B	90	C	C
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	22	A	A	74	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	95	D	D	304	D	D
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	129	B	B	480	B	C
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	215	B	B	895	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	A	421	A	B	638	B	C
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	68	B	B	151	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	195	D	F	415	B	B
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	42	B	B	88	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	239	B	B	582	B	B
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	235	B	B	568	B	B
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	112	C	C	229	C	C
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	368	B	B	652	B	B
SW 288th Street	from SW 137th Ave to FL Turnpike	0	D	D	326	D	D	605	D	E
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	194	C	C	366	C	C
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	8	B	B	16	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	10	B	B	19	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	59	D	D	132	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	7	A	A	16	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	7	A	A	16	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	4	A	A	7	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	8	A	A	16	A	A

Source: SAIC; **FDOT 1995**.
LOS Level of Service

Cumulative Impacts

Cumulative impacts with the Commercial Spaceport alternative would be similar to the Proposed Action, with reuse-related traffic making a slightly smaller contribution (about 1 percent) to total traffic volumes with a high level of population growth. This would be a minor effect, considering several roadways could experience marginal or unacceptable LOS by 2015 if high growth occurred.

Mitigation Measures

Increasing the capacity on affected roadway segments could reduce adverse impacts resulting from reuse-related traffic under the Commercial Spaceport alternative. The following improvements would achieve acceptable service levels:

- Widen U.S. Highway 1 between SW 112th Avenue and SW 127th Street from four to six lanes. This will likely be needed to accommodate baseline growth, with or without the Commercial Spaceport traffic.
- Widen U.S. Highway 1 between SW 147th Avenue and SW 308th Street from four to six lanes. Again, this would be required by baseline growth, at least to 157th Street.
- Widen SW 288th Street between SW 137th Avenue and Florida's Turnpike from four to six lanes.

Mass transit could be considered to mitigate roadway congestion, as described for the Proposed Action. This would be largely in response to baseline population growth rather than the development of the Commercial Spaceport alternative.

4.2.4 Mixed Use Alternative

Roadways

The impacts of this alternative would vary depending on whether it involved Market-Driven development or the plans developed by Collier Resources Company and/or the Hoover Environmental Group.

Market-Driven Development. The peak-hour traffic generation under the Market-Driven scenario in combination with the projected baseline was estimated to be 773 trips in 2000, 1,590 trips in 2005, 3,267 trips in 2015, and 7,570 by full buildout. Trips associated with reuse-related secondary development were estimated to increase 3 percent in 2005 and 5 percent in 2015. **Table 4.2-6** presents the estimated traffic conditions on key roads in the ROI in 2000, 2005, and 2015. Full buildout could not be modeled for reasons discussed under the Proposed Action.

Sections of SW 137th Avenue would experience an unacceptable LOS by 2005, but this problem is expected to be corrected by a scheduled road improvement before 2015. The same sections of U.S. Highway 1 projected to experience unacceptable LOS under the Proposed Action and Commercial Spaceport alternative would do so under this alternative, as well as under the projected baseline. The same segment of SW 288th Street would be adversely affected as under the other alternatives.

Table 4.2-6. Estimated Increase in Peak-Hour Traffic Volumes and LOS on Key Roads—Market-Driven Development

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	219	A	B	612	B	B
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	110	A	A	290	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	64	A	A	150	B	B
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	192	B	B	535	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	148	A	A	425	A	B
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	115	A	A	323	B	A
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	126	F	F	319	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	111	C	C	284	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	159	E	E	430	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	164	E	E	445	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	115	B	B	314	B	C
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	117	B	B	324	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	90	B	B	242	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	34	B	C	81	C	D
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	32	B	B	81	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	14	C	C	40	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	44	B	B	115	C	C
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	22	A	A	63	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	99	D	D	264	D	D
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	132	B	B	359	B	B
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	208	B	B	604	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	A	400	A	B	1190	B	D
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	66	B	B	192	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	190	D	F	548	B	B
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	41	B	B	120	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	231	B	B	672	B	B
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	227	B	B	660	B	B
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	111	C	C	312	C	C
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	355	B	B	1037	B	C
SW 288th Street	from SW 137th Ave to FL Turnpike	0	D	D	315	D	D	920	D	E
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	188	C	C	545	C	D
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	8	B	B	24	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	10	B	B	27	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	64	D	D	161	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	8	A	A	20	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	8	A	A	20	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	3	A	A	10	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	8	A	A	21	A	A

Source: SAIC; **FDOT 1995**.
LOS Level of Service

Collier-Hoover Proposal. The peak hour traffic generation under the Collier-Hoover proposal in combination with the projected baseline was estimated to be 773 trips in 2000, 2,382 trips in 2005, 4,531 trips in 2015, and 7,737 by full buildout. **Table 4.2-7** describes the estimated traffic conditions on key roads in the ROI in 2000, 2005, and 2015. Full buildout could not be modeled.

A section of SW 137th Avenue would experience an unacceptable LOS by 2005, but this problem is expected to be corrected by a scheduled road improvement before 2015. Sections of U.S. Highway 1, Krome Avenue, SW 127th Avenue, and SW 288th Street are expected to experience unacceptable LOS by 2015. The degradation in LOS on U.S. Highway 1 would also occur under the projected baseline. The decline in the other road segments would be attributable to the Collier-Hoover development.

Original Collier Proposal. The peak-hour traffic generation of the original Collier proposal, in combination with projected baseline, was estimated to be 773 trips in 2000, 1,374 trips in 2005, 2,087 trips in 2015, and 2,794 by full buildout. Trips associated with reuse-related secondary development were estimated to be 3 percent in 2005 and 6 percent in 2015. **Table 4.2-8** presents the estimated traffic conditions on key roads in the ROI in 2000, 2005, and 2015. Full buildout could not be modeled.

The impact of the original Collier proposal would likely be similar to the Market-Driven scenario. Sections of SW 137th Avenue would experience an unacceptable LOS by 2005, but this problem is expected to be corrected by a scheduled road improvement before 2015. The same sections of U.S. Highway 1 would experience unacceptable LOS by 2015, because of anticipated deterioration under the projected baseline.

Original Hoover Plan. The peak-hour traffic generation of the original Hoover plan, in combination with projected baseline, was estimated to be 773 trips in 2000, 3,050 trips in 2005, 5,508 trips in 2015, and 7,986 by full buildout. Trips associated with reuse-related secondary development were estimated to increase 11 percent in 2005 and 15 percent in 2015. **Table 4.2-9** presents the estimated traffic conditions on key roads in the ROI in 2000, 2005, and 2015. Full buildout could not be modeled.

Four roads are projected to have volumes in excess of the acceptable service capacity by 2015. Sections of SW 137th Avenue would experience an unacceptable LOS by 2005, but this problem is expected to be corrected by a scheduled road improvement before 2015. Sections of U.S. Highway 1, Krome Avenue, SW 127th Avenue, SW 268th Street, and SW 288th Street would be expected to decline to LOS E by 2015. In the case of U.S. Highway 1, these problems would occur with the projected baseline growth. The other reductions in service would be attributable to reuse of former Homestead AFB.

Emergency Evacuation

As shown in Table 4.2-3, the Mixed Use alternative is estimated to increase total evacuation travel time in the event of a hurricane by only a few minutes. Table 4.2-4 shows that evacuation time for the Turkey Point Nuclear Power Plant could increase slightly under the Collier-Hoover or original Hoover plan but would not be affected by the other two scenarios.

Cumulative Impacts

The cumulative impacts of the Mixed Use alternative in combination with a high growth rate in Miami-Dade County could range from similar to the Commercial Spaceport alternative, with Market-Driven development or the original Collier proposal, to similar to the Proposed Action if the original Hoover plan were implemented and received the level of visitation envisioned.

Table 4.2-7. Peak-Hour Traffic Volumes and LOS on Key Roads—Collier-Hoover Proposal

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	405	A	B	837	B	B
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	109	A	B	271	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	0	A	A	0	B	B
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	277	B	B	667	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	228	A	A	554	A	B
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	185	A	A	441	B	A
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	75	F	F	171	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	75	C	D	171	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	155	E	F	372	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	175	E	F	431	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	115	B	B	292	B	C
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	151	B	B	378	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	97	B	B	243	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	7	B	C	18	C	D
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	14	B	B	36	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	22	C	C	54	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	36	B	C	91	C	D
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	39	A	A	80	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	100	D	D	214	D	D
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	186	B	B	389	B	B
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	417	B	B	837	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	A	783	A	C	1602	B	E
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	122	B	B	269	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	306	D	F	714	B	B
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	75	B	B	171	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	463	B	B	935	B	B
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	341	B	B	720	B	B
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	139	C	C	298	C	C
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	727	B	B	1805	B	F
SW 288th Street	from SW 137th Ave to FL Turnpike	0	D	D	594	D	D	1445	D	F
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	354	C	C	869	C	D
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	14	B	B	36	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	14	B	B	36	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	36	D	D	91	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	7	A	A	18	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	7	A	A	18	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	7	A	A	18	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	7	A	A	18	A	A

Source: SAIC; **FDOT 1995**.
LOS Level of Service

Table 4.2-8. Estimated Increase in Peak-Hour Traffic Volumes and LOS on Key Roads—Original Collier Proposal

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	217	A	B	405	B	B
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	102	A	B	234	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	65	A	A	155	B	B
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	148	B	B	329	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	101	A	A	228	A	A
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	94	A	A	205	B	A
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	117	F	F	267	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	102	C	C	231	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	120	E	E	278	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	124	E	D	288	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	83	B	B	198	B	B
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	85	B	B	199	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	72	B	B	169	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	34	B	C	79	C	D
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	32	B	B	74	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	12	C	C	29	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	41	B	B	97	C	C
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	14	A	A	25	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	83	D	D	178	D	D
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	124	B	B	247	B	B
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	175	B	B	298	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	A	254	A	B	416	B	B
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	47	B	B	90	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	128	D	E	274	B	B
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	30	B	B	61	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alternative
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	190	B	B	323	B	B
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	122	B	B	227	B	B
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	65	C	C	131	C	C
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	286	B	B	634	B	B
SW 288th Street	from SW 137th Ave to FL Turnpike	0	D	D	229	D	D	502	D	D
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	144	C	C	318	C	C
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	7	B	B	16	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	8	B	B	20	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	61	D	D	144	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	7	A	A	17	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	7	A	A	17	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	3	A	A	6	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	7	A	A	17	A	A

Source: SAIC; **FDOT 1995**.
LOS Level of Service

Table 4.2-9. Estimated Increase in Peak-Hour Traffic Volumes and LOS on Key Roads—Original Hoover Plan

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
FL Turnpike Ext.	from Old Cutler Road to SW 112th Ave	0	B	B	1196	A	B	2182	B	C
FL Turnpike Ext.	from SW 112th Ave to SW 137th Ave	0	B	B	271	A	A	409	B	B
FL Turnpike Ext.	from SW 137th Ave to SW 288th St	0	B	B	263	A	B	370	B	C
FL Turnpike Ext.	from SW 288th St to SW 308th St	0	B	B	408	B	B	713	B	C
FL Turnpike Ext.	from SW 308th St to SW 172nd Ave	0	A	A	255	A	A	472	A	B
FL Turnpike Ext.	from SW 172nd Ave to U.S. Highway 1	0	A	A	248	A	A	442	B	B
U.S. Highway 1	from SW 112th Ave to SW 137th Ave	0	D	D	481	F	F	743	F	F
U.S. Highway 1	from SW 137th Ave to SW 147th Ave	0	C	C	420	C	E	657	F	F
U.S. Highway 1	from SW 147th Ave to SW 157th Ave	0	D	D	425	E	F	693	F	F
U.S. Highway 1	from SW 157th Ave to SW 308th St	0	D	D	372	E	E	604	F	F
U.S. Highway 1	from SW 308th St to SW 328th St	0	B	B	220	B	B	348	B	C
U.S. Highway 1	from SW 328th St to SW 336th St	0	B	B	178	B	B	295	B	B
U.S. Highway 1	from SW 336th St to SW 352nd St	0	B	B	181	B	B	283	B	B
Krome Avenue	from SW 248th St to SW 272nd St	0	B	B	127	B	C	180	C	D
Krome Avenue	from SW 272nd St to Homestead City Limits	0	B	B	109	B	B	158	B	C
Krome Avenue	from Homestead City Limits to SW 328th St	0	C	C	22	C	C	38	C	C
Krome Avenue	from SW 328th St to SW 352nd St	0	B	B	121	B	C	181	C	D
SW 107th Avenue	from SW 268th St to SW 328th St	0	A	A	112	A	A	214	A	A
SW 112th Avenue	from U.S. Highway 1 to Old Cutler Road	0	D	D	417	D	D	705	D	E
SW 112th Avenue	from Old Cutler Rd to FL Turnpike	0	B	B	645	B	C	1134	B	B
SW 112th Avenue	from FL Turnpike to SW 268th St	0	B	B	1251	B	B	2364	B	B
SW 127th Avenue	from SW 268th St to Homestead AFB	0	A	B	2103	A	E	4092	B	F
SW 137th Avenue	from U.S. Highway 1 to SW 268th	0	B	B	242	B	B	465	B	B
SW 137th Avenue	from SW 268th St to SW 288th St	0	C	C	473	D	F	892	B	B
SW 137th Avenue	from SW 288th St to SW 328th St	0	B	B	130	B	B	250	B	B

Roadway	Link	2000			2005			2015		
		Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive	Increase in Traffic Volume	Projected Baseline/ No Action LOS	LOS With Reuse Alterna-tive
SW 268th Street	from SW 112th Ave to SW 127th Ave	0	B	B	1356	B	C	2570	B	F
SW 268th Street	from SW 127th Ave to SW 137th Ave	0	B	B	951	B	B	1813	B	D
SW 268th Street	from SW 137th Ave to U.S. Highway 1	0	C	C	428	C	C	784	C	D
SW 288th Street	from SW 132nd Ave to SW 137th Ave	0	B	B	225	B	B	502	B	C
SW 288th Street	from SW 137th Ave to Fl Turnpike	0	D	D	407	D	D	826	D	E
SW 288th Street	from FL Turnpike to U.S. Highway 1	0	C	C	203	C	C	406	C	C
SW 312th Street	from SW 137th Ave to 3-Mile Road	0	B	B	10	B	B	18	B	B
SW 312th Street	from 3-Mile Rd to FL Turnpike	0	B	B	16	B	B	26	B	B
SW 312th Street	from FL Turnpike to U.S. Highway 1	0	C	C	202	D	D	294	D	D
SW 328th Street	from SW 142nd Ave to Homestead City Limits	0	A	A	20	A	A	30	A	A
SW 328th Street	from SW 112th St to SW 142nd Ave	0	A	A	20	A	A	30	A	A
SW 344th Street	from SW 112th Ave to SW 132nd Ave	0	A	A	2	A	A	5	A	A
SW 344th Street	from SW 132nd Ave to SW 147th Ave	0	A	A	21	A	A	32	A	A

Source: SAIC; **FDOT 1995**.
LOS Level of Service

Mitigation Measures

The mitigation measures identified for the Commercial Spaceport alternative would also be appropriate for the Market-Driven development and original Collier proposal. To reduce the potential impacts from the Collier-Hoover proposal and bring affected roadways to acceptable service levels, the following additional measures are suggested.

- Widen U.S. Highway 1 between SW 112th Avenue and SW 308th Street from four to six lanes. This will likely be needed to accommodate baseline growth.
- Widen Krome Avenue between SW 248th Street and SW 272nd Street and between SW 328th Street and SW 352nd Street from two to four lanes.
- Widen SW 127th Avenue from SW 268th Street to the former base from two to six lanes.
- Widen 268th Street from SW 112th Avenue to SW 137th Avenue from four to six lanes.
- Widen SW 288th Street from SW 132nd Avenue to Florida's Turnpike from four to six lanes.

Similar improvements would be needed with the original Hoover plan. Mass transit could be considered to reduce roadway congestion, as described for the Proposed Action.

4.2.5 No Action Alternative

Under the No Action alternative, peak-hour traffic on roadways in the ROI would be the same as under the projected baseline, as shown in each foregoing table. By 2015, U.S. Highway 1 could decline from LOS C and D in 2000 to LOS F. Krome Avenue between SW 248th Street and SW 272nd Street may continue to operate at LOS B in some areas and decline slightly to LOS C in others. SW 312th Street between Florida's Turnpike and U.S. Highway 1 may decline from LOS C to D by 2005. Only U.S. Highway 1 between 112th Avenue and SW 137th Avenue is projected to exceed its maximum service volume by 2015.

4.2.6 Independent Land Use Concepts

Traffic generated by most of the independent land use concepts would be subsumed within the estimates generated for the Proposed Action and other reuse alternatives.

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4.3 UTILITIES

This section addresses projected water consumption, wastewater generation, solid waste disposal, electrical consumption, and natural gas consumption in the ROI for the Proposed Action and alternatives.

4.3.1 Introduction

The analysis of impacts on utilities considers direct on-site demand generated by employment and land development located on former Homestead AFB and indirect demand generated by estimated changes in population. On-site demand projections derived from usage factors for the type of anticipated development and intensity of use. Projected utility demands for former Homestead AFB include the combined total use of retained areas, conveyed areas, and the disposal property.

Projected baseline average daily utility demands in the ROI for 2000, 2005, and 2015 are presented in Section 3.3. Those utility demands were calculated based on projected baseline population levels. The utility impact analysis in this section is based on the population impacts presented in Section 4.1, which shows population increases estimated to result from implementation of the Proposed Action and alternatives. The percent increases in population for the utility service areas (generally south Miami-Dade County, City of Homestead, and Florida City) were used as factors to calculate future utility demands that would result from population growth caused by implementation of the Proposed Action and alternatives on top of the projected baseline growth.

Population was used as the determining factor for utility demand rather than employment because persons already resident in the county are expected to fill most of the jobs generated by reuse of the former base (see Section 4.1). These persons are part of the baseline population projections and, thus, already have been factored into the projected baseline utility demand, as presented in Section 3.3. Therefore, only population increases attributable to reuse-related in-migration and relocation were used to factor future increases in utility demands resulting from implementation of the Proposed Action and alternatives. The following sections provide total estimated utilities consumption in 2000, 2005, 2015. Demands for full buildout could not be estimated because baseline population levels are not available for that phase of development.

4.3.2 Potable Water

4.3.2.1 Proposed Action

The estimated total average daily water demand in the ROI in 2000, 2005, and 2015 under the Proposed Action is presented in **Table 4.3-1**. Projected water demand is shown for each of the water treatment plant service areas in the ROI, including WASD's Alexander Orr and Rex System plants (which serve most of the unincorporated area of south Miami-Dade County), the City of Homestead, Florida City, and former Homestead AFB.

The total water demand in the ROI with the Proposed Action is estimated to be approximately 290 mgd in 2015. This would be about 10 mgd (less than 4 percent) greater than the projected baseline demand in 2015. About 7 percent of the increase would be attributed to direct, on-site demand, and the remainder to off-site effects.

Table 4.3-1. Total Water Demand in the ROI—Proposed Action

Water Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Permitted Capacity (mgd)
Alexander Orr (WASD)	187.0	206.6	250.3	196.0[1]
Rex System (WASD)	6.6	7.4	11.8	12.6
City of Homestead	11.4	13.6	20.6	17.0
Florida City	3.2	3.9	5.8	4.1
Former Homestead AFB	0.3	0.4	1.0	3.0
Total	**208.5**	**231.9**	**289.5**	**232.7**
Projected Baseline/No Action	208.5	231.0	279.3	232.7

Source: SAIC.
Note: [1] Planned for expansion to 220 mgd.
mgd million gallons per day

The projected service area water demands would be within the existing permitted capacities (or currently planned expansions) of their water treatment plants (as shown in Table 3.3-1), except at Alexander Orr, City of Homestead, and Florida City in 2015. As shown in Table 4.3-1, the capacities of these facilities are already expected to be exceeded by the projected baseline demand. Therefore, additional treatment capacity will be needed before 2015 with or without the Proposed Action. In each case, the amount of additional capacity required to accommodate the Proposed Action is small compared to the additional capacity required to accommodate the projected baseline. At the Alexander Orr plant, the Proposed Action is estimated to add 5.3 mgd (2 percent) over the projected baseline demand of 245 mgd in 2015. At the City of Homestead plant, the Proposed Action increase would be less than 1 mgd (3.5 percent) and at Florida City, the Proposed Action would not increase the projected baseline demand.

Cumulative Impacts

If the Miami-Dade County high-growth forecasts were to occur, population in the southern portion of the county could be approximately 70 percent higher than under the projected baseline with moderate growth. Water demand could be expected to exceed current permitted capacities of water treatment plants in the ROI before 2005. About 5 percent of this increase would be contributed by the Proposed Action.

Mitigation Measures

If the additional water treatment capacity necessary to treat projected baseline water demand is developed on a timely basis with an adequate margin of additional capacity, it could accommodate the demand attributable to the Proposed Action.

Possible Future Expansion

Activity levels at HST could increase substantially with the addition and full utilization of a second runway. It is conceivable that the resulting increase in water demand could be double that of the Proposed Action.

4.3.2.2 Commercial Spaceport Alternative

The estimated total average daily water demand in the ROI in 2000, 2005, and 2015 under the Commercial Spaceport alternative is presented in **Table 4.3-2**. Projected water demand is shown for each of the water treatment plant service areas in the ROI.

Table 4.3-2. Total Water Demand in the ROI—Commercial Spaceport Alternative

Water Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Permitted Capacity (mgd)
Alexander Orr (WASD)	187.0	206.2	245.5	196.0[1]
Rex System (WASD)	6.6	7.4	8.7	12.6
City of Homestead	11.4	13.6	20.0	17.0
Florida City	3.2	3.9	5.8	4.1
Former Homestead AFB	0.3	0.4	0.6	3.0
Total	**208.5**	**231.5**	**280.6**	**232.7**
Projected Baseline/No Action	208.5	231.0	279.3	232.7

Source: SAIC.
Note: [1] Planned for expansion to 220 mgd.
mgd million gallons per day

The total water demand in the ROI with the Commercial Spaceport alternative is estimated to be approximately 281 mgd in 2015. This would be about 1 mgd (less than 1 percent) greater than the projected baseline demand in 2015. Direct, on-site demands would generate about 17 percent of this demand, with the remainder attributable to off-site demand.

The projected service area water demands would be within the existing permitted capacities (or currently planned expansions) of their water treatment plants, except at Alexander Orr, City of Homestead, and Florida City in 2015, which are expected to exceed their capacities under the projected baseline. Therefore, additional treatment capacity will be needed before 2015 with or without the Commercial Spaceport alternative. In each case, the amount of additional capacity required to accommodate the Commercial Spaceport alternative is very small compared to the additional capacity required to accommodate the projected baseline. At the Alexander Orr plant, reuse-generated increase in demand would be 0.5 mgd (0.2 percent), at the City of Homestead it would be 0.1 mgd (0.5 percent), and at Florida City there would be no change over the projected baseline in 2015.

Combined Commercial Spaceport/Airport

The estimated average daily water demand in the ROI with a combined Commercial Spaceport/ Airport is presented in **Table 4.3-3**. The total water demand in the ROI is estimated to be about 282 mgd in 2015, just slightly more than the Commercial Spaceport alternative without a commercial airport. This would be about 3 mgd (1 percent) greater than the projected baseline demand in 2015.

Table 4.3-3. Total Water Demand in the ROI—Combined Commercial Spaceport/Airport

Water Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Permitted Capacity (mgd)
Alexander Orr (WASD)	187.0	206.7	246.3	196.0[1]
Rex System (WASD)	6.6	7.6	9.1	12.6
City of Homestead	11.4	13.7	20.1	17.0
Florida City	3.2	3.9	5.8	4.1
Former Homestead AFB	0.3	0.6	0.9	3.0
Total	**208.5**	**232.5**	**282.2**	**232.7**
Projected Baseline/No Action	208.5	231.0	279.3	232.7

Source: SAIC.
Note: [1] Planned for expansion to 220 mgd.
mgd million gallons per day

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions, and water demand could significantly exceed current permitted capacities of water treatment plants in the ROI before 2005. The proportion of this exceedance that would be contributed by the Commercial Spaceport alternative would be very small (much less than 1 percent).

Mitigation Measures

If the additional water treatment capacity necessary to treat projected baseline water demand is developed on a timely basis with any margin of additional capacity, it would accommodate the estimated demand of the Commercial Spaceport alternative.

4.3.2.3 Mixed Use Alternative

The impact of the Mixed Use alternative on water demand and supply would depend on how the alternative was implemented. Four potential plans were analyzed: a Market-Driven development scenario, a joint proposal submitted by Collier Resources Company and the Hoover Environmental Group, the original Collier proposal, and the original Hoover plan. The estimated range of total average daily water demand in the ROI in 2000, 2005, and 2015 encompassing the four scenarios is presented in **Table 4.3-4**.

With Market-Driven development, total water demand in the ROI is estimated to be approximately 281 mgd in 2015. This would be slightly more than 1 mgd (less than 1 percent) greater than the projected baseline. Estimates for the original Collier proposal are about the same. Under the Collier-Hoover proposal, total water demand is estimated to be approximately 233 mgd in 2005 and 282 mgd in 2015 (about 1 percent of the projected baseline). Total water demand for the original Hoover plan is estimated to be about the same as the Collier-Hoover proposal.

Projected baseline demand would exceed the capacities of the Alexander Orr, City of Homestead, and Florida City facilities by 2015, and additional treatment capacity will be needed before 2015 with or without the Mixed Use alternative. The amount of additional capacity required to accommodate the Mixed Use alternative would be similar to the Commercial Spaceport alternative and very small (less than 1 percent) compared to the additional capacity required to accommodate the projected baseline.

Table 4.3-4. Total Water Demand in the ROI—Mixed Use Alternative

Water Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Permitted Capacity (mgd)
Alexander Orr (WASD)	187.0	206.2–206.5	245.5–246.0	196.0[1]
Rex System (WASD)	6.6	7.4–7.7	8.7–9.1	12.6
City of Homestead	11.4	13.6	20.0	17.0
Florida City	3.2	3.9–4.0	5.8	4.1
Former Homestead AFB[2]	0.3	0.4–0.7	0.7–1.4	3.0
Total	**208.5**	**231.5–232.5**	**280.7–282.3**	**232.7**
Projected Baseline/No Action	208.5	231.0	279.3	232.7

Source: SAIC.
Note: [1] Planned for expansion to 220 mgd.
[2] Does not include water for irrigation.
mgd million gallons per day

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, population could be approximately 70 percent higher than under baseline conditions, and water demand could significantly exceed current permitted capacities of water treatment plants in the ROI before 2005. The proportion of this exceedance that would be contributed by the Mixed Use alternative would be very small (less than 1 percent).

Mitigation Measures

If the additional water treatment capacity necessary to treat baseline water demand is developed on a timely basis with any margin of additional capacity, it would accommodate the demand of the Mixed Use alternative.

4.3.2.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property, except continued use of the airfield for military and other government operations, which is included in the projected baseline. There would be no impacts due to reuse of former Homestead AFB. The projected baseline growth would still result in exceedances of the capacities of the Alexander Orr, City of Homestead, and Florida City facilities. This would likely require these purveyors to modify their existing water use permits.

4.3.2.5 Independent Land Use Concepts

It is possible that some of the independent land use concepts could be incorporated in the Proposed Action or the industrial and commercial uses of the Commercial Spaceport and Mixed Use alternatives. The water demands of these independent land use concepts are considered subsumed under the development scenarios addressed above.

Two independent land use concepts could generate higher than average water demand: agriculture and a cemetery. In each case, the water demand could be highly variable depending on factors such as farming practices, type of crop, amount of irrigation-dependent landscaping, and weather patterns.

4.3.3 Wastewater

4.3.3.1 Proposed Action

The estimated total average daily wastewater generation in 2000, 2005, and 2015 under the Proposed Action is presented in **Table 4.3-5**. Projected wastewater generation is shown for each of the wastewater treatment plant service areas in the ROI. The service areas included in the table are WASD's South District plant (which serves most of the unincorporated area of south Miami-Dade County) and the City of Homestead. Florida City and former Homestead AFB wastewater is treated at the South District plant.

Table 4.3-5. Total Wastewater Generation in the ROI—Proposed Action

Wastewater Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Planned Average Flow (mgd)
South District (WASD)	84.5	93.7	115.6	112.5
City of Homestead	3.3	4.0	6.0	6.0
Total	**87.8**	**97.7**	**121.6**	**118.5**
Projected Baseline/No Action	87.8	97.4	116.9	118.5

Source: SAIC.
mgd million gallons per day

The total wastewater generation in the ROI with the Proposed Action is estimated to be approximately 122 mgd in 2015. This would be 5 mgd (about 4 percent) greater than the projected baseline of 116.9 mgd in 2015 (shown in Table 4.3-5). About 15 percent of this increase is attributable to direct, on-site development, with the rest from off-site demand. The projected wastewater generation rates would be within the capacities of the planned average flows of currently planned expansions of the treatment plants (as shown in Table 3.3-3), except at the South District plant in 2015. The estimated treatment demand at South District in 2015 would be 115.6 mgd, with a planned average flow of 112.5 mgd, about 2 percent less than the estimated demand with the Proposed Action.

Miami-Dade WASD operates three regional wastewater treatment plants in the north, central, and south districts. The system is interconnected and the service districts have flexible boundaries. Flows from one district can be diverted to other plants in the system. The north and central plants are considerably larger than the south plant, as shown in Table 3.3-3. A 2 percent exceedance at the South District plant would not be a significant impact on the overall system. The Proposed Action wastewater treatment demand (1.4 mgd) would be small (about 1 percent) of the projected baseline in 2015.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions and wastewater treatment demand could significantly exceed planned capacities of treatment plants in the ROI before 2005. The proportion of this exceedance that would be contributed by the Proposed Action would be small (about 2 percent).

Mitigation Measures

No mitigation measures are suggested.

Possible Future Expansion

Activity levels at HST could increase substantially with the addition and full utilization of a second runway. It is conceivable that the resulting increase in wastewater generation could be double that of the Proposed Action.

4.3.3.2 Commercial Spaceport Alternative

The estimated total average daily wastewater generation in the ROI in 2000, 2005, and 2015 for the Commercial Spaceport alternative is presented in **Table 4.3-6**. Total wastewater generation in the ROI with the Commercial Spaceport alternative is estimated to be approximately 117.5 mgd in 2015. This would be 0.6 mgd (less than 1 percent) above the projected baseline of 116.9 in 2015. Direct, on-site development would account for about 75 percent of the increase, with the rest attributable to off-site demand. All of the projected wastewater generation rates would be within the capacities of the planned average flows of currently planned expansions of the treatment plants.

Table 4.3-6. Total Wastewater Generation in the ROI—Commercial Spaceport Alternative

Wastewater Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Planned Average Flow (mgd)
South District (WASD)	84.5	93.7	111.7	112.5
City of Homestead	3.3	4.0	5.8	6.0
Total	**87.8**	**97.7**	**117.5**	**118.5**
Projected Baseline/No Action	87.8	97.4	116.9	118.5

Source: SAIC.
mgd million gallons per day

Combined Commercial Spaceport/Airport

The total estimated average daily wastewater generation in the ROI in 2000, 2005, and 2015 for a combined Commercial Spaceport/Airport is presented in **Table 4.3-7**. Total wastewater generation in the ROI is estimated to be approximately 118.3 mgd in 2015, just slightly more than the Commercial Spaceport alternative without a commercial airport. This would be approximately 1.4 mgd (less than 1 percent) greater than the projected baseline demand in 2015. All of the projected wastewater generation rates would be within the capacities of the planned average flows of currently planned expansions of the treatment plants.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions and wastewater treatment demand could significantly exceed planned capacities of treatment plants in the ROI before 2015. The proportion of this exceedance that would be contributed by the Commercial Spaceport alternative or the combined Commercial Spaceport/Airport would be very small (much less than 1 percent).

Mitigation Measures

No mitigation measures are needed or suggested.

Table 4.3-7. Total Wastewater Generation in the ROI—Combined Commercial Spaceport/Airport

Wastewater Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Planned Average Flow (mgd)
South District (WASD)	84.5	94.1	112.5	112.5
City of Homestead	3.3	4.0	5.8	6.0
Total	**87.8**	**98.1**	**118.3**	**118.5**
Projected Baseline/No Action	87.8	97.4	116.9	118.5

Source: SAIC.
mgd million gallons per day

4.3.3.3 Mixed Use Alternative

The estimated range of total average daily wastewater generation in the ROI in 2000, 2005, and 2015 under the Mixed Use alternative is presented in **Table 4.3-8.** Total wastewater generation in the ROI is estimated to range from approximately 117.9 to 118.5 mgd in 2015. The Market-Driven development would be at the lower end of the range. Total wastewater generation under the Collier-Hoover proposal is estimated to be about 98 mgd in 2005 and 118 mgd in 2015. This would be between 1 and 2 mgd (less than 1 percent) above the projected baseline demand in 2015. The projected wastewater generation rates would be within the capacities of the planned average flows of currently planned expansions of the treatment plants.

Table 4.3-8. Total Wastewater Generation in the ROI—Mixed Use Alternative

Wastewater Treatment Plant Service Area	2000 (mgd)	2005 (mgd)	2015 (mgd)	Planned Average Flow (mgd)
South District (WASD)	84.5	93.8–94.1	112.1–112.7	112.5
City of Homestead	3.3	4.0	5.8	6.0
Total	**87.8**	**97.8–98.1**	**117.9–118.5**	**118.5**
Projected Baseline/No Action	87.8	97.4	116.9	118.5

Source: SAIC.
mgd million gallons per day

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions, and wastewater generation could significantly exceed planned capacities of treatment plants in the ROI before 2015. The proportion of this exceedance that would be contributed by the Mixed Use alternative would be very small (less than 1 percent).

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.3.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property, except continued use of the airfield for military and other government operations, which is included in the projected baseline. The No Action alternative would have no impact on wastewater treatment demand or capacity.

4.3.3.5 Independent Land Use Concepts

Some of the independent land use concepts could be incorporated in the Proposed Action or the industrial and commercial uses of the Commercial Spaceport and Mixed Use alternatives. No effects specific to these independent land use concepts are expected to exceed those associated with the Proposed Action and other alternatives.

4.3.4 Solid Waste

4.3.4.1 Proposed Action

The estimated total average daily solid waste disposal in the ROI in 2000, 2005, and 2015 under the Proposed Action is presented in **Table 4.3-9**. Projected solid waste disposal is shown for each of the solid waste generation areas in the ROI, including the unincorporated area of Miami-Dade County, the City of Homestead, Florida City, and former Homestead AFB.

Table 4.3-9. Total Solid Waste Generation in the ROI—Proposed Action

Solid Waste Generation Area	2000 (tpd)	2005 (tpd)	2015 (tpd)
Unincorporated Area	638	706	868
City of Homestead	127	152	230
Florida City	12	15	22
Former Homestead AFB	5	12	44
Total	**782**	**885**	**1,164**
Projected Baseline/No Action	782	877	1,088

Source: SAIC.
tpd tons per day

Total solid waste disposal in the ROI with the Proposed Action is estimated to be approximately 1,164 tpd in 2015. This would be 76 tpd (about 7 percent) greater than the projected baseline in 2015 (shown in Table 4.3-9). Direct, on-site development would account for about 52 percent of the increase, with the rest attributable to off-site demand. The projected solid waste disposal rates would be within the capacities of the existing waste disposal facilities.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions and solid waste disposal requirements could significantly impact the available capacities at solid waste disposal facilities. The proportion of this impact that would be contributed by the Proposed Action would be about 5 percent.

Mitigation Measures

No mitigation measures are needed or suggested.

Possible Future Expansion

Activity levels at the proposed airport could increase substantially with the addition and full utilization of a second runway. It is conceivable that the resulting increase in solid waste generation could be double that of the Proposed Action.

4.3.4.2 Commercial Spaceport Alternative

The estimated total average daily solid waste disposal in the ROI in 2000, 2005, and 2015 under the Commercial Spaceport alternative is presented in **Table 4.3-10**. Total solid waste disposal in the ROI under the Commercial Spaceport alternative is estimated to be approximately 1,109 tpd in 2015. This would be 21 tpd (about 2 percent) greater than the projected baseline in 2015. About 81 percent of this increase would be attributable to direct, on-site development, with the rest due to off-site demand. The projected solid waste disposal rates would be within the capacities of the existing waste disposal facilities.

Table 4.3-10. Total Solid Waste Generation in the ROI—Commercial Spaceport Alternative

Solid Waste Generation Area	2000 (tpd)	2005 (tpd)	2015 (tpd)
Unincorporated Area	638	706	842
City of Homestead	127	152	223
Florida City	12	15	22
Former Homestead AFB	5	12	22
Total	**782**	**885**	**1,109**
Projected Baseline/No Action	782	877	1,088

Source: SAIC.
tpd tons per day

Combined Commercial Spaceport/Airport

Total projected average daily solid waste disposal in the ROI in 2000, 2005, and 2015 for a combined Commercial Spaceport/Airport is presented in **Table 4.3-11**. Total solid waste disposal in the ROI is estimated to be 1,125 tpd in 2015. This would be 37 tpd (about 3 percent) greater than the projected baseline demand in 2015. All of the projected solid waste disposal rates would be within the capacities of the existing waste disposal facilities.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions and solid waste disposal requirements could significantly impact the available capacities at solid waste disposal facilities. The proportion of this impact that would be contributed by the Commercial Spaceport alternative would be about 2 percent.

Table 4.3-11. Total Solid Waste Generation in the ROI—Combined Commercial Spaceport/Airport

Solid Waste Generation Area	2000 (tpd)	2005 (tpd)	2015 (tpd)
Unincorporated Area	638	709	846
City of Homestead	127	153	224
Florida City	12	15	22
Former Homestead AFB	5	17	33
Total	**782**	**894**	**1,125**
Projected Baseline/No Action	782	877	1,088

Source: SAIC.
tpd tons per day

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.4.3 Mixed Use Alternative

The estimated range of total average daily solid waste disposal rates in the ROI in 2000, 2005, and 2015 under the Mixed Use alternative are presented in **Table 4.3-12**. Total solid waste disposal in the ROI is estimated to be between 1,107 and 1,129 tpd in 2015. This would be 19–41 tpd (about 2–4 percent) greater than the projected baseline demand in 2015. The Market-Driven scenario would be at the lower end of the range. Total solid waste generation under the Collier-Hoover proposal is estimated to be 891 tpd in 2005 and 1,122 tpd in 2015. The projected solid waste disposal rates would be within the capacities of the existing waste disposal facilities.

Table 4.3-12. Total Solid Waste Generation in the ROI—Mixed Use Alternative

Solid Waste Generation Area	2000 (tpd)	2005 (tpd)	2015 (tpd)
Unincorporated Area	638	706–707	842–845
City of Homestead	127	152	223
Florida City	12	15	22
Former Homestead AFB	5	10–18	20–39
Total	**782**	**883–892**	**1,107–1,129**
Projected Baseline/No Action	782	877	1,088

Source: SAIC.
tpd tons per day

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions, and solid waste disposal requirements could significantly impact the available capacities at solid waste disposal facilities. The proportion of this exceedance that would be contributed by the Mixed Use alternative would be 1–2 percent.

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.4.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property, except continued use of the airfield for military and other government operations, which is included in the projected baseline. The No Action alternative would have no impact on solid waste.

4.3.4.5 Independent Land Use Concepts

Some of the independent land use concepts could be incorporated in the Proposed Action or the industrial and commercial uses of the Commercial Spaceport and Mixed Use alternatives. No solid waste disposal impacts specific to these independent land use concepts are expected to exceed those associated with the Proposed Action and other alternatives.

4.3.5 Electricity

4.3.5.1 Proposed Action

The estimated total average daily electrical demand in the ROI in 2000, 2005, and 2015 under the Proposed Action is presented in **Table 4.3-13**. Projected electrical demand is shown for each of the electrical service areas in the ROI. The service areas include south Miami-Dade County and former Homestead AFB, both served by Florida Power and Light Company, plus the additional electrical power generated by the City of Homestead.

Table 4.3-13. Total Electrical Demand in the ROI—Proposed Action

Electrical Demand Area	2000 (MWh/d)	2005 (MWh/d)	2015 (MWh/d)
South Miami-Dade County	28,629	31,693	38,926
City of Homestead	184	220	333
Former Homestead AFB	56	93	280
Total	**28,869**	**32,006**	**39,539**
Projected Baseline/No Action	28,869	31,902	38,010

Source: SAIC.
MWh/d megawatt hours per day

The total electrical demand in the ROI with the Proposed Action is estimated to be approximately 39,539 MWh/day in 2015. This would be 1,529 MWh/day (about 4 percent) greater than the projected baseline demand in 2015 (shown in Table 4.3-13). Direct, on-site development would account for about 14 percent of the increase, with the rest due to off-site demand. All of the projected service area electrical demands would be within the existing capacities of the electrical utilities.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under projected baseline conditions and electrical demand could

increase considerably. This increase would be within the capability of the FPL power distribution system, which currently has a statewide system capacity that is 40 percent in excess of demand.

Mitigation Measures

No mitigation measures are needed or suggested.

Possible Future Expansion

Activity levels at the proposed airport could increase substantially with the addition and full utilization of a second runway. It is conceivable that resulting increase in electrical demand could be double that of the Proposed Action.

4.3.5.2 Commercial Spaceport Alternative

The estimated total average daily electrical demand in the ROI in 2000, 2005, and 2015 under the Commercial Spaceport alternative is presented in **Table 4.3-14**. The total electrical demand in the ROI with the Commercial Spaceport alternative is estimated to be approximately 38,280 MWh/day in 2015. This would be 270 MWh/day (less than 1 percent) greater than the projected baseline demand in 2015. Direct, on-site development would account for about 47 percent of the increase, with the rest due to off-site demand. All of the projected service area electrical demands would be within the existing capacities of the electrical utilities.

Table 4.3-14. Total Electrical Demand in the ROI—Commercial Spaceport Alternative

Electrical Demand Area	2000 (MWh/d)	2005 (MWh/d)	2015 (MWh/d)
South Miami-Dade County	28,629	31,690	37,762
City of Homestead	184	220	323
Former Homestead AFB	56	113	195
Total	**28,869**	**32,023**	**38,280**
Projected Baseline/No Action	28,869	31,902	38,010

Source: SAIC.
MWh/d megawatt hours per day

Combined Commercial Spaceport/Airport

Total projected average daily electrical demand in the ROI for a combined Commercial Spaceport/Airport in 2000, 2005, and 2015 is presented in **Table 4.3-15**. The total electrical demand in the ROI is estimated to be approximately 38,513 MWh/day in 2015, just slightly more than the Commercial Spaceport alternative without a commercial airport. This would be 503 MWh/day (about 1 percent) greater than the projected baseline demand in 2015. All of the projected electrical demands would be within the existing capacities of the electrical treatment plants.

Cumulative Impacts

The cumulative increase in electrical demand generated by a high level of population growth would be within the capacity of the FPL power distribution system.

Table 4.3-15. Total Electrical Demand in the ROI—Combined Commercial Spaceport/Airport

Electrical Demand Area	2000 (MWh/d)	2005 (MWh/d)	2015 (MWh/d)
South Miami-Dade County	28,629	31,788	37,932
City of Homestead	184	221	325
Former Homestead AFB	56	143	256
Total	**28,869**	**32,152**	**38,513**
Projected Baseline/No Action	28,869	31,902	38,010

Source: SAIC.
MWh/d megawatt hours per day

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.5.3 Mixed Use Alternative

The estimated range of total average daily electrical demand in the ROI in 2000, 2005, and 2015 under the Mixed Use alternative is presented in **Table 4.3-16**. The total electrical demand could range from 38,254 to 38,437 MWh/day in 2015. This would be between 244 and 427 MWh/day (up to about 1 percent) greater than the projected baseline demand. The Market-Driven scenario would be at the low end of the range. Total electrical demand under the Collier-Hoover proposal is estimated to be 32,071 MWh/day in 2005 and 38,363 MWh/day in 2015. All of the projected service area electrical demands would be within the capacities of the electrical utilities.

Table 4.3-16. Total Electrical Demand in the ROI—Mixed Use Alternative

Electrical Demand Area	2000 (MWh/d)	2005 (MWh/d)	2015 (MWh/d)
South Miami-Dade County	28,629	31,681–31,752	37,782–37,886
City of Homestead	184	220	323
Former Homestead AFB	56	91–117	149–228
Total	**28,869**	**31,992–32,089**	**38,254–38,437**
Projected Baseline/No Action	28,869	31,902	38,010

Source: SAIC.
MWh/d megawatt hours per day

Cumulative Impacts

The cumulative increase in electrical demand generated by a high level of population growth would be within the capacity of the FPL power distribution system.

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.5.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property, except continued use of the airfield for military and other government operations, which is reflected in the projected baseline (see Table 3.3-7). The No Action alternative would have no effect on electrical demand or supply.

4.3.5.5 Independent Land Use Concepts

Some of the independent land use concepts could be incorporated in the Proposed Action or the industrial and commercial uses of the Commercial Spaceport and Mixed Use alternatives. No effects specific to these independent land use concepts are expected to exceed those associated with the Proposed Action and other alternatives.

4.3.6 Natural Gas

4.3.6.1 Proposed Action

The City Gas service area includes the northern portion of south Miami-Dade County. The City of Homestead, Florida City, and former Homestead AFB do not currently have natural gas service. The estimated total average daily natural gas demand in the ROI in 2000, 2005, and 2015 under the Proposed Action is presented in **Table 4.3-17**. The total natural gas demand in the ROI with the Proposed Action is estimated to be 150,317 therms per day in 2015. This would be 5,039 therms per day (about 3 percent) greater than the projected baseline demand in 2015; all of the increase would be from off-site demand. The projected natural gas demands would be within the existing capacities of the natural gas utility.

Table 4.3-17. Total Natural Gas Demand in the ROI

Baseline and Alternatives	2000 (therms/day)	2005 (therms/day)	2015 (therms/day)
Projected Baseline/No Action Alternative	110,553	122,553	145,278
Proposed Action	110,553	122,812	150,317
Commercial Spaceport Alternative	110,553	122,803	145,821
Combined Commercial Spaceport/Airport	110,553	123,180	146,480
Mixed Use Alternative	110,553	122,767–123,044	145,783–146,298

Source: SAIC.

Cumulative Impacts

If the high-growth forecasts for south Miami-Dade County were to occur, the population could be approximately 70 percent higher than under baseline conditions and natural gas demand could increase considerably. This increase would still be well within the capacity of the City Gas distribution system within its service area.

Mitigation Measures

No mitigation measures are needed or suggested.

Possible Future Expansion

The possible expansion of HST with a second runway could conceivably double the increase in demand for natural gas reported for the Proposed Action.

4.3.6.2 Commercial Spaceport Alternative

The estimated total average daily natural gas demand in the ROI in 2000, 2005, and 2015 under the Commercial Spaceport alternative is presented in Table 4.3-17. The total natural gas demand is estimated to be 145,821 therms per day in 2015. This would be 543 therms per day (less than 1 percent) greater than the projected baseline demand in 2015. The projected natural gas demands would be well within the existing capacities of the natural gas utility.

Combined Commercial Spaceport/Airport

Projected average daily natural gas demand in the ROI in 2000, 2005, and 2015 with a Combined Commercial Spaceport/Airport is estimated to be 146,480 therms per day in 2015 (see Table 4.3-17). This would be 1,202 therms per day (about 1 percent) greater than the projected baseline demand in 2015. The projected natural gas demands would be well within the existing capacities of the natural gas utility.

Cumulative Impacts

The cumulative increase in natural gas demand generated by a high level of population growth would be well within the capacity of the City Gas distribution system within its service area.

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.6.3 Mixed Use Alternative

The estimated range of total average daily natural gas demand in the ROI in 2000, 2005, and 2015 under the Mixed Use alternative is presented in Table 4.3-17. The total natural gas demand is estimated to range from 145,783 to 146,298 therms per day in 2015. This would be between 505 and 1,020 therms per day (less than 1 percent) greater than the projected baseline demand in 2015. The projected natural gas demands would be within the existing capacities of the natural gas utility.

Cumulative Impacts

The cumulative increase in natural gas demand generated by a high level of population growth would be well within the capacity of the City Gas distribution system within its service area.

Mitigation Measures

No mitigation measures are needed or suggested.

4.3.6.4 No Action Alternative

Under the No Action alternative, no activity would occur on the disposal property, except continued use of the airfield for military and other government operations, which is included in the projected baseline (see Table 4.3-17). There would be no impact on the natural gas utility.

4.3.6.5 Independent Land Use Concepts

The independent land use concepts would not affect natural gas use. There is no natural gas service to former Homestead AFB. Any increase in off-site natural gas use associated with the independent land use concepts would not exceed estimates presented for the Proposed Action and other alternatives.

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4.4 AIRSPACE AND SAFETY

This section addresses the potential effects of the Proposed Action and alternatives on airspace use in the Miami Approach Control Area, flight safety, and ground safety.

4.4.1 Introduction

The airspace analysis compares current and projected future use of airspace in the Miami Approach Control Area by aircraft operations at both Homestead ARS and other airports in the ROI under TRACON control, to determine the potential for impacts on the airspace environment. The analysis considers whether the Proposed Action and alternatives could (1) require modifications to the airspace structure or ATC systems and/or facilities; (2) restrict, limit, or otherwise delay other air traffic in the region; or (3) encroach on other airspace areas or uses. The conclusions are based on information and aviation system planning documents provided by the FAA, FDOT, and other related sources.

The FAA has overall responsibility for airspace management and is required to evaluate any proposed changes or impacts to the airspace structure that may be triggered by changes in airport roles and service levels. This evaluation includes review of the airport proponent's ALP, an airspace analysis, a flight safety review, and assessment of the potential effect of the proposal on air traffic control and air navigational facilities. The FAA then determines the actual requirements for any airspace actions, instrument flight procedures, or new facilities to accommodate the proposed airport improvements or role changes. Consultation with FAA's Miami TRACON was used to identify the flight tracks presented for the Proposed Action. Therefore, the Proposed Action is assumed to conform to FAA, ATC, and safety requirements (see Appendix A).

The safety analysis discusses potential flight and ground safety issues that may arise as a result of implementing the Proposed Action or one of the reuse alternatives. For each alternative, the elements of the reuse plan that have a potential to affect safety were evaluated relative to the degree to which the action could increase or decrease safety risks to ground-support personnel, aircrews, the public, and property.

For the analysis of flight safety risks for civil aircraft FAA, data on mishaps were used to identify the potential for a mishap occurring that could have significant consequences. The potential impacts of a crash, should one occur, on the environment are addressed primarily in the Biological Resources analysis in Section 4.11.

For commercial aviation, significant accidents are categorized as "major" and "serious" and can be compared with total flight hours to calculate a rate of occurrence per 100,000 flying hours. Major and serious accidents are defined as follows (**FAA 1998a**):

- A major accident is one in which any of three conditions is met:
  - An aircraft was destroyed;
  - There were multiple fatalities; or
  - There was one fatality and an aircraft was substantially damaged.
- A serious accident is one in which at least one of two conditions is met:
  - There was one fatality without substantial damage to an aircraft; or
  - There was at least one serious injury and an aircraft was substantially damaged.

Not all events used to calculate the statistics associated with these accident categories necessarily involved an actual aircraft crash. For example, in 1997, the statistics included a ground crew member crushed by a nose wheel and a passenger who fell through an open catering door during the boarding process (**FAA 1998a**). Nevertheless, the statistical data provide a reasonable basis for analysis.

No statistical data are available to calculate incidence rates for specific aircraft types (e.g., Boeing 737, Lockheed L-1011). Flight hours used to establish occurrence rates per 100,000 flying hours reflect the aviation industry as a whole. The statistics maintained on general aviation are only categorized by total frequency of accidents and frequency of fatalities. For this analysis, statistics on fatal accidents were used to calculate an incidence rate per 100,000 flying hours.

The risk associated with bird-aircraft strike hazards is also evaluated as a flight safety concern. In the absence of specific data for civil aircraft, the bird-aircraft strike data for F-16 military aircraft at Homestead ARS was used to generate rough estimates of potential risks under the Proposed Action and alternatives.

In considering ground safety, potential reuse-related activities were reviewed to determine if they might pose an additional or unique risk. For some alternatives, the ground safety analysis also considered explosive safety issues, which were evaluated in terms of increased risk. The airport safety analysis considered the appropriateness of land uses in the areas potentially exposed to safety risks from the former Homestead AFB airfield.

The analysis of ground safety issues associated with the Turkey Point Nuclear Power Plant is dependent on the safety analysis report required by NRC (see Section 3.4.4).

4.4.2 Airspace

4.4.2.1 Proposed Action

The Proposed Action would introduce increasing numbers of civil aircraft operations at HST into the airspace in successive future years. Considering the higher levels of military aircraft operations that occurred in the past, airspace and ATC system capabilities to accommodate the proposed operations, and FAA review processes required for implementation of the Proposed Action, no significant impacts on airspace use are anticipated. The Proposed Action would not likely require any major airspace reclassifications or modifications for the Miami Approach Control area, individual airports and traffic patterns, Alert Area A-291D, or IR-053 as a direct result of this action.

General aviation operational levels are currently much lower than they were in the late 1970s. Many general aviation operations are either local training flights conducting multiple touch-and-go landings in closed airport traffic patterns or transients operating under VFR conditions which do not normally require ATC clearances and radar services. Commercial, air transport, and military operations are conducted on arrival and departure routes that provide separation between the different airports in the region. Considering these factors, the regional airspace structure and routes, procedures, and radar/navigational aids comprising the ATC system have been able to accommodate current air traffic operations and the higher levels experienced in the past without any significant constraints.

Increased operations estimated for HST and those forecast for the other airports in the region may eventually present some potential constraints that could be resolved within the context of the regional airspace system and FAA review. Any route changes/additions that may be needed to accommodate future activities would be developed in consultation with the Miami FAA TRACON to make the most

efficient use of the airspace while avoiding any potential conflicts between the different airports, and would require public coordination and compliance with NEPA.

Two considerations are important in resolving any potential conflicts: the flight tracks and the flight profiles flown by the aircraft involved. A *flight track* describes the path of an aircraft over the surface of the earth and is defined by the track's length and width. A *flight profile* adds altitude, the height of the aircraft above the ground as it flies along the flight track.

To support the analyses in this SEIS, a series of flight tracks were developed to represent the expected patterns of operation as HST expands to include large components of commercial and private civilian air traffic. For planning purposes, consultations were held with Miami TRACON and the Miami ARTCC, as well as with the FAA's Airspace and Air Traffic officials at the national level. As a result of this coordination, and considering existing operations in the region, a series of "backbone" flight tracks was developed between HST and each arrival and departure navigational fix serving the area. The expected dispersion on either side of these backbones was developed from an analysis of radar data from airports currently operating in the region. The resulting dispersed flight tracks are illustrated in Appendix B.

The airspace in the southern Florida region is complex. Several airports use the same navigational fixes for arrivals and departures, and flight tracks to and from different airports cross and overlap. When introduced into HST, civil aircraft operations would have to be integrated into the existing airspace structure and would be constrained by other operations at airports in the ROI, especially Miami International. The vertical flight profiles for civil aircraft operating from HST were developed with these constraints in mind. Instead of a constant and steady rate of climb (for departures) or descent (for arrivals), these flight profiles more closely resemble stair steps. Aircraft would proceed to established altitudes and then fly level until they passed beyond navigational fixes, thereby flying above or below potentially conflicting traffic. Thus, aircraft using the same fixes would be safely separated by altitude from other aircraft intersecting their flight tracks. In this way, the aircraft proposed to operate from HST would be smoothly integrated into the overall regional air traffic flow, while still being safely separated from other air traffic, and not constraining any other airport's operations.

Cumulative Impacts

None of the other activities considered in the cumulative impact analysis involve aviation activities. Therefore, no additional cumulative impacts on airspace use or management are anticipated. Future increases in regional air traffic are reflected in the projected baseline. The potential effects from the addition of a fourth runway at MIA were taken into consideration in identifying flight paths for the Proposed Action and included in the analysis of its effects.

Mitigation Measures

No mitigation measures involving airspace management are suggested. All airspace safety considerations have been incorporated in the identification of flight paths for the Proposed Action.

Possible Future Expansion

Possible future airport expansion at HST could include a second runway. With a second runway, HST could potentially accommodate a maximum of 370,000 aircraft operations annually. The time frame of initial operation is likely to be no earlier than 2038, with maximum use beyond the middle of the century. This action, coupled with other airport growth in the region for that time period, would require additional review by airport planners and the FAA to ensure that airspace requirements, airport arrival/departure routing, and other ATC system considerations could support aircraft operational levels for the region.

Anticipated changes based on the introduction of new technology will affect future airspace configuration and procedures.

4.4.2.2 Commercial Spaceport Alternative

The potential for space vehicle launch and recovery operations to affect airspace use would depend on their specific operational attributes and requirements. An area of airspace may have to be cleared of all nonparticipating aircraft for a short period during the launch/recovery window for a space vehicle operation. Similar restrictions are imposed on air traffic for space shuttle launches/recoveries, aerial demonstrations, and other special ground or flight activities that may interfere with routine airspace use and flight safety. Air traffic operating at MIA and along the eastern coastal region would have the potential to be affected by space vehicle launch/recovery operations at former Homestead AFB. Each launch/recovery operation would be carefully planned and coordinated with the FAA and other interests well in advance of the scheduled periods so that appropriate actions could be taken and advisories issued to safely accommodate the spaceport activities.

The real potential for any airspace impacts cannot be assessed until the flight parameters for the space vehicle(s) are developed and tested, and the FAA's Associate Administrator for Commercial Space Transportation permitting and licensing safety reviews provide a more detailed definition of flight tracks, associated airspace requirements, and operational procedures. However, to the extent that space launch and recovery operations could preclude other operations within a given airspace for some period of time, there could be impacts on military and government activities at Homestead ARS, as well as on civil aircraft at other airports in the region. These could include delays and rerouting requirements.

Combined Commercial Spaceport/Airport

With a combined Commercial Spaceport/Airport, the potential effects on airspace use during scheduled space vehicle launch/recovery operations would be the same as discussed above. During commercial airport operations, the effects would be as described for the Proposed Action.

Cumulative Impacts

No other identified activities considered in the cumulative impacts analysis have the potential to interact with regional airspace use and management. Potential effects from the addition of a fourth runway at MIA have been taken into account in the analysis. No additional cumulative airspace impacts are anticipated.

Mitigation Measures

Any airspace conflicts would be resolved through established ATC scheduling and coordination processes as described above, and no specific mitigation measures are suggested.

4.4.2.3 Mixed Use Alternative

Under this alternative, Homestead ARS would continue to be used for military and government operations and future aircraft operations would be the same as described in Section 2.1.1.2 and shown in Table 2.1-4. This alternative would have no impact on airspace use in the region.

4.4.2.4 No Action Alternative

Under the No Action alternative, airspace use would remain as described for the projected baseline in Section 3.4.2.

4.4.2.5 Independent Land Use Concepts

The airport-related independent land use concepts (e.g., aircraft maintenance) were incorporated in the analysis of the Proposed Action and Commercial Spaceport alternative. Their impacts on airspace would not be different from those described above. The other independent land use concepts would not affect airspace.

4.4.3 Flight Safety

4.4.3.1 Proposed Action

Aircraft Mishaps. Under the Proposed Action, military and government flight operations are projected to remain at current levels, while commercial and general aviation operations at HST would increase. Considering all operations, and using the military's Class A mishap rate for F-16s and the statistical accident rates for civil operations, **Table 4.4-1** reflects the relative risk of an accident at 2000, 2005, and 2015, assuming current statistical accident rates remain unchanged. Flying hours were calculated assuming that each operation would spend five minutes in the immediate airport environs. No estimates were developed for maximum use of the one runway at HST because it is too far in the future for meaningful prediction.

Table 4.4-1. Estimated Aircraft Mishap Risk—Proposed Action

Year	Type	Mishap Rate	Flying Hours	Years Between Mishaps
Current	Military	4.43	1,000	23
	Commercial	0.03	0	NA
	General Aviation	1.63	0	NA
2000	Military	4.43	1,000	23
	Commercial	0.03	0	NA
	General Aviation	1.63	3,403	18
2005	Military	4.43	1,000	23
	Commercial	0.03	812	3,519
	General Aviation	1.63	3,761	16
2015[1]	Military	4.43	1,000	23
	Commercial	0.03	74,140	462
	General Aviation	1.63	4,731	13

Source: **USAF 1998b, FAA 1998a.**
Note: [1] Based on current statistical accident rates. Future rates are expected to be reduced with improved technological and human factors research.
NA Not applicable

For the military aircraft, the estimated risk is based on the Class A mishap rate for the single-engine F-16, which is the predominant aircraft that will operate from HST, conducting an estimated 12,000 operations per year. Due to the frequency of operations, this aircraft would continue to carry the highest potential risk of mishap. Since all other military and government aircraft that operate from former Homestead AFB will conduct significantly fewer operations, risks associated with their operations would be substantially less. This represents no change from baseline conditions.

To assess the potential operational flying safety risks associated with commercial and general aviation aircraft at HST, FAA statistical safety data for the last five years were considered. In the case of commercial aviation, a combined total of 24 major and serious accidents occurred. Based on the estimated 68,593,000 flight hours in that same time frame, these data indicate an accident rate of 0.035 per 100,000 flying hours. In the case of general aviation for the same five-year period, 1,923 fatal accidents occurred during an estimated total of 117,770,000 flight hours. This reflects a rate of 1.63 per 100,000 flying hours.

Based on the numbers of operations projected for HST in each year analyzed, the probability of a mishap occurring is estimated as follows:

- For military aircraft—0.000004 (4×10^{-6}) or one chance in 276,000.
- For commercial aircraft—0.000000029 (2.9×10^{-8}) or one chance in 34,275,060.
- For general aviation aircraft—0.00000136 (1.36×10^{-6}) or one chance in more than 735,000.

The Florida Fish and Wildlife Conservation Commission conducts controlled burning on SFWMD lands in the Model Lands Basin and Southern Glades south and southeast of Homestead (see Section 3.6.4.1) to reduce risks of wildfire and enhance and maintain wildlife habitat. These fires and associated smoke could have the potential to interfere with aviation operations. No regulations prohibit these activities when they are an integral part of land management. Coordination between the responsible natural resource management agency, airport managers, and air traffic controllers would minimize potential risks to aviation. If burns are conducted on days when prevailing meteorological conditions are expected to carry the smoke away from the runway and in directions that do not interfere with air traffic routing, there should be little or no impact. Should the runway or critical flight paths become unexpectedly obscured by smoke, air traffic controllers would react just as if meteorological conditions (e.g., fog, severe thunder storms) created a situation in which visibility fell below minimum safe operating levels. The response could range from keeping aircraft in a holding pattern, to temporarily closing the runway, to closing the airport and diverting traffic to an alternate airport.

Bird-Aircraft Strike Hazard. The habitat around former Homestead AFB is conducive to supporting bird populations. Bird dispersal techniques have been developed and are currently required on a regular basis (**AFRC 1996b**). Vegetation control in aquatic habitats is also practiced (**AFRC 1998b**). While bird and wildlife control and management are ongoing, some bird-aircraft strikes do occur. Military and other governmental aircraft currently operating from Homestead ARS experience, on average, about six bird strikes per year (**Dunaway 1998**).

Currently, a bird strike occurs on average once for every 3,300 F-16 operations, resulting in a strike rate of approximately 0.3 per 1,000 operations. Bird strikes involving F-16s are the only data available for Homestead ARS adequate to allow some level of statistical analysis. Therefore, they have been used to provide a rough estimate of bird strike risks for aircraft in general operating from the Homestead airfield. **Table 4.4-2** applies the rate derived from the F-16 data to the total projected number of aircraft operations for the Proposed Action in each of the analysis years and at maximum use of one runway. This provides a rough estimate of the number of strikes that might be expected to occur under the Proposed Action.

Data maintained by the Air Force reflect that Class A mishaps result from 0.06 percent of all reported strikes (**USAF 1998a**). This means that a Class A mishap occurs only once every 1,667 strikes. If these statistics are applied to the Proposed Action, it would take about 76 years at the level of operations projected for 2005, 37 years at the level of operations projected for 2015, and 24 years at the level of operations projected for maximum use to experience 1,667 strikes. This translates to a probability of catastrophic accident resulting from a bird strike during any given operation of 0.0000002 (2×10^{-7}), or less than one chance in 5 million.

Table 4.4-2. Estimated Annual Bird-Aircraft Strikes—Proposed Action

Year	Operations	Projected Strikes
2000	60,658	18
2005	74,697	22
2015	150,735	45
Maximum Use	231,274	69

Source: SAIC, derived from **Dunaway 1998**.

While these levels of risk are low, they are based on operations under current conditions. They rely on rough analogies that may underestimate the exposure of commercial aircraft that are larger than fighter aircraft. On the other hand, commercial aircraft also have lower mishap rates. Many other factors including aircraft speed and flight profiles could also affect the level of risk.

There are several aspects of the Proposed Action that have the potential to create situations that would attract wildlife, thus exacerbating the risk of bird-aircraft strikes. FAA has issued Advisory Circular 150/5200-33 on "Hazardous Wildlife Attractants On Or Near Airports." This Advisory Circular provides recommendations and guidance for locating certain land uses on or in the vicinity of public-use airports. The guidance is intended to minimize land uses that have the potential to attract and sustain wildlife that are hazardous to aircraft operations around airports. Such land uses should be sited no closer than 10,000 feet from the airport itself and 5 statute miles from any airspace supporting approach and departure flight tracks (**FAA 1997**). Land uses identified include human-made or natural areas—such as poorly drained areas, retention ponds, roosting habitats on buildings, landscaping, putrescible-waste disposal operations, wastewater treatment plants, agricultural activities, surface mining, or wetlands—that may be used by wildlife for escape, feeding, loafing, or reproduction. Airport operators, land developers, and land owners are requested to notify the FAA in writing of known or reasonably foreseeable land use practices on or near airports that either attract or may attract hazardous wildlife.

USEPA requires any operator proposing a new or expanded waste disposal operation within 5 statute miles of the end of a runway to notify FAA and airport operators of the proposal. USEPA also requires owners or operators of new municipal solid waste landfill units or lateral expansions of existing units located within 10,000 feet of the end of any runway used by turbojet aircraft to demonstrate successfully that they are not hazardous to aircraft. Although no similar requirements exist for other land use modifications that could create attractants for hazardous wildlife, the FAA requests that proponents of such projects provide notification as early in the development process as possible. Airport operators who become aware of such projects in the airport vicinity should also notify the FAA (**FAA 1997**).

When circumstances indicate that there is a potential for hazardous wildlife to create safety concerns, the holder of the certificate authorizing airport operations is required to comply with the provisions of 14 CFR 139.337, *Wildlife Hazard Management*. Management actions include the following:

- The certificate holder must conduct an ecological study that defines the safety concerns, identifies the wildlife of concern, and describes the attractants contributing to the concern.
- Based on the findings of the study, FAA will determine the need for a Wildlife Hazard Management Plan.
- The Wildlife Hazard Management Plan, if required, will be developed by the certificate holder and will detail measures required to alleviate or eliminate wildlife hazards to air carrier operations. The plan will assign responsibilities, address required habitat modification and land use changes identified

in the ecological study, identify resources required for implementation, and establish procedures to be followed during air carrier operations to minimize safety risks.

- The plan must be reviewed periodically for effectiveness and currency.

Some current and proposed land uses constitute wildlife attractants as described above and are in close enough proximity to the airfield to create potential safety concerns. Of particular concern is the existing Miami-Dade County landfill.

On the airport site itself, the element of the Proposed Action with the most potential for creating bird-airstrike concerns is the Surface Water Management Master Plan. It includes various mechanisms to manage, direct, and control stormwater runoff, including construction of French drains and retention and detention ponds. The FAA supports the use of French drains and detention ponds but recommends against the use of retention ponds because they provide a more reliable water source that may attract birds (**FAA 1997**). Similarly, proposals included in the Wildlife/Habitat Management and Mitigation Plan of the Proposed Action could also create wildlife attractants which are discouraged by the FAA when they are in close proximity to airports (**FAA 1997**).

Outside the former base boundary, the surrounding environment contains numerous wetlands and water bodies that attract waterfowl, including Biscayne Bay, which is within 5 miles of approach and departure flight tracks for the runway. These conditions are part of the existing and past environment and are reflected in historic bird-airstrike statistics for the former base.

Increased development and population expansion in the ROI have the potential to increase the generation of solid waste. Disposal of this waste may exacerbate safety concerns involving the county landfill ("Mount Trashmore") since both the FAA and USEPA have major concerns with developing or expanding landfills located near aviation facilities (**FAA 1997**). This landfill currently attracts numerous birds, especially gulls, and dispersal efforts have been generally ineffective.

Cumulative Impacts

None of the future activities identified in the ROI have the potential to directly affect the risk of aircraft accidents, but some could increase risk of bird-aircraft strikes. The L-31E Flowway Redistribution project and the county's proposed stormwater treatment and distribution area would result in an expansion of wetlands east of the former base. These wetlands could begin approximately 1 mile east of the runway and would be expected to create habitat highly conducive to attracting waterfowl and wading birds.

Miami-Dade County has evaluated its proposed STDA in consideration of FAA Advisory Circular 150/5200-33 and concluded that the STDA is not expected to pose additional risk to present or future operations at the former base (**Miami-Dade County 2000a**). The reasons stated indicate the area involved in the STDA is already wetland, and no additional wetlands would be created. Although some additional volume of water may be introduced periodically into the area, this would only occur when some water is already present. The project's design is to manage the additional water volume as detention ponding rather than retention ponding, thereby minimizing the attractiveness of the habitat, as is recommended by FAA.

Mitigation Measures

The analyses of the potential for aircraft accidents do not suggest a significant risk. No specific mitigation measures are recommended. However, coordination between airport developers, land developers, and natural resource management agencies, as well as consideration of the guidance contained in FAA Advisory Circular 150/5200-33, could reduce the possibility of increased risk of bird-aircraft strikes.

Compliance with the provisions of 14 CFR 139.337, *Wildlife Hazard Management*, as outlined above, would mitigate the potential risks to some degree. The ecology of the region reflects conditions that would support wildlife of a size or in numbers that could result in multiple bird strikes and ingestion of birds into a turbojet engine, and could be capable of causing a damaging collision [14 CFR 139.337 (a)(1), (2), and (3)]. Therefore, the Miami-Dade County Aviation Department would be required to conduct an ecological study for HST. This requirement has been acknowledged in the county's Wildlife/Habitat Management Plan. Based on the findings of the study, and in coordination with the FAA, a Wildlife Hazard Management Plan, if required, would develop and detail processes and procedures necessary to alleviate or eliminate wildlife hazards to air carrier operations.

Possible Future Expansion

The construction of a second runway would provide the capability for HST to support additional aviation operations. Increasing the number of operations could reduce the duration between potential mishaps. It is not possible to statistically predict what the risk might be, since any potential airport expansion is not anticipated to occur for 30 years or more. Current mishap rates are unlikely to be applicable so far into the future.

4.4.3.2 Commercial Spaceport Alternative

Aircraft Mishaps. The concept of a horizontal space launch facility is in an early developmental stage, and no historic data are available to assess the potential for mishaps associated with space launch activities. Based on historical experience with vertically launched spacecraft, any launch accident typically results in the loss of both the launch vehicle and the payload.

The FAA's Associate Administrator for Commercial Space Transportation is responsible for licensing space launch activities as directed by 14 CFR Chapter III §401.3, and for ensuring, through its licensing process, that proposed launch activities are not hazardous to public health and safety or the safety of property. At present, no specific standards or requirements exist for commercial launch activities like these that could occur at Homestead under this alternative. However, as part of the licensing requirements, an applicant must provide a Safety Analysis that satisfies requirements in 14 CFR §§411.3, 411.5, and 415.11 through 415.17. The Safety Analysis must identify and evaluate all hazards to public health and safety or to off-site property that may occur during prelaunch or launch. It must also include procedures to be employed to control the hazards identified; qualifications of range safety personnel and other critical personnel responsible for assuring hazard controls; and design characteristics of range safety systems (flight and ground) and their effectiveness in assuring a safe launch operation.

Because the space launch proposals being considered under this alternative are based on evolving technologies that do not as yet have a Safety Analysis, no specific flight safety assessment could be performed for the SEIS. However, the FAA's licensing requirements would ensure that there would be no significant hazards posed by spaceport operations at Homestead.

Mishap risks associated with conventional military and government aircraft operations would be the same under this alternative as under baseline conditions.

Bird-Aircraft Strike Hazard. Bird-aircraft strike hazard under the Commercial Spaceport alternative would not be appreciably different from baseline conditions. It is not known whether bird-aircraft strike hazards would be a concern for space launch vehicles.

Combined Commercial Spaceport/Airport

A combined Commercial Spaceport/Airport could include some commercial and general aviation operations in addition to the military, other government, and space launch operations. As shown in **Table 4.4.3**, the risk of aircraft mishaps involving these operations would be lower than under the Proposed Action because of a lower number of civil aircraft operations.

Table 4.4-3. Estimated Aircraft Mishap Risk—Combined Commercial Spaceport/Airport

Year	Type	Mishap Rate	Flying Hours	Years Between Mishaps
Current	Military	4.43	1,000	23
	Commercial	0.03	0	NA
	General Aviation	1.63	0	NA
2000	Military	4.43	1,000	23
	Commercial	0.03	0	NA
	General Aviation	1.63	0	NA
2005	Military	4.43	1,000	23
	Commercial	0.03	812	3,519
	General Aviation	1.63	834	74
2015[1]	Military	4.43	1,000	23
	Commercial	0.03	1,353	2,112
	General Aviation	1.63	834	74

Sources: **USAF 1998b, FAA 1998a.**
Notes: [1] Based on current statistical accident rates. Future rates are expected to be reduced with improved technological and human factors research.
NA Not Applicable

The estimated number of bird-aircraft strikes is presented in **Table 4.4-4**. Statistical data from F-16 operations suggest that a serious accident occurs once every 1,667 strikes. At the projected levels of conventional aircraft flight operations at a combined Commercial Spaceport/Airport at full buildout, it would take 119 years of operations to reach that level.

Table 4.4-4. Estimated Annual Bird-Aircraft Strikes—Combined Commercial Spaceport/Airport

Year	Operations	Projected Strikes
2000	29,824	9
2005	39,724	12
2015	46,534	14
Full Buildout	46,534	14

Source: SAIC, derived from **Dunaway 1998.**

Although the projected number of bird-aircraft strikes would be low under this alternative, the same safety issues and concerns discussed for the Proposed Action would apply to a combined Commercial Spaceport/Airport.

Cumulative Impacts

The potential for cumulative impacts under this alternative would be similar to the Proposed Action.

Mitigation Measures

It is assumed FAA Safety Analysis procedures and licensing requirements would preclude significant safety risks from spaceport and/or space vehicle operations. The potential mitigation measures discussed for the Proposed Action would apply to a combined Commercial Spaceport/Airport.

4.4.3.3 Mixed Use Alternative

Under this alternative, military and government aviation activities would continue at the airfield, but no civil aviation capability would be developed. The Collier-Hoover proposal, like the original Hoover plan, includes development of extensive on-site wetlands that could increase the bird-airstrike hazard for those activities. Vegetation control and other measures would need to be used to control attraction of birds near the airfield. The proposal discusses possible measures for reducing wildlife attractants in critical areas, especially in close proximity to the runways (**CRC/HEG 2000**). Proposals to manage wastewater treatment and sewage are also designed to reduce the attraction these items have for wildlife.

There could be a potential for the L-31E Flowway Redistribution Project and for the STDA proposed by Miami-Dade County to increase bird-airstrike hazards for continuing military and government operations at Homestead ARS.

4.4.3.4 No Action Alternative

Under the No Action alternative, military and government aviation activities would continue at the airfield but no other aviation activity would occur. Risks associated with aircraft mishaps and bird-aircraft strikes would remain as described for baseline conditions.

There could be a potential for the L-31E Flowway Redistribution Project and for the STDA proposed by Miami-Dade County to increase bird-airstrike hazards for continuing military and government operations at Homestead ARS.

4.4.3.5 Independent Land Use Concepts

With one exception, the independent land use concepts would have little or no effect on operational flight safety. The exception could be any agricultural or recreational use near the runway that could attract birds and create a hazard to aircraft operations.

4.4.4 Ground Safety

4.4.4.1 Proposed Action

Airport Safety. The Proposed Action would involve constructing and operating passenger and freight facilities, other aviation support facilities, and infrastructure improvements necessary to support the airport. During construction, standard industrial best-management practices and occupational safety and health requirements would be expected to be followed. Safety risks associated with this development would be no greater than with any similar type of commercial or industrial development. Operations at air passenger and air freight facilities would be similar to operations conducted at other civil airports. No unique ground safety risk is expected to be associated with civil operations at HST.

The Air Force's AICUZ program provides recommendations for compatible land uses in the immediate vicinity of the runway and other direct aviation support at Air Force bases. Under the Proposed Action, the AICUZ program would no longer be applicable, but land use safety would continue to be addressed by civil aviation standards. The FAA provides land use and airport design standards that include establishing and maintaining clear and safety areas around runways, object-free zones, and obstacle-free zones. The size of and surface areas involved in these zones varies depending on the type of aviation activities, but they provide public and property protection much like the AICUZ program (**FAA 1989**).

Turkey Point Nuclear Power Plant. FPL operates a power plant with two nuclear reactor units at Turkey Point (Turkey Point Units 3 and 4), located approximately 5 miles from former Homestead AFB. Safety issues associated with the operation of nuclear power plants are addressed in 10 CFR §100.10. NRC staff interpretation of this regulation is described in NUREG-0800, "U.S. NRC Standard Review Plan (SRP) 2.2.3." NRC guidance provides that the frequency of an aircraft accident resulting in radiological consequences greater than 10 CFR Part 100 exposure guidelines be less than about 1×10^{-7} per year. If the risk is greater, it must be shown that the plant can withstand design basis aircraft impacts and associated fires without loss of safe shutdown capability, and without causing a release of radioactivity which would exceed 10 CFR Part 100 dose guidelines.

In 1998, the NRC requested additional aircraft-accident safety analyses of plant operation at Turkey Point, based on the proposal to create a commercial airport at former Homestead AFB. Specifically, the NRC requested that FPL "assess the impact of the projected changes and update the Turkey Point Units 3 and 4 Final Safety Analysis Report and other related documents if such projections significantly exceed that described in the present study to reflect the potential impact of this external hazard" (**Jabbour 1998**). Based on the number of projected aircraft operations for HST, FPL did not perceive a substantial safety issue. Flight tracks for HST were not available at that time.

Subsequently, information on estimated flight operations and flight tracks developed in connection with this SEIS has been provided to FPL and NRC. Based on these data, FPL has updated the safety risk assessment for Turkey Point Units 3 and 4. The risk assessment completed by FPL using these new data concluded that the probability of an aircraft accident involving Units 3 and 4 that could either prevent a safe shut-down of the units or result in radiological consequences in excess of dosages specified in 10 CFR Part 100 was approximately 3.63×10^{-7} per year. This estimate is conservative because analysts assumed that every crash would result in an unacceptable release of radiation. No reduction in risk was assumed for plant design, site layout, or topographical features.

In consideration of public concerns about risks associated with the incidence of bird-aircraft strikes and the foreign carriers anticipated to use HST under the Proposed Action, additional conservatism was then factored into the risk assessment. Based on national averages, FPL analysts originally calculated the bird-aircraft strike contribution to the risk of serious aircraft accidents to be 4.1 percent for military aircraft and 0.175 percent for civil aircraft. To allow for the bird population densities in southern Florida, these estimates were increased by a factor of five. This raised the estimates to 20.5 percent for military aircraft and 0.875 percent for civil aircraft. These rates are higher than has historically been experienced in the region, making the assessment highly conservative (i.e., tending to overestimate the risk).

The analysts also considered data indicating that mishap rates for aircraft operating in Latin America are 5.7 per 1 million departures, as compared to 0.5 per 1 million departures for the United States. Based on the forecast composition of the civil aircraft fleet that would operate through HST, when these data were considered, the overall probability of an aircraft crash was increased by approximately 5 percent. This also was a conservative assumption, since foreign aircraft operating in the U.S. are required to adhere to U.S. safety standards.

As a result of these two added considerations, the overall risk was increased from 3.63×10^{-7} per year to 4.43×10^{-7} per year. Based on these assessments, FPL concluded that this risk was acceptable, meeting the acceptance criterion of SRP 3.5.1.6 of about 1×10^{-7} per year. FPL's analyses were reviewed and approved by NRC. In approving FPL's assessment, NRC stated, "[FPL's assessment]...meets the SRP 3.5.1.6 acceptance criterion of about 10^{-7} per year. In addition, FPL's estimate is within the guidelines of SRP 2.2.3, wherein the acceptance criterion of 10^{-6} per year is applicable if reasonable qualitative arguments can be made to show that the realistic probability estimate is lower... FPL has qualitatively identified some conservatism inherent in its analysis which indicates that the actual risk from on-site aircraft crashes is lower than the estimate of 3.63×10^{-7} per year." The NRC correspondence is included in **Appendix I**.

While approving FPL's assessment, NRC did highlight the fact that the margin between the estimated crash frequency (using the conservative assumptions described above) and the acceptance guidelines of SRP 3.5.1.6 is relatively small. Therefore, NRC advised FPL to closely monitor the development of aviation activity at Homestead to ensure that the types and levels of operations remain within the envelope of those used for the assessment.

Cumulative Impacts

No other future activities considered in the cumulative impact analysis would have a direct interaction with ground safety considerations addressed for the Proposed Action. While each development and construction project must consider ground safety issues, they are localized and site and project specific. Therefore, there are no identifiable cumulative ground safety impacts.

Mitigation Measures

No specific ground safety mitigations have been identified. Compliance with federal Occupational Safety and Health Administration regulations for specific tasks, standard industrial safety practices, and best-management practices would keep ground safety risks at minimal levels.

Possible Future Expansion

Possible future expansion of HST could include the construction of a second runway and other facilities. Standard industrial safety practices would control ground safety risks during construction. The design and development of the second runway would be expected to follow FAA standards and guidance for airport design, to ensure land uses in the vicinity of the runway would be compatible with that guidance. Additional environmental and safety analyses would be required at the time of a specific proposal to more precisely identify any safety issues, including additional risks involving the Turkey Point plant.

4.4.4.2 Commercial Spaceport Alternative

Spaceport Safety. The technologies associated with space launch operations are evolving, and before any space launch operations could be conducted from former Homestead AFB, both the spaceport operator and the space vehicle operators would be required to prepare a detailed Safety Analysis as part of their licensing requirements. Therefore, a detailed ground safety assessment of the potential impacts associated with this alternative is not available for this SEIS. The following assessment is based on preliminary available data.

The spaceport proposals advanced for former Homestead AFB would involve reusable space vehicles that might use hypergolic and/or cryogenic fuels and oxidizers for their propulsion. Hypergolic fuels and oxidizers ignite spontaneously when they are mixed. Cryogenic fuels and oxidizers are liquefied gases

that are hazardous due to their composition and extremely cold temperatures. The operations proposed at former Homestead AFB would require storage of large quantities of these fuels on site and involve substantial quantity of fuels onboard the vehicle when the system was prepared for launch. It is assumed the quantities of hypergolic fuels would be less than cryogenic fuels.

Because commercial space launch operations are in an early stage of planning, the majority of the safety data pertaining to the storage, use, and handling of these substances has been developed by DOD. Discussions with space vehicle developers indicate that, pending future direction, safety standards described in DOD explosive safety guidelines (**DOD 1997**) would most likely be followed in their operations.

Overall, safety requirements associated with the hypergolic and cryogenic fuels and oxidizers are the most stringent. It is possible that between 500,000 and 1,000,000 pounds of liquid oxygen and liquid hydrogen could be stored at a spaceport on former Homestead AFB. Based on those quantities and their associated hazards, the storage area would most likely have to be located at least 1,800 feet from inhabited buildings (**DOD 1997**).

Existing safety standards for space vehicles have been developed for vertically launched systems (rockets), but not horizontally launched systems like those proposed under the Commercial Spaceport alternative. Based on available data about the proposed systems, the only element that would separate the fuel from the oxidizer on a fully fueled launch vehicle would be the vehicle's integral tankage. Therefore, it is reasonable to assume that a vehicle sitting at the end of a runway prior to launch would be analogous to a "Range Launch Pad" (**Olson 1998**), and explosive equivalents would apply (**DOD 1997**). This indicates a safety zone with a radius of 1,200 feet from parked aircraft and 1,800 feet from inhabited buildings would be required around the space vehicle when fully fueled and stationary.

Other systems could involve launch vehicles fueled with RP-1, a rocket propellant similar to kerosene, with liquid oxygen as an oxidizer. Elements of those operations would also require safety and clear zones, which would be expected to be only slightly less restrictive than those described above.

Preliminary data indicate that the space launch operations would not preclude other uses of the airfield and surrounding area. However, a number of safety issues remain unresolved, and will remain so until the technologies are better defined. Some of these include such considerations as clear zones around the space vehicle while being fueled and serviced, as well as around the vehicle while taxiing from the fueling area to the end of the runway in preparation for launch. Other safety or clear zones along the vehicle's flight track may also be required. All of these issues would have to be resolved in the Safety Analysis required for licensing space launch activities.

If a commercial launch facility were established with no conventional civil aviation operations, it is assumed the Air Force's AICUZ program described in Section 3.4 would continue to apply. Since the space launch aspect of this alternative is still in a technological development phase, it is uncertain at this time if additional restrictions may be associated with those operations. It is reasonable to assume that some additional requirements may result from the Safety Analysis that must be conducted as part of the space operations licensing process.

Turkey Point Nuclear Power Plant. Assessing possible risks to the Turkey Point facility associated with this alternative is not possible at this time. An additional risk assessment would be required once adequate information became available about the space launch vehicles and their hazards, to ensure there would be no significant risk of an accident, or if an accident occurred, radiological release would not exceed NRC dose guidelines in 10 CFR Part 100.

Combined Commercial Spaceport/Airport

Ground safety considerations for a combined Commercial Spaceport/Airport facility would include the requirements described for the Proposed Action, in addition to the spaceport safety issues described above. Locating both the spaceport facilities, with their safety requirements/restrictions, and civil airport facilities within the available land area would increase the complexity of compatible siting. In particular, the compatibility of public facilities, such as passenger terminals, located along the flightline with pre-launch space vehicle preparations would have to be addressed in the design of the facility and in the spaceport and launch operator licensing processes.

Cumulative Impacts

No other future activities considered in the cumulative impact analysis would be expected to have a direct interaction with ground safety considerations at the spaceport, so no cumulative impacts have been identified.

Mitigation Measures

With the implementation of safety analyses required to license a commercial launch facility at former Homestead AFB, no additional mitigation measures would be needed.

4.4.4.3 Mixed Use Alternative

Under the Mixed Use alternative, no additional aviation development would occur. Standard construction and industrial and commercial safety requirements would apply. No specific or unique ground safety concerns have been identified with this alternative. Existing AICUZ recommendations would continue to apply. Aviation flight risks to the Turkey Point Nuclear Power Plant would be the same as they are currently.

4.4.4.4 No Action Alternative

Under the No Action alternative, no additional aviation, industrial, or commercial development would occur on the disposal property. Existing military and governmental operations would continue. Recommendations in the Air Force's AICUZ program would continue to apply, and aviation flight risks to the Turkey Point Nuclear Power Plant would be the same as they are currently.

4.4.4.5 Independent Land Use Concepts

None of the independent land use concepts are anticipated to pose ground safety risks beyond those described for the Proposed Action and alternatives.

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4.5 NOISE

4.5.1 Introduction

This section presents the findings of the analysis of noise from aircraft operations at former Homestead AFB, in combination with other aircraft operations in the ROI, under each of the reuse alternatives. Aircraft operations would change under the Proposed Action and Commercial Spaceport alternative. In the analysis of the Mixed Use alternative, as well as the No Action alternative, aircraft operations from the former base do not differ from the projected baseline presented in Section 3.5 and are limited to military and other government missions.

The noise analysis is based on modeling performed with an enhanced version of the FAA's Integrated Noise Model. The INM is described in detail in Section 3.5 and the Noise Appendix. Projected aircraft operations and flight paths were entered into the model for each alternative in 2000, 2005, 2015, and maximum use of a one-runway airport. Noise abatement flight paths are also evaluated for the Proposed Action. For each modeled scenario, noise data are presented in several metrics, including Day-Night Average Sound Level, Peak-Hour Equivalent Sound Level, Maximum Sound Level, Sound Exposure Level, and Time Above ambient.

The full results of the noise analyses are contained in a *Technical Memorandum on Aircraft Noise Considerations in the Transfer of Ownership of Homestead Air Reserve Base, Homestead, Florida, from the United States Air Force to Dade County, Florida* (**Landrum & Brown 1999b**). The main components of this Technical Memorandum are reproduced in Appendix E. The Technical Memorandum takes into account field measurements of ambient sound levels in the national parks and refuges. The field measurements were conducted in August 1998 by the John A. Volpe National Transportation Systems Center under contract to FAA and in September/October 1997 and November 1998 by Sanchez Industrial Design, Inc. under contract to the National Park Service. The results of the field measurements are in the Volpe Center's *Ambient Sound Levels at Four Department of Interior Conservation Units* (**Fleming et al. 1999**) and in SID's *Acoustic Data from Biscayne National Park and Everglades National Park* (1997) and 1998 supplemental acoustic data. In addition, Appendix H contains a draft report prepared by Wyle Laboratories to assist NPS in resolving methodological issues associated with defining the natural soundscape in the national parks, that interprets measured and monitored data involving natural ambient levels.

This section summarizes the results of an extensive noise analysis conducted for the SEIS. It primarily focuses on the maximum potential noise levels that might occur if the existing runway were used to its full capacity (maximum use). This is not anticipated to be achieved until sometime in the 2030s, but it provides a sense of the maximum potential impact from reuse of former Homestead AFB. Information for 2000, 2005, and 2015 is provided in Appendix E.

For the Proposed Action, the estimated noise levels from maximum use of a one-runway airport at HST incorporate future changes in aircraft models that are known, but it is not possible to predict other technologies that might evolve by the time maximum use is achieved. The analysis therefore assumes that aircraft at that time will be no quieter than they are expected to be in 2015. As such, it likely overestimates the probable noise levels. It is also assumed that HST would be very successful in achieving an unusually high rate of growth, both to achieve the level of operations forecast for 2015 and to reach its maximum capacity.

Impacts from aircraft noise are also addressed in Sections 4.6 Land Use and Aesthetics, 4.11 Biological Resources, 4.13 Minority and Low-Income Populations, and 4.14 Department of Transportation Act Section 4(f).

4.5.2 Proposed Action

Table 4.5-1 presents forecast average daily operations at HST under the Proposed Action for the major aircraft types in each period of analysis.

Table 4.5-1. Summary of Forecast Average Daily Operations at HST

Aircraft Type	Current	2000	2005	2015	Maximum Use
Military and Government	54.31	54.31	54.31	54.31	54.31
Commercial Passenger	0	0	20.85	140.33	345.87
General Aviation	0	111.87	123.65	155.54	155.54
Aircraft Maintenance	0	0	1.56	4.03	4.03
Cargo	0	0	4.27	58.77	73.88
Total Daily Operations	**54.31**	**166.18**	**204.64**	**412.98**	**633.63**
Total Annual Operations	**19,824**	**60,658**	**74,697**	**150,735**	**231,274**

Source: Derived from **Landrum & Brown 1999b.**

The noise levels produced by these operations would be determined by the type of aircraft flying into and out of HST, the flight tracks used (determined by origin and destination), and distance from the airfield. Each takeoff and each landing counts as an operation, so the number of civil aircraft landing and taking off from HST would be half the number of operations depicted in Table 4.5-1. Generally, any specific location on the ground could only be exposed to either the landing or the takeoff of a given aircraft, not both, because the arrival and departure paths would be on opposite sides of the airport. As aircraft flew farther away from the airport, they would disperse along different flight paths, so not every aircraft would fly over the same point, except very close to the runway. As shown in Table 2.2-5, a wide variety of aircraft types are forecast to fly at HST. Commercial passenger, cargo, and high-performance general aviation jets are projected to comprise 50–55 percent of the operations. All these factors would affect the noise level at different locations.

Flight paths for civil aircraft operating into and out of HST have been identified for the Proposed Action in consultation with FAA. These differ from flight tracks currently used and projected to continue to be used for military and government operations. However, in the immediate vicinity of the airfield and out for the first few miles, the departure and arrival routes overlap substantially, diverging thereafter depending on type of aircraft and origin or destination. At greater distances from the airport, the civil aviation traffic are assumed to operate on a more unique set of flight paths. Therefore, noise effects attributable to the Proposed Action would vary depending on whether affected locations are presently exposed to overflight from military and government aircraft operating from Homestead ARS.

Noise effects are presented in the following sections in two main forms: as noise contours and as point noise data. Community noise impacts are described primarily in DNL. LAmax, Leq(h), and TAamb data are primarily used to describe noise effects in the national parks and refuges.

4.5.2.1 Community Noise

Noise modeling of the Proposed Action using the enhanced version of INM involved applying the total projected annual aircraft operations, by aircraft type, for each year of analysis to derive average daily operations and assigning each operation to a departure or arrival flight path. Nighttime (10:00 p.m. to 7:00 a.m.) operations were separated from daytime operations for the DNL computations in order to apply the 10 dB weighting that is used to reflect the higher level of annoyance associated with nighttime noise events.

DNL Contours. **Figures 4.5-1 through 4.5-4** depict the estimated DNL 60, 65, 70, and 75 dB noise contours for the Proposed Action for 2000, 2005, 2015, and at maximum use of a one-runway airport at HST, respectively. **Table 4.5-2** indicates the land area that would be encompassed within each contour for the maximum use, compared to the existing condition presented in Section 3.5. The total land area affected by DNL 60 dB or higher is projected to increase by 1,568 acres, or 24 percent, at maximum use. The areas within the DNL 65, 70, and 75 dB contours are projected to increase by 22, 15, and 8 percent, respectively. **Table 4.5-3** estimates the change in dwelling units and residential population that would be exposed to noise levels exceeding DNL 60 dB. The table shows both existing residents who would be within each contour and the potential growth in population (through 2015) within each contour, assuming no land use compatibility controls are implemented. This estimated growth was based on the moderate growth forecasts described in Section 2.1.3. Because of the uncertainty of the timing and the lack of population forecasts beyond 2020, population growth was not projected for maximum use.

Table 4.5-2. Land Area Within DNL Contours—Proposed Action at Maximum Use

DNL Contour	Within Airport Boundary (acres)		Outside Airport Boundary (acres)		Total Area (acres)	
	Current	Proposed Action	Current	Proposed Action	Current	Proposed Action
60–65 dB	390	404	3,322	4,275	3,712	4,679
65–70 dB	372	384	1,062	1,459	1,434	1,843
70–75 dB	301	326	301	410	602	736
Above 75 dB	666	704	45	64	710	768
Total Above 60 dB	1,729	1,818	4,730	6,208	6,458	8,026

Source: **Landrum & Brown 1999b.**

The Federal Interagency Committee on Urban Noise defined noise impact zones and established guidelines for land use compatibility. Their guidelines have been adopted by FAA and incorporated in Federal Aviation Regulations Part 150. The land use compatibility guidelines are shown in **Table 4.5-4.** These guidelines identified residential uses, unless treated with adequate noise insulation, as incompatible with noise exposure levels of DNL 65 dB and higher. The FAA encourages communities to reduce or prevent residential land uses within the DNL 65 dB contour to the extent possible.

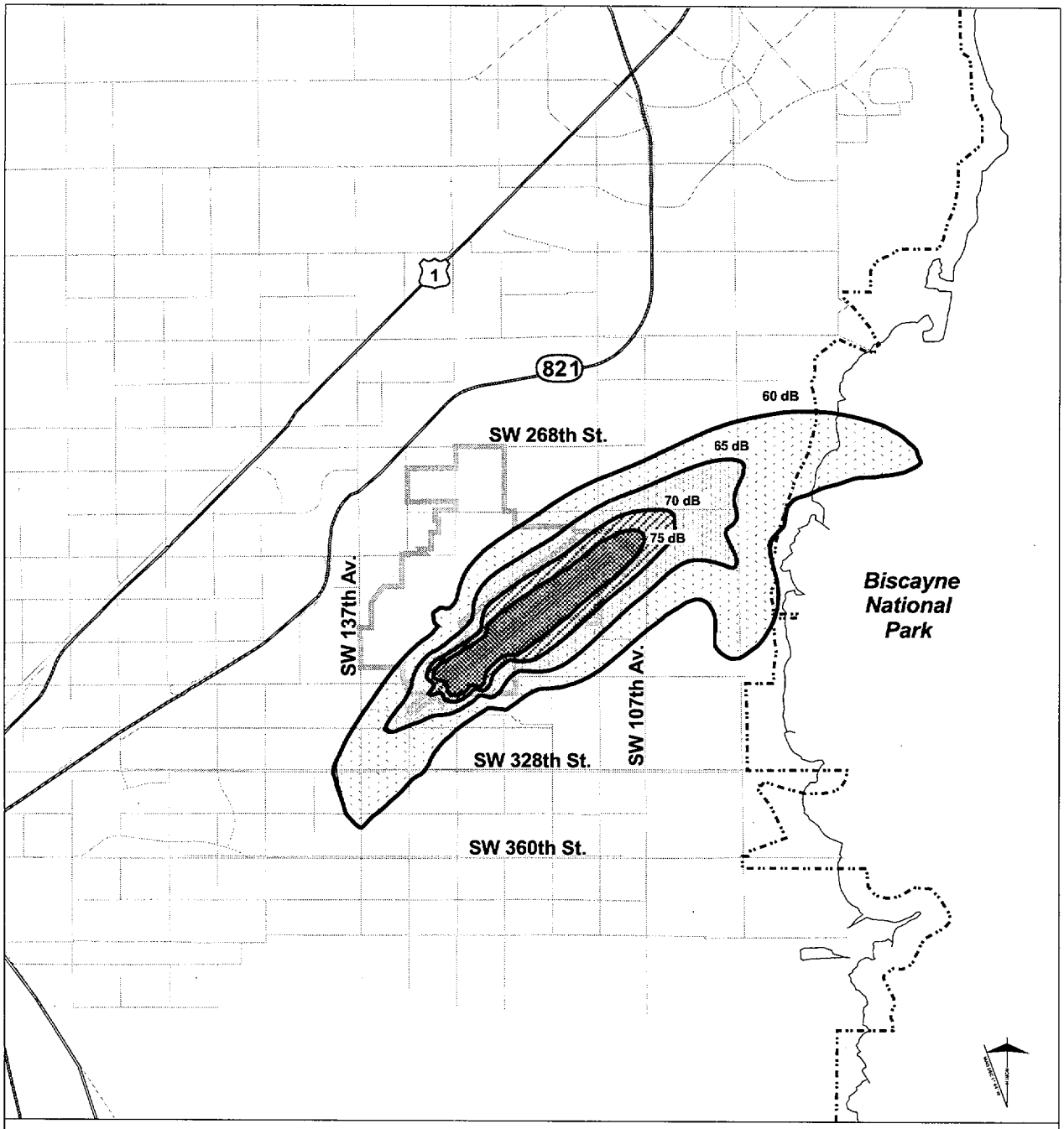
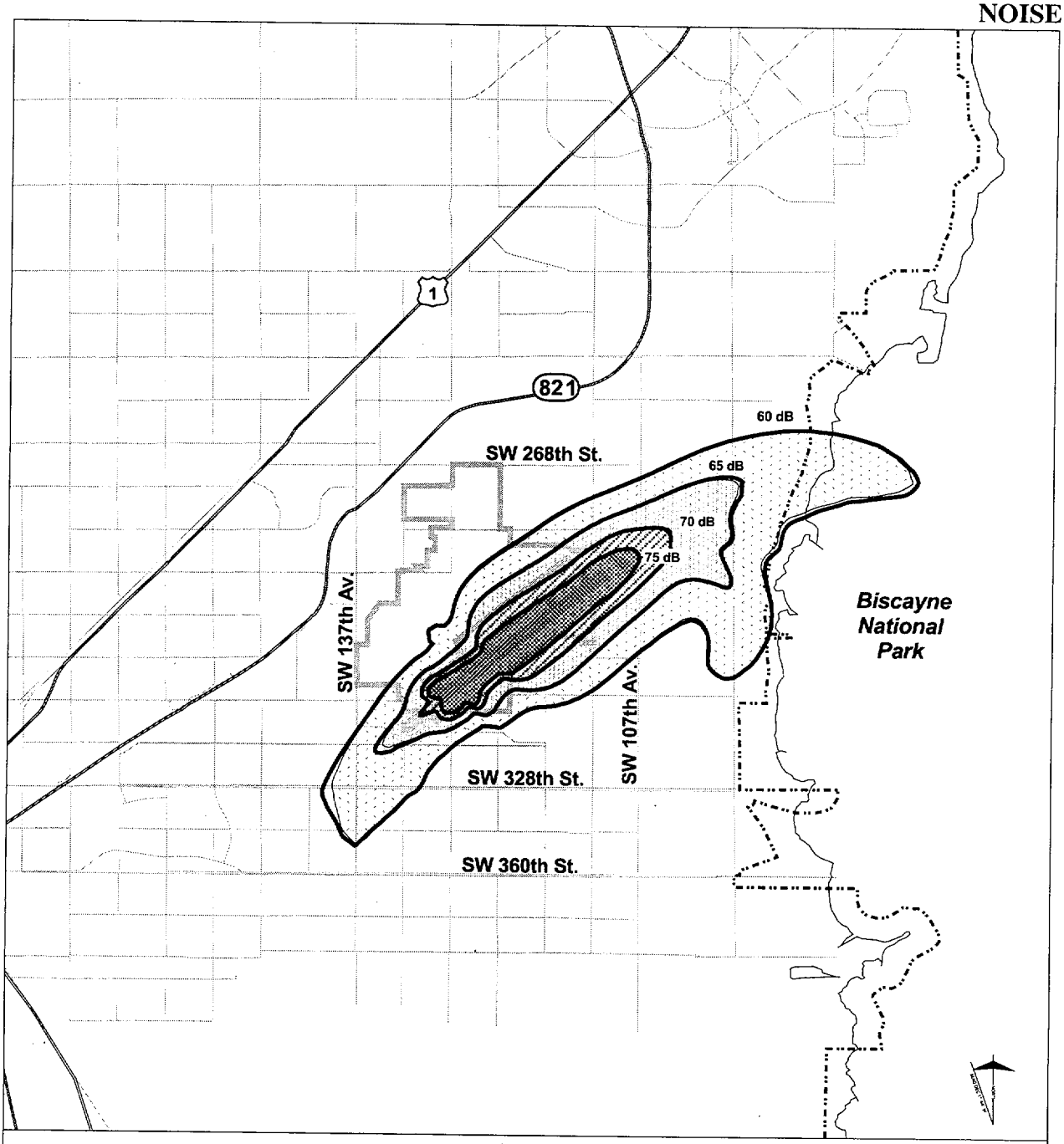


Figure 4.5-1
Comparison of Proposed Action and Projected Baseline DNL Contours (2000)



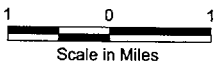
LEGEND

60 dB **Proposed Action DNL Contour**

Projected Baseline DNL

- **60 - 65 db**
- **65 -70 db**
- **70 - 75 db**
- **> 75 db**
- **Former Homestead AFB**
- **National Park Boundary**
- **Street**
- **U.S. Highway**
- **State Highway**

332749668



Derived from:
Landrum & Brown 1999b

Figure 4.5-2
Comparison of Proposed Action and Projected Baseline DNL Contours (2005)

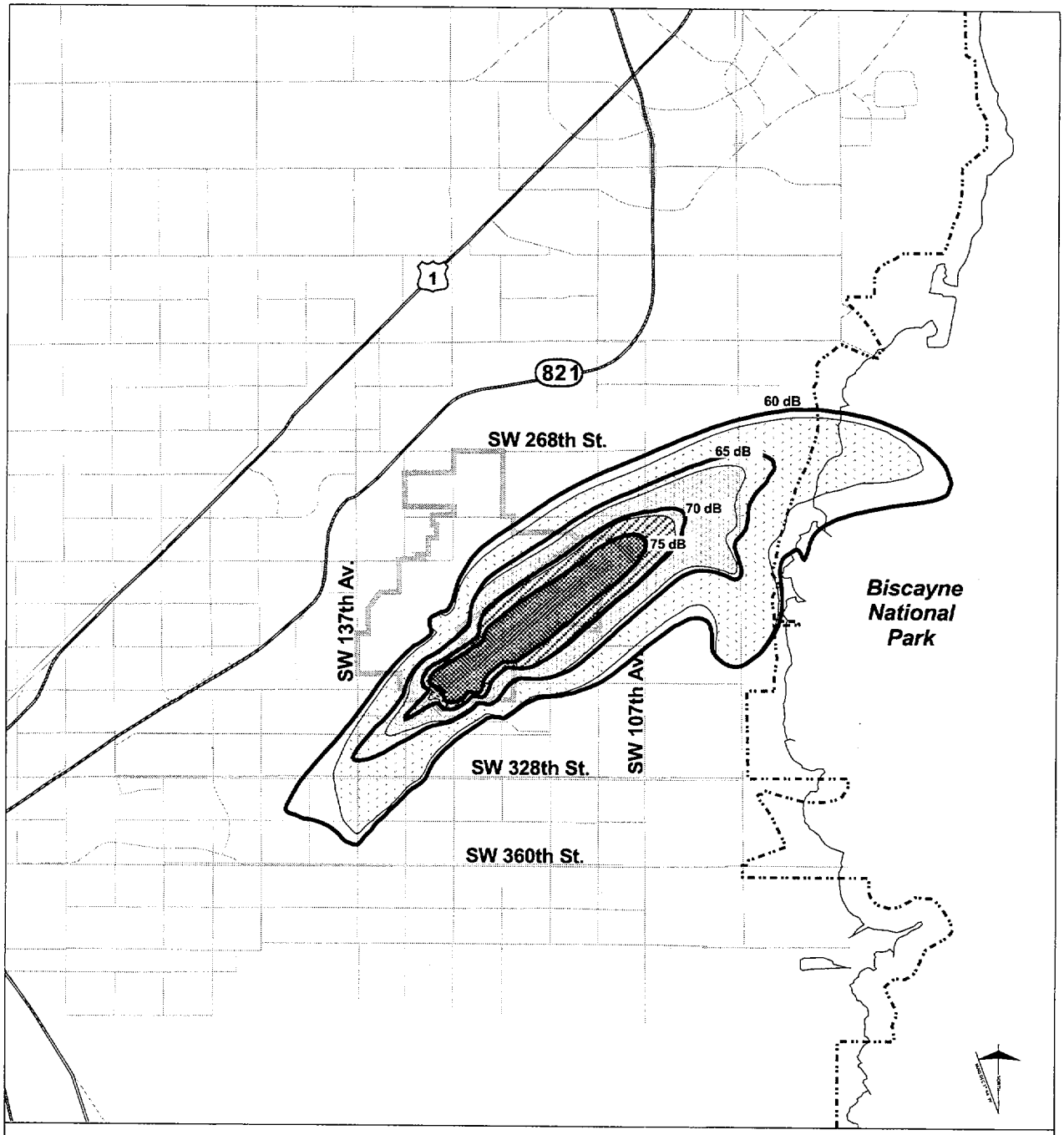
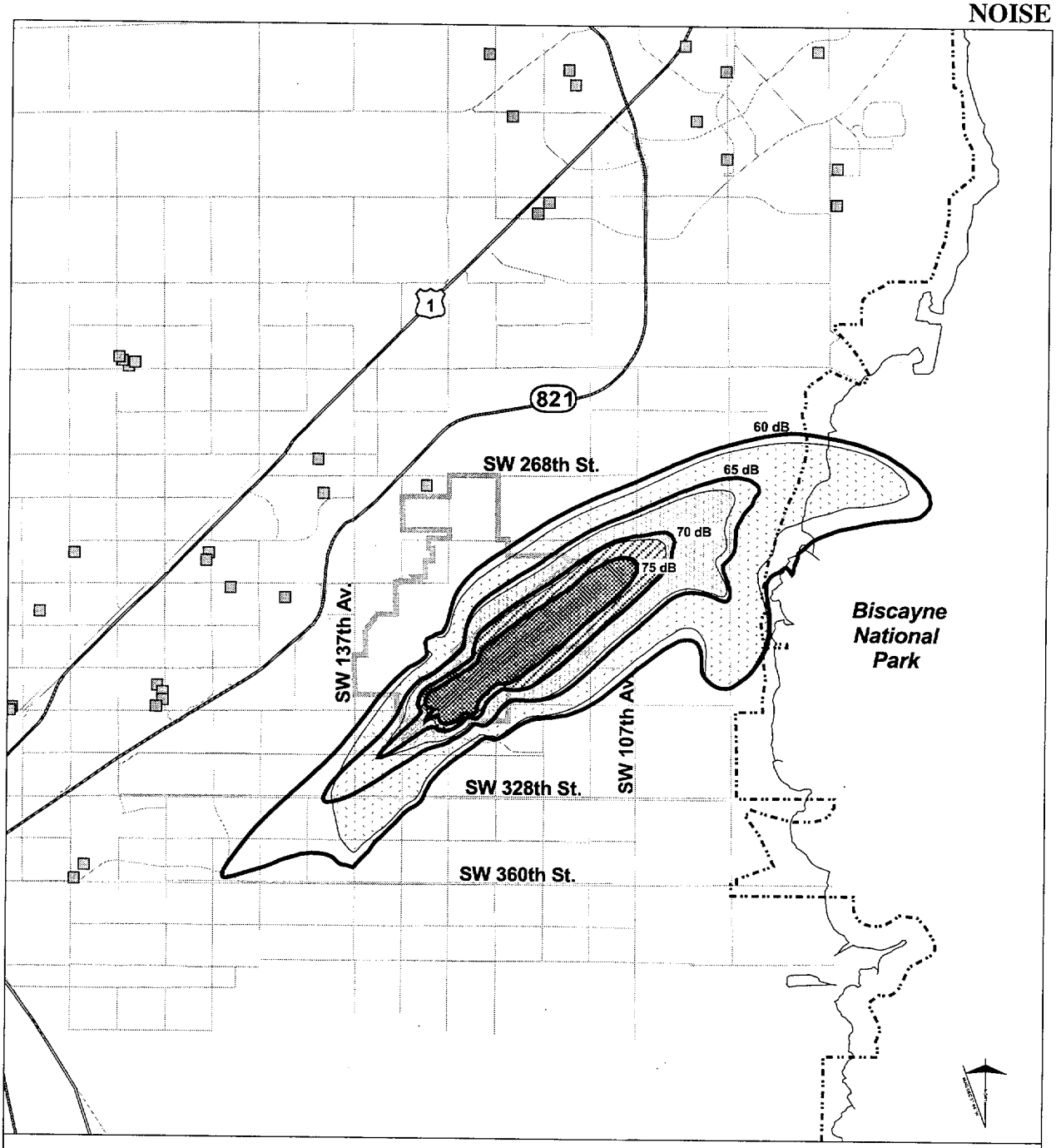


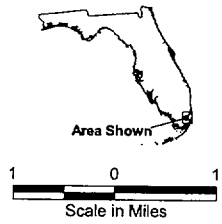
Figure 4.5-3
Comparison of Proposed Action and Projected Baseline DNL Contours (2015)



LEGEND

60 dB Proposed Action DNL Contour
Projected Baseline DNL
- 60 - 65 db
- 65 -70 db
- 70 - 75 db
- > 75 db
- School

- Former Homestead AFB
- National Park Boundary
- Street
- U.S. Highway
- State Highway



Derived from:
Landrum & Brown 1999b,
Metro-Dade County 1998f

Figure 4.5-4
Comparison of Proposed Action and Projected Baseline DNL Contours (Maximum Use of One Runway)

Table 4.5-3. Dwelling Units and Population Within DNL Contours—Proposed Action

DNL Contour	Current Operations		Proposed Action							
			2000		2005		2015		Maximum Use	
	Units	Pop	Units	Pop	Units	Pop	Units	Pop	Units	Pop
Existing Residents										
60–65 dB	202	1,148	212	1,188	228	1,284	273	1,429	262	1,396
65–70 dB	95	656	98	680	99	680	97	642	124	652
70–75 dB	0	0	0	0	3	24	23	166	53	398
Above 75 dB	0	0	0	0	0	0	0	0	1	3
Total Above 60 dB	297	1,804	310	1,868	330	1,988	393	2,237	440	2,449
Projected Growth[1]										
60–65 dB	NA	NA	234	1,243	283	1,382	432	1,812	NA	NA
65–70 dB	NA	NA	101	689	109	707	130	737	NA	NA
70–75 dB	NA	NA	0	0	3	24	25	171	NA	NA
Above 75 dB	NA	NA	0	0	0	0	0	0	NA	NA
Total Above 60 dB	NA	NA	335	1,932	395	2,113	587	2,720	NA	NA

Source: **Landrum & Brown 1999b**.
Note: [1] Assumes growth in vicinity of HST is not controlled.
NA Not available

Schools are not expected to be adversely affected by the Proposed Action. According to the land use compatibility guidelines, schools are compatible with aircraft noise levels below DNL 65 dB. As shown in Figure 4.5-4, there are no schools within or even close to the DNL 60 dB contour at maximum use of one runway.

By 2015, the potential growth of the airport to include over 51,000 commercial passenger operations and more than 21,000 cargo operations, as well as estimated activity in the maintenance, general aviation, and government operations, would result in an increase in the noise contours. Sometime beyond the year 2015, the airport could reach its one-runway capacity. The forecasts for that condition project that the dominant component of the fleet mix would be passenger aircraft, with passenger jets providing the principal service. In addition, the fleet mix is forecast to include turboprop passenger flights, general aviation activity, continued government operations, and increased levels of cargo activity by jet aircraft. The FAA's expectation is that the future fleet will be comprised of aircraft that are quieter than aircraft currently in service, resulting in reduced individual aircraft source noise, which would counterbalance increases in numbers of aircraft. The extent of potential counterbalance cannot currently be quantified because the noise characteristics of future aircraft types are not known.

The projected increase in noise levels to the southwest of the airport is largely attributable to aircraft landings. Since the airport operates in east flow the majority of time, most landings would occur from the southwest. In those areas where landings would be the dominant operation, the noise exposure would be concentrated because the rate of descent for civil aircraft is relatively constant and the course would generally be straight. In contrast, noise from departures, although individually louder than landings, would be dispersed over a broader area by variable climb rates and turning flight tracks.

Table 4.5-4. Land Use Compatibility Guidelines—FAR Part 150

Land Use	DNL in dB					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
Public Use						
Schools, hospitals, nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	N[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware, and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade, general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y	Y[5]	N[5]	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Notes:
[1] Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
[2] Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
[3] Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
[4] Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
[5] Land use compatible provided special sound reinforcement systems are installed.
[6] Residential buildings require a NLR of 25 dB.
[7] Residential buildings require a NLR of 30 dB.
[8] Residential buildings not permitted.

Y (Yes) Land use and related structures compatible without restrictions.
N (No) Land use and related structures are not compatible and should be prohibited.
NLR Noise Level Reduction (outdoor and indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25,30,35 Land use and related structures generally compatible; measures to achieve a NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Nevertheless, the current condition, projected baseline, and Proposed Action DNL contours are similar. This is because military aircraft contribute so much noise energy to the exposure in the airport environs that they would dominate the Proposed Action conditions, despite the fact that the number of operations is forecast to increase over tenfold by maximum use.

FAA Order 5050.4A defines a significant noise increase as an increase of DNL 1.5 dB or more over noise sensitive land uses within the DNL 65 dB and higher contours. In addition, a Federal Interagency Committee on Noise has recommended that airport noise analyses performed under the National Environmental Policy Act also include increases of DNL 3 dB or more over noise sensitive land uses located in moderate levels of noise exposure between DNL 60 and 65 dB.

To identify areas meeting those criteria, the contours modeled for the Proposed Action for each analysis year were compared to the projected baseline contours. Areas where DNL differences of 1.5 dB and higher were found within the DNL 65 dB contour and where differences of DNL 3.0 dB and higher were identified between DNL 60 and 65 dB contour were mapped and overlain on maps of estimated population density and dwelling units. **Figure 4.5-5** presents a forecast of those areas in 2015 under the Proposed Action. The projected areas of increase are located to the southwest of the airport, along the approach to Runway 5. In 2015, 68 existing dwelling units housing an estimated 513 persons are projected to be located within the area experiencing 1.5 dB increase within the 65 dB contour, while the area experiencing 3.0 dB increase is estimated to have 127 persons in 43 dwellings. **Figure 4.5-6** shows the DNL difference contours for maximum use of a one-runway airport. An estimated 219 existing dwellings and 967 residents are projected to be within the area of 1.5 dB increase, and 74 dwellings with 219 residents are projected to be in the area of 3.0 dB increase. If residential development is not controlled in the high-noise areas, the number of people and dwelling units could increase under maximum use.

SEL Contours. SEL patterns were developed for a combined single departure and single arrival by one military and five civil aircraft along the flight track forecast to be most commonly used by those aircraft to and from HST. SEL patterns for the F-16 military aircraft are shown in Figure 3.5-6. **Figures 4.5-7 through 4.5-11** display SEL patterns of 85 dB and above for the Boeing 727-200 with retrofit engines, Boeing 737-500, Boeing 757-200, McDonnell Douglas MD-82, and Canadair Challenger 601. In each case, the contours widen on takeoff as the aircraft lifts off and begins to climb. These aircraft are the principal user groups expected to contribute to the noise levels at HST if it is used as a civilian airport.

Each SEL footprint represents a specific aircraft operation. The SEL footprints look different because of different aircraft noise characteristics. SEL footprints also look different from DNL contours. The DNL evaluates the total noise energy associated with every operation by every type of aircraft using an airport over the period of a year and then averages it to a single day. DNL contours will usually be smaller than the SEL footprints of louder aircraft and larger than the SEL footprints of the quieter aircraft using an airport.

Figure 4.5-7 shows the SEL footprint for a Boeing 727 aircraft equipped with an engine hush kit to meet Federal Aviation Regulations Part 36 Stage 3 noise standards. The forecasts indicate that this aircraft is not expected to remain in the fleet mix in 2015. The shape of this contour turns right to follow the proposed southward departure climb out, the path anticipated to have the most operations by this aircraft type. To the southwest, the 727 footprint extends about 4 miles from the airport, with the higher level contours appearing as the aircraft descends and slows to its landing.

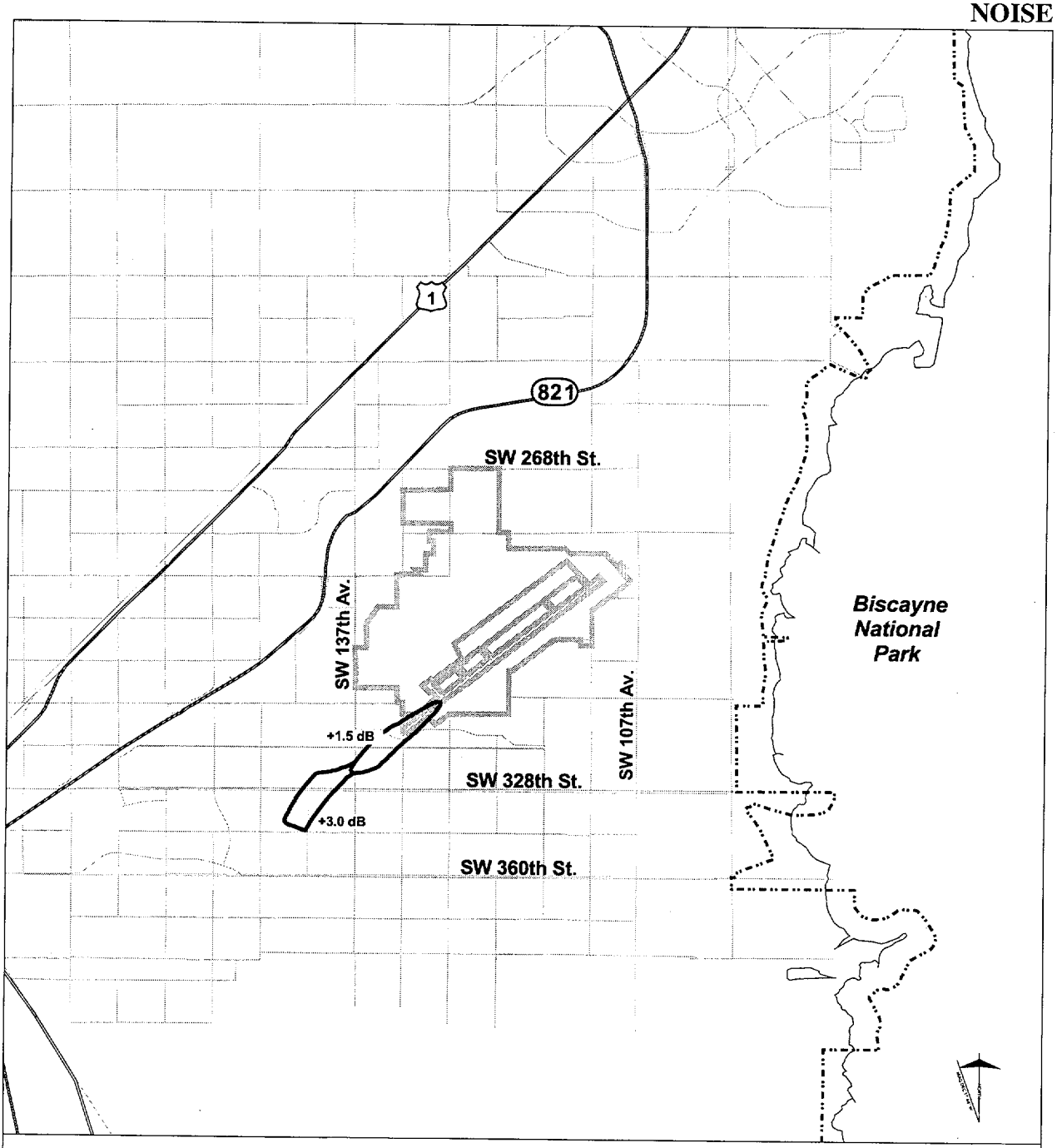


Figure 4.5-5
1.5 dB and 3.0 dB Difference DNL Contours—Proposed Action (2015)

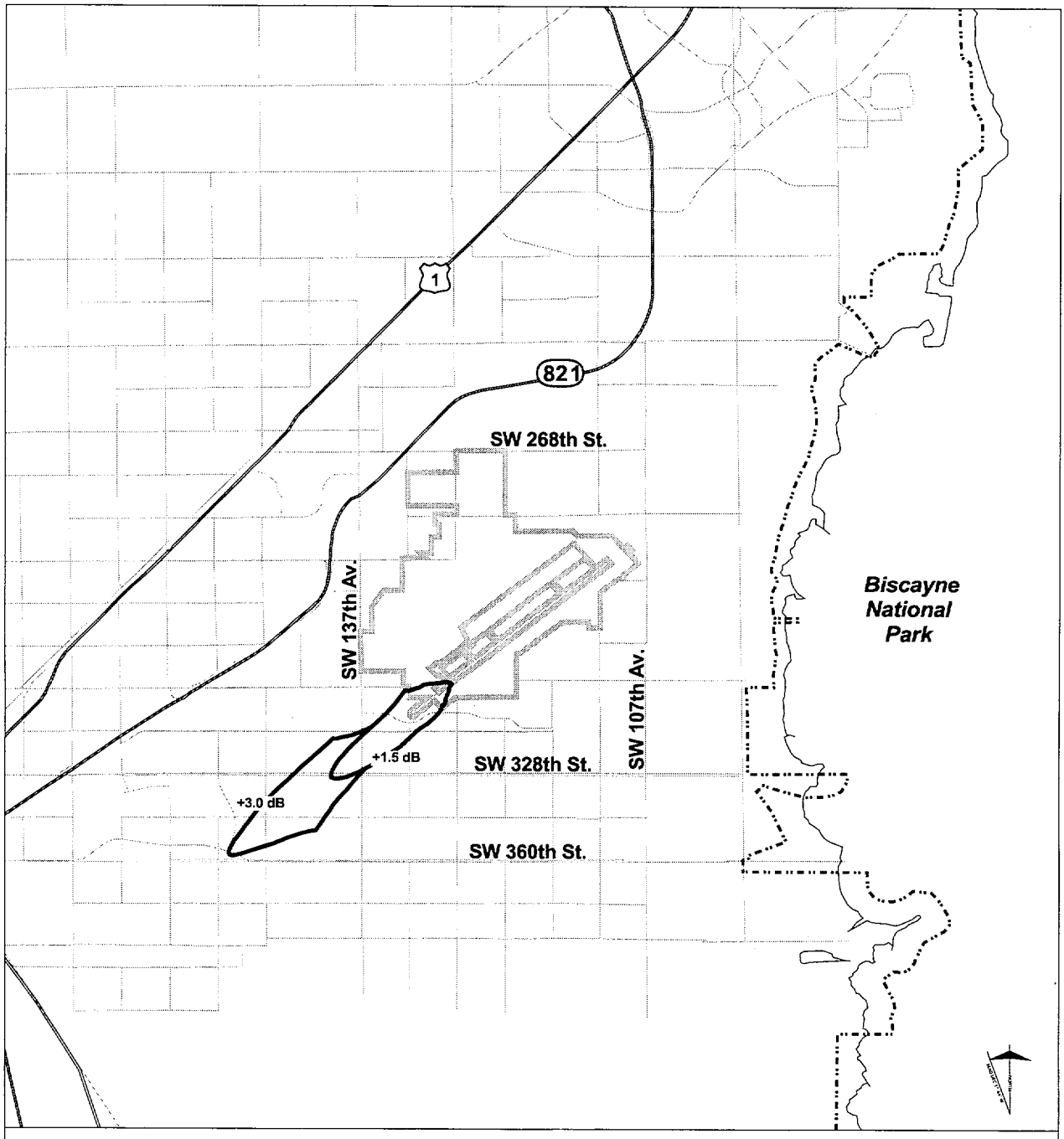


Figure 4.5-6
1.5 dB and 3.0 dB Difference DNL Contours —
Proposed Action (Maximum Use of One Runway)

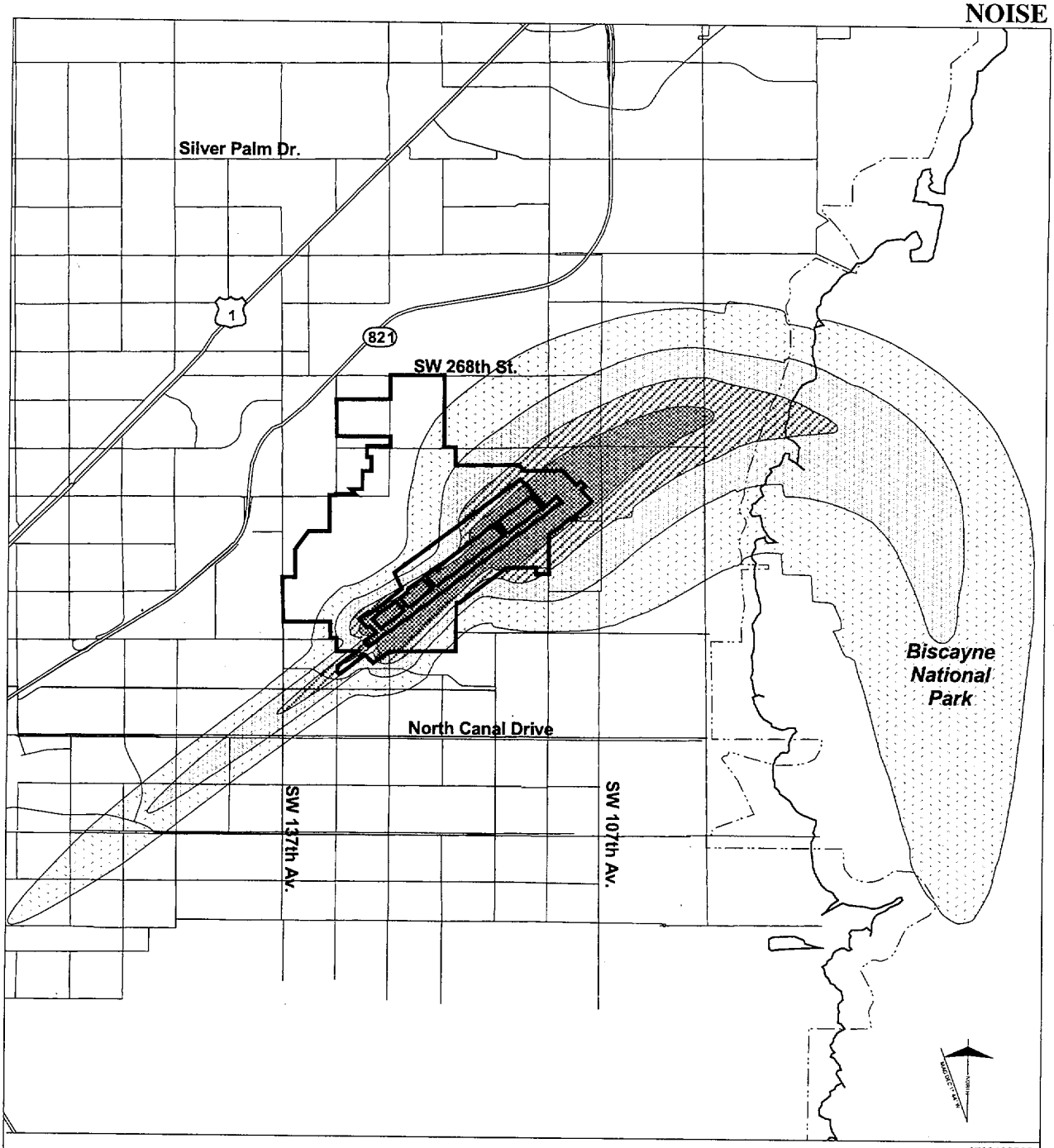


Figure 4.5-7
SEL Contours, 727-200 Hush Kit Aircraft (727EM2), One Departure and One Arrival

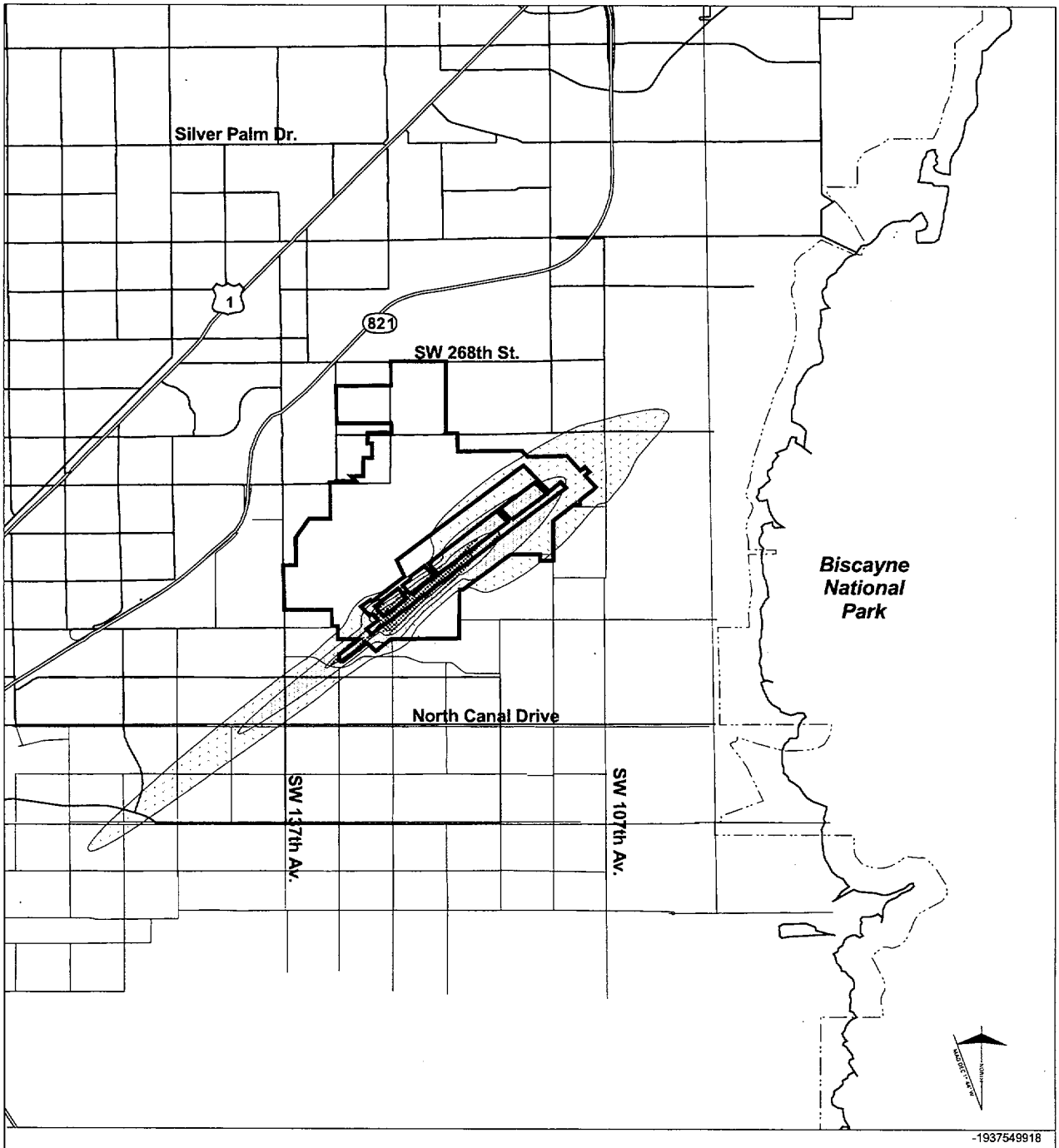


Figure 4.5-8
SEL Contours, 737-500 Aircraft,
One Departure and One Arrival

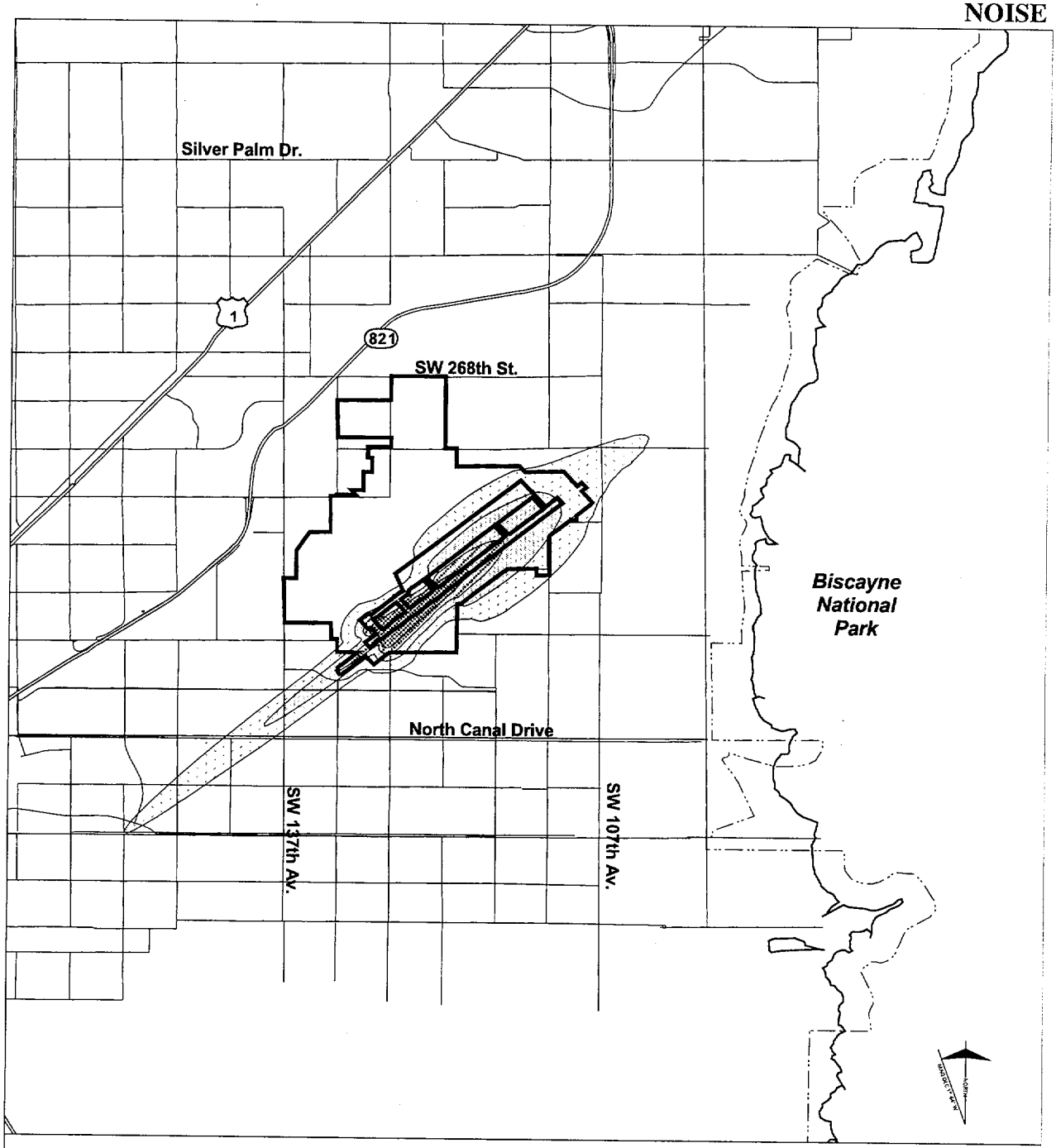


Figure 4.5-9
SEL Contours, 757-200 Aircraft (757RR),
One Departure and One Arrival

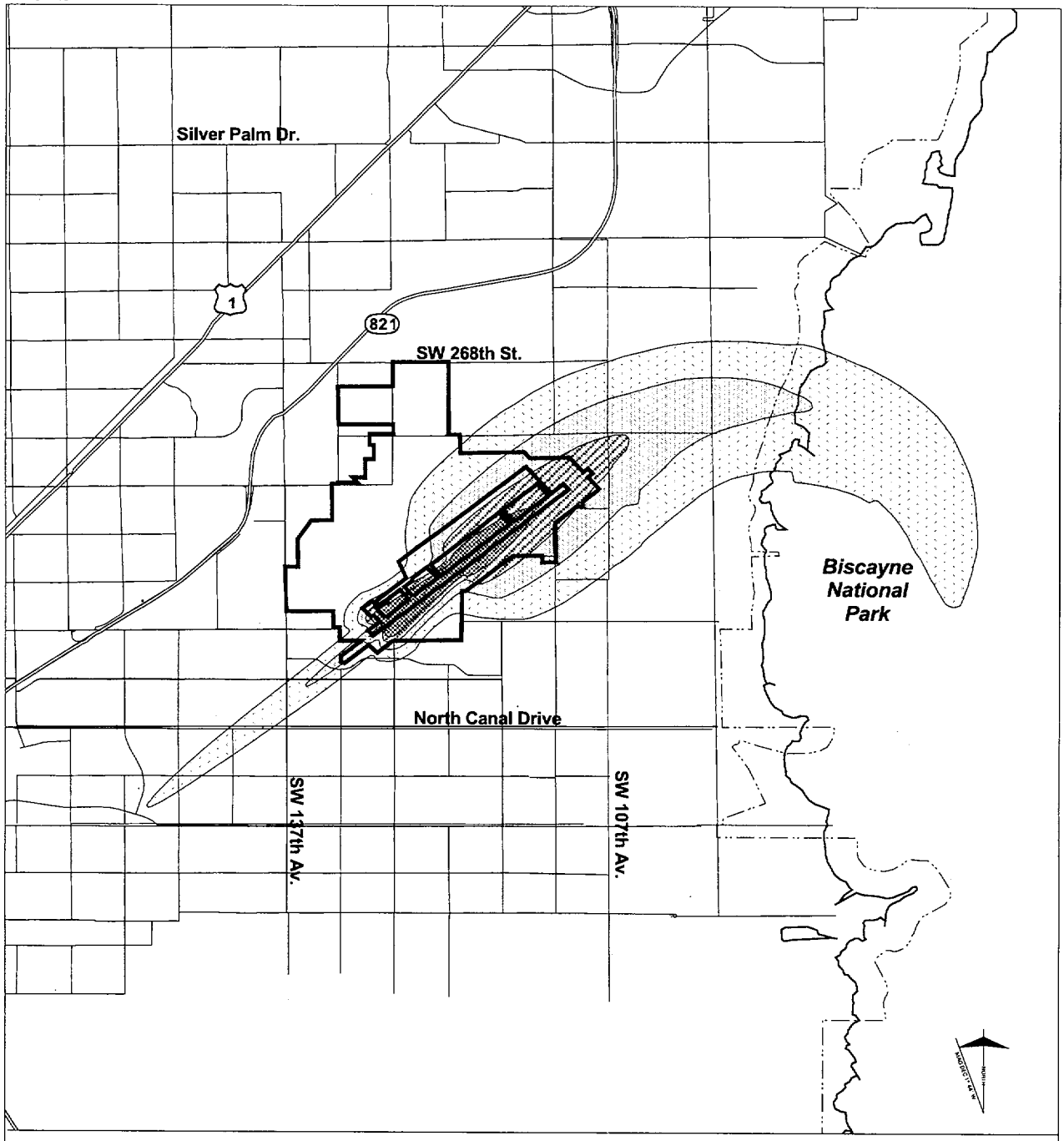


Figure 4.5-10
SEL Contours, MD 80 Aircraft (MD82),
One Departure and One Arrival

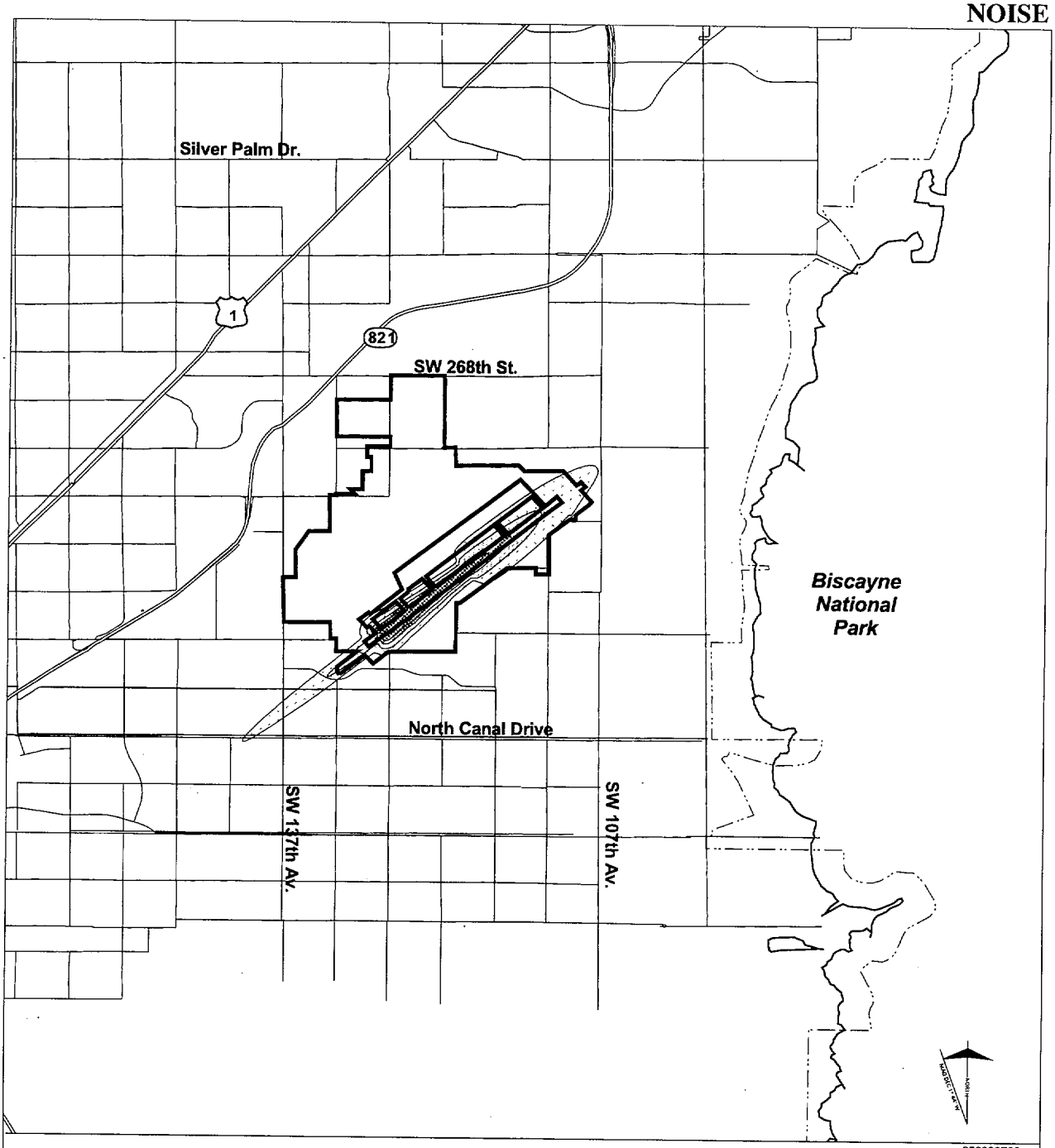


Figure 4.5-11
SEL Contours, CL601 Aircraft,
One Departure and One Arrival

Figure 4.5-8 shows the footprint associated with an operational cycle of the Boeing 737-500 commercial jet. This aircraft is expected to be representative of the typical large jet passenger aircraft of future years. The noise footprint indicates that the departure pattern to the northeast quickly fades to levels below SEL 85 dB shortly after passing beyond the airport boundary. Noise at the higher levels would not extend beyond the airport boundaries on takeoff. During the approach from the southwest, the 85 dB contour extends about 3.5 miles from the airport along the extended centerline; noise at the highest level (100 dB) would not extend outside the airport. This aircraft is forecast to be in use at HST by 2005.

Figure 4.5-9 presents the footprint for a landing and takeoff by a Boeing 757 commercial jet. The footprint is very similar to that of the B-737-500, although the aircraft is considerably heavier than the 737. The departure portion of the footprint extends beyond the airport boundary at the 85 dB level, but higher noise levels would remain on airport property. Under the approach from the southwest, the tail of 85 dB extends approximately 3 miles from the airport. Use of this aircraft is forecast for after 2005.

Figure 4.5-10 shows the noise footprint for an arrival and takeoff by a McDonnell Douglas MD-82 passenger or cargo jet. The size of the pattern falls between that of the B-727 and the B-737-500, with the lowest indicated noise level terminating over Biscayne Bay. The SEL 90 dB contour is projected to end at the shoreline, while the 95 dB contour is projected to extend beyond the airport boundary to the northeast. This aircraft also has an arrival tail extending to the southwest along the centerline of the approach to a point about 3 miles from landing. The aircraft is projected to enter service at the airport after 2000 and be removed from the passenger fleet by 2015 and from the entire fleet by full buildout.

Figure 4.5-11 shows the footprint of a typical 50 passenger regional jet, represented by the Challenger 601 aircraft. This aircraft is projected to enter local service after 2005 and remain there through full buildout. The 85 dB footprint of the CL-601 barely extends beyond the airport to the northeast and reaches about 1 mile from the airport under the approach from the southwest.

Community Grid Point Analysis. DNL contours are based on joining points of equal noise exposure and constitute the primary analysis near airports for community noise impacts. In addition, a number of locations in the vicinity of HST were analyzed for a range of noise metrics as representative examples of noise exposure levels in the community. **Table 4.5-5** lists modeled DNL, LAmax, and Time Above at 12 sample community locations under the Proposed Action at maximum use of a one-runway airport, compared to future baseline/No Action levels. These locations are shown on Figure 3.5-8. A discussion of the noise effects at each community location as measured by the different metrics is provided in Chapter IV of Appendix E.

Cumulative Impacts

The cumulative impact analysis considered the growth in airport activity in the ROI at airports other than HST. For the noise levels that are included in the community noise analysis, aircraft arrivals and departures at HST dominate the noise. No additional cumulative noise effects are attributable to growth in regional aviation activity serving other airports.

Accelerated population growth in the area surrounding HST could result in more future residents being exposed to noise levels over DNL 60 dB, if land use controls are not imposed by Miami-Dade County to prevent encroachment of incompatible land uses near the airport. Based on the county's high growth forecasts, an additional 64 residents could be affected by 2005 and 492 by 2015.

Table 4.5-5. Sample Community Noise Levels—Proposed Action at Maximum Use of a One-Runway Airport

Location	Map Designation[1]	DNL (dB)		LAmax (dB)		Time Above[2] (minutes)	
		Proposed Action	Projected Baseline/ No Action	Proposed Action	Projected Baseline/ No Action	Proposed Action	Projected Baseline/ No Action
Miami-Dade County Community College–Homestead Campus	HCC	42	39	71	71	1	1
Keys Gate Community	KGX	51	43	97	97	5	2
South Dade Center	MH1	71	69	107	107	217	186
Naranja	NJA	48	45	81	78	6	5
Homeless Trust Center	HTA	56	54	83	83	19	16
Homestead High School	HSH	48	43	80	80	2	2
Nursing Home	NHA	48	44	83	83	3	2
Florida City City Hall	FCH	43	39	72	72	1	1
Redland	RFP	40	37	74	74	<1	<1
Ocean Reef Community	ORX	39	35	77	77	<1	<1
Angler's Club	ACX	40	35	77	77	<1	<1
Key Largo	CKL	31	23	69	69	0	0

Source: **Landrum & Brown 1999b.**
Notes: [1] See Figure 3.5-8.
[2] Time above DNL 65 dB.
<1 Less than 1

Mitigation Measures

The community location that would be affected by significant and moderate increases in noise as commercial aircraft operations grew at HST would be the South Dade Center located at the southwest end of the runway. Two mitigation options may be considered for this residential area, assuming that future forecast levels of operations are achieved and result in projected noise increases. The two options are (1) acquisition of the residential area and relocation of the residents, or (2) sound attenuation to reduce interior noise levels. In addition, to preclude future land use development from creating additional noncompatible land uses within the noise contours, Miami-Dade County should adopt land use controls prohibiting new residential development in areas projected to be exposed to DNL levels of 65 dB and higher.

Noise contours were computed for each noise abatement flight path described in Section 2.11.2 (see Figures 2.11-1, 2.11-2, and 2.11-3). In each case, the resulting noise contours are virtually identical to the unmitigated Proposed Action contours for the same forecast year. The potential modifications to the flight paths would take place well beyond the area affected by DNL 60 dB and above. There are very minor differences in the area within the DNL 65 dB contour in 2015 and at maximum use which could result in small differences in the population affected. An additional three to nine dwelling units could be within the DNL 65 dB contour with some of the noise abatement flight paths. No differences were

indicated in areas exposed to DNL increases of 1.5 dB within the 65 dB contour or 3 dB within the 60 dB contour.

None of the community sites selected for grid point analysis are projected to experience any change in Time Above (DNL 65 dB) or LAmax levels with any of the flight track alternatives, compared to the proposed flight tracks. Several community locations that are outside the DNL 60 dB contour are projected to increase by DNL 1 dB if flight track alternatives are implemented. In each of those instances, the DNL levels for the Proposed Action and flight track alternatives would be less than 65 dB.

Thrust management during aircraft departures and approaches has been used at some airports in the United States as a means of reducing noise exposure of nearby communities. Part 91-53A of the Federal Aviation Regulations sets forth suggested noise abatement departure procedures that may be adopted by various air carriers for the reduction of takeoff noise levels in the close proximity of airports. The takeoff procedures are designated as "close-in" or "distant" noise abatement departure procedures (NADP) based on implementation distance from the runway.

The typical close-in NADP would benefit areas about 3–5 miles from the runway, while a typical distant NADP would benefit areas about 5–9 miles from the runway. At Homestead, the close-in NADP might reduce noise levels over areas northeast of the airport to about the western boundary of Biscayne National Park. To the southwest, single event departure noise levels might be reduced by several decibels over the residential housing immediately southwest of the airport boundary. The distant NADP might result in slightly reduced single event noise levels (normally by less than 3 dBA) over the western portion of Biscayne National Park. To the southwest, the procedure might result in reduced single event noise levels over residential property in Florida City, west of 147th Avenue and south of 320th Street.

The benefits of any NADP is specifically related to particular aircraft as operated by specific air carriers and cannot be quantified with more clarity than the above estimates at this time. It should be noted that the aircraft that would produce the greatest benefit by using NADPs are projected to be removed from the fleet by 2015, when the number of operations by large civil jet aircraft is forecast to reach substantial levels. Moreover, the F-16 aircraft so dominate the DNL noise contours that little resultant reduction in DNL would be anticipated in any timeframe from the use of NADPs.

In addition to departure procedures, noise levels on approach may be reduced in several ways: through reduction of level segments in the approach profile, by remaining higher longer, and by limiting the amount of reverse thrust used in landing.

More thrust is required to maintain level flight in a step-down profile than is used during a constant descent approach. Emerging technologies such as global positioning satellite navigation, on-board flight management systems (FMS), and Vertical Navigational Performance (VNP) procedures will enable constant descent rate from one flight coordinate to another. Another possibility for reducing arrival noise involves keeping aircraft higher longer, resulting in somewhat steeper descent downstream. For new arrival profiles, however, it is unlikely that new HST procedures could be threaded through the approach and departure corridors over south Florida without affecting the procedures leading to and from the other airports. Consequently, any change in the altitudes and routes associated with the HST traffic would require systemwide consideration of possible effects on operations in the region.

The application of reverse thrust during landing is a measure often cited as a potential noise reduction tool by those unfamiliar with the operating requirements of large aircraft. The use of reverse thrust results in a considerably safer operation and is generally required by the rules set forth by the using carriers. At HST, the only area that would receive any substantive benefit from the limitation of reverse

thrust is the residential area located immediately southwest of the runway. The area would not experience a reduction in DNL, but would receive a reduction of single event levels by several decibels (as much as 10 dBA) during the landing roll.

Advanced navigational procedures using new technology, such as GPS, FMS, and area navigation systems (RNAV), are expected to provide additional opportunities for avoiding or minimizing noise impacts over sensitive areas. Such procedures will allow tighter and less dispersed departure streams, narrower flight corridors, and greater precision on flight paths and on approach into the airport. In 1999, approximately 60 percent of the commercial fleet was equipped with the appropriate technology to allow precision flight within one-half mile of a prescribed course defined by advanced navigation systems. It is projected that this percentage will increase with time until beyond 2005, when virtually all large commercial aircraft will be capable of following such approach and departure courses.

The ability to prescribe specific FMS or GPS courses at Homestead is dependent upon the interrelationships between all approach and departure procedures in an airports environs. In south Florida, the timing for the development of complex FMS, GPS, or RNAV procedures will likely be guided by their utility at MIA or FLL. By the time such measures are useful for substantive noise abatement at HST (beyond 2005), they are likely to have been developed and introduced at other facilities. At the time any such measures are developed elsewhere, it is appropriate to evaluate their usefulness for noise abatement at HST.

As with all developing technology, unforeseen improvements in the handling of air traffic, or the invention of new communication, navigation and surveillance techniques may lead to future improvements in noise mitigation by placing aircraft in areas of lesser sensitivity. The FAA would consider the implementation of such measures as they are developed and proved useful.

The imposition of restrictions on air carrier aircraft operations has additionally been suggested as a possible means of mitigating noise at Homestead. A federal government imposed limitation on the number of air carrier operations to a forecast or artificial level at a public use airport is not authorized by federal law because such a limitation would have the direct or indirect effect of regulating the rates, routes or services of air carriers, contrary to the Airline Deregulation Act of 1978. The U.S. Congress deregulated the airline industry in the Airline Deregulation Act—terminating federal authority to regulate an air carrier's rates, routes, and services. Other than statutory provisions on very limited regulations related to slots and essential air service, there is no statutory provision for federally imposed aeronautical use restrictions at a civilian airport.

A local government in its role as airport proprietor, such as Dade County, has the authority to adopt reasonable, nondiscriminatory restrictions on aircraft operations that do not impose an undue burden on interstate commerce. Any such restrictions proposed by an airport proprietor must comply with the Airport Noise and Capacity Act of 1990 (ANCA). ANCA provides that a restriction on the operation of Stage 3 aircraft (which would be the air carrier and cargo aircraft in operation at Homestead) may become effective only if agreed to by the airport proprietor and all aircraft operators, or if not subject to such an agreement, if submitted to and approved by the FAA under specific statutory criteria. The statutory criteria require a detailed analysis to confirm that the restriction is reasonable, nonarbitrary, and nondiscriminatory; the restriction does not create an undue burden on interstate or foreign commerce; the restriction does not adversely affect airspace, safety, or efficiency; and there has been adequate opportunity for public comment.

It is a relatively common practice for airport proprietors to engage in noise evaluation as airports develop and create higher levels of noise. Most noise evaluations done by airport proprietors include consultation

with other federal, state, and local agencies having land use jurisdiction in the area. In the case of Homestead, this would certainly include the National Park Service. The SEIS could include a commitment for Dade County, in consultation with the FAA, NPS, and other appropriate parties, to periodically review the noise impact of Homestead and to develop, maintain, and implement a noise mitigation program to minimize noise to the extent possible for the community and the national parks and refuges. Periodic reviews at reasonably-spaced timeframes can review the extent of growth in aircraft operations and noise, advances in aircraft noise reduction, advantageous technological advances in aircraft and air traffic operation, and changes in community development patterns and in national park and refuge plans and operation that are relevant to noise from Homestead. Such reviews can also provide the basis for determining whether airport noise restrictions are needed to reasonably abate noise. Technological advances that are beneficial to noise, including aircraft source noise reduction, are expected by the FAA to advance at a more rapid pace than HST would grow as a commercial airport. The prospects are excellent for technological advances to reduce aircraft noise to a greater extent than can currently be analyzed.

Possible Future Expansion

If a commercial service airport at HST successfully captured air transportation markets and achieved forecast levels of operations, at some point the airport could reach the operating capacity of the single runway, which approximates 231,000 annual operations. If and when growth approached that level, Miami-Dade County could propose to build a second runway to better accommodate the traffic demand and more efficiently handle operations. In fact, the Airport Layout Plan for HST developed by Miami-Dade County includes, for future facility planning purposes, a second runway 9,000 feet long and parallel to and 3,500 feet southeast of the present runway.

Given the capacity of the existing single runway at HST, there is no foreseeable need for a second runway for capacity reasons well beyond 2015. A new federal EIS would be required, in addition to environmental and development impact analyses required by the State of Florida. If the construction of a second runway were approved and operations began near the time the existing runway is forecast to reach 100 percent capacity, the time frame for second runway initial operation could be around 2038. Assuming the addition of a second runway, the time frame in which a two-runway system at HST might reach capacity is estimated to be 2057 or later.

The ability to analyze a runway so far into the future beyond a reasonably foreseeable time frame is highly speculative, particularly in an area of high technology like the aviation industry. Aircraft types, and the technological advancements that are certain to occur in the operation and control of aircraft, as well as in the airspace, are not currently defined for conditions so far into the future. A quantitative noise analysis using detailed noise modeling would be so highly speculative as to be unreliable. The following information provides a current best qualitative discussion of possible noise implications of a future second runway.

If a second runway were constructed, it would probably be initially used principally to reduce congestion on the existing runway. Airports are usually operated so that aircraft departures occur on the inboard runway closest to the terminal and aircraft arrivals occur on the outboard runway. With the terminal complex north of the existing runway at HST, this operational scheme would be expected, applying today's general operating mode. Military aircraft conducting overhead approaches and general aviation touch-and-go training would more likely be conducted on the new parallel runway to avoid aircraft using the existing runway, because the patterns associated with these activities would be south of the airport. Approach paths for itinerant operations on a new runway would likely extend straight in from positions at least 3 miles from touchdown.

If the airport and its level of operations continued to grow and if a new terminal area were developed between the runways, it is likely that the operational use pattern of the airport would shift. Airports with mid-field terminal complexes between runways typically operate with mixed operations on both runways. This means that both arrivals and departures by passenger aircraft would likely occur on each runway, with the runway selected being related to the side of the terminal on which the user has its gates. Activity by general aviation, maintenance, military and cargo operators (except local military and general aviation operations) would likely continue to use the existing runway since those ground-related facilities would be on the north side of the airfield. It may logically be assumed that if half of the passenger aircraft operators used gates on the south side of the mid-field terminal, they would use the south (new) runway. All other aircraft operators could be expected to use the existing runway for itinerant operations, but all local operations (touch-and-go training and overhead approaches) would probably be conducted on the south (new) runway to avoid conflicts with operations on the north runway.

Flight paths for approaches to the new runway would likely remain along the runway centerline for itinerant traffic, but a divergent departure course occasionally would be required when simultaneous takeoffs were conducted from both runways. It is likely that the divergent departure course would be along a heading or electronic course 15 degrees to the south of the extended centerline of the new runway. This divergence meets current FAA standards for traffic separation. It is required only when departures are made at the same time from both runways.

Given the speculative nature of the fleet mix, airport geometry and operations, and future airspace parameters, the noise effects associated with the potential future development of a second parallel runway at HST can only be qualitatively estimated in general terms. In the early years of a second runway, the primary assumptions are that the aircraft fleet mix and total numbers of aircraft would be about the same as for the maximum one-runway condition, and the existing runway would be predominantly used for aircraft departures (primarily in an east flow) while the second southerly runway would be predominantly used for aircraft arrivals (also primarily in an east flow).

Since departures toward the northeast would be expected to remain predominantly on the existing runway, the noise contours northeast of the airport that are governed by aircraft departures would be about the same as with the one-runway configuration for that time frame, as shown in Figure 4.5-4. Southwest of the airport, with few arrivals expected on the existing runway, the contours would more closely resemble the projected baseline on the southwest end of the existing runway. Long, thin arrival spikes in the noise contours associated with approaches on the second runway would be expected to extend to the southwest from that runway. The width of the noise contours near the airport would be slightly wider with a second runway than with one runway.

If the airport continued to grow, departures and arrivals were distributed relatively evenly on two runways, and a mid-field terminal were developed, the noise contours could be expected to widen along their full length by approximately 3,500 feet (the separation distance between the runways) along the southeastern edge of the airport parallel to the new runway. The length of the contours to the northeast might increase beyond the maximum use one-runway contours, owing to a higher service level, although this could be offset by anticipated reductions in noise of future aircraft types. Under the approaches to both runways, parallel spikes of arrival noise would likely be present to the southwest of the airport. Each arrival spike would be expected to be shorter, but broader than a single arrival spike because of the more equal distribution of arrival traffic on both runways.

The maximum operation of a two-runway system at its capacity could produce noise contours that would roughly duplicate over two runways the contours shown in Figure 4.5-4, although the level of operations for a two-runway configuration at its capacity is less than double the maximum use of one runway, so

duplicating the one-runway noise contour would be an overestimation. A higher proportion of commercial passenger and cargo aircraft and a lower number of smaller general aviation aircraft in the mix would serve to increase contour size and extend it outward northeast and southwest of the airport off the ends of both runways. However, reductions in aircraft source noise in the far future years could counterbalance increased numbers of aircraft by an unknown amount.

4.5.2.2 National Parks and Refuges

A total of over 35,000 noise values were calculated for a set of 539 individual points covering a 4,000 square mile area of south Florida coinciding with Biscayne and Everglades NPs, Crocodile Lake NWR, and Big Cypress National Preserve. The points are centered in grids that were developed to geographically cover the national parks and refuges. These grids are designated A, B, C, D, and E (see Figures 3.5-9, 3.5-10, 3.5-11, 3.5-12, and 3.5-7).

This section summarizes the projected noise effects in the national parks and refuges that may occur if the single runway at HST were intensively used to its full capacity for a commercial airport (i.e., maximum use) and if technology does not produce quieter aircraft than the current quietest models by that time. This is a conservative approach that projects the maximum potential aircraft noise effects that could occur. Projected noise effects for 2000, 2005, and 2015 are included in Appendix E.

Five noise metrics were used in the grid point analysis. Three of those metrics have been graphed to show noise comparisons using a single-event metric (LAmax), a cumulative metric (Leq(h)), and a Time Above ambient metric (TAamb). Data from all five metrics are included in detailed tabular form in the Technical Memorandum (**Landrum & Brown 1999b**). As Figures 4.5-1 through 4.5-4 show, a portion of Biscayne NP along the shoreline and into the bay is currently within the DNL 60 dB contour. That contour would increase in size, beginning with a slight increase in 2005 and growing by a small amount in subsequent years. The change from baseline DNL levels would be less than 3 dB. None of the other parks or refuges would be affected by these levels. Figures 4.5-7, 4.5-10, and 4.5-11, as well as 3.5-6, show that some areas of Biscayne NP would be exposed to SEL levels above 85 dB, as they are currently. The SEL figures only show east flow operations and do not account for west flow operations that are estimated to occur about 6 percent of the time. When departures are to the west, the F-16 SEL 85 dB footprint extends into the eastern edge of Everglades NP under both current and future conditions. The civil aircraft SEL 85 dB footprints are not expected to extend into Everglades NP.

LAmax. The LAmax metric has been selected to provide an indication of the loudest instantaneous noise levels that are likely to be associated with the Proposed Action. LAmax is not a cumulative metric and does not reflect the duration of a noise event or the number of events that occur over time. In fact, the majority of the highest LAmax levels reported in this document are for aircraft events that occur less than once per day and, in some cases, less than once per week. This is because, from a fixed reference point on the ground, a maximum LAmax value may occur only when a particular type of acoustically dominant aircraft happens to fly relatively close to the point.

LAmax levels can be compared with ambient noise levels, but caution must be exercised because ambient levels are averages over a sampling period (usually 3 hours in this SEIS) and are actually Leq values combining sound events that are both quieter and louder than the resulting ambient level. Imbedded within the ambient levels, therefore, are values that are substantially higher than the estimated ambient value. The difference between the reported LAmax value at a given point and its ambient value for that point will therefore be larger than if the LAmax were compared to the highest value embedded in the ambient data.

Figure 4.5-12 graphically depicts the changes in LAmax at the grid point locations due to the Proposed Action at maximum use of one runway. The changes shown in the figure are concentrated beneath the proposed flight paths for HST. The largest effects of 10 dB or more are confined to points that are at considerable distance from the airport. This is due to the dominance of military aircraft in the areas closest to the airfield. Areas north and west of HST are dominated by aircraft noise from other airports in the ROI. **Figure 4.5-13** shows the resulting LAmax levels and can be compared to current LAmax levels in Figure 3.5-14.

The Proposed Action at maximum use of the single runway would result in little difference in the maximum sound level (LAmax) in the areas closest to HST that receive the loudest single-event noise. The LAmax in Biscayne NP and Crocodile Lake NWR would continue to be dominated by military aircraft that are louder than civil aircraft. In areas that are more remote from HST, such as in western and southern Everglades NP and in Big Cypress National Preserve, the Proposed Action would result in LAmax increases exceeding 10 dB in some areas. The LAmax increases, on the whole, would occur in areas farther from the airport where civilian and military flight tracks would diverge—in Everglades NP under the FAMIN approach from the southwest and under the MNATE departures in the southeast, and in Big Cypress under the WORPP approach from the northwest (see Section 2.2 for a description of the air traffic fixes).

In the areas that would be expected to receive the most increase in LAmax, the absolute LAmax values would remain lower than in areas closer to the airport. The effects on the resulting LAmax absolute values in the national parks and refuges can be generally understood by comparing the color-coded graphically mapped LAmax absolute value ranges of the Proposed Action at maximum use (Figure 4.5-13) to the existing condition at Homestead ARS (Figure 3.5-14).

To provide a broad sample of the comparison between the Proposed Action and other alternatives (Commercial Spaceport and Mixed Use/No Action, which is the same as the projected baseline), **Table 4.5-6** lists the LAmax values for the 37 points at which ambient noise levels were measured (see Section 3.5.2.1).

Leq(h). The Leq(h) metric represents the average noise level over the one hour period having the most aircraft operations in any 24 hour period. It incorporates the noise level of each event, the duration of each event, and the number of events that occur over the specified one hour time period. Leq metrics in general are sometimes criticized because they appear to mask individual loud events in the averaging process. However, individual loud events are actually accentuated in the calculation. The Leq(h) metric provides an indication of the cumulative effects of multiple noise events with different amplitudes, which LAmax and TAamb do not address. LAmax addresses amplitude but not the duration or number of events, and TAamb indicates the duration of events above a specified threshold.

Figure 4.5-14 illustrates the changes in Leq(h) under the Proposed Action at maximum use of one runway, and **Figure 4.5-15** shows the resulting Leq(h) levels. Figure 4.5-15 can be compared to current conditions in Figure 3.5-13. At a number of points, both the projected baseline Leq(h) and the Proposed Action Leq(h), as modeled with the INM, were below average traditional ambient levels. Very few areas in the national parks and refuges would experience as much as a 5 dB increase in peak Leq(h) above the traditional ambient level as a result of the Proposed Action at maximum use of the single runway. Leq(h) changes of less than 5 dB are *de minimus* and are mapped as no change because so few people noticeably react to such small changes in cumulative noise at low levels of aircraft noise exposure. Areas showing an increase of between 5 and 9.9 dB would be in eastern Everglades NP, as graphically depicted on Figure 4.5-14. The resulting absolute peak Leq(h) values in the areas of Leq(h) increase at maximum one-runway use, ranging from 35.1 to 45.0 dB, are considered to be low Leq values.

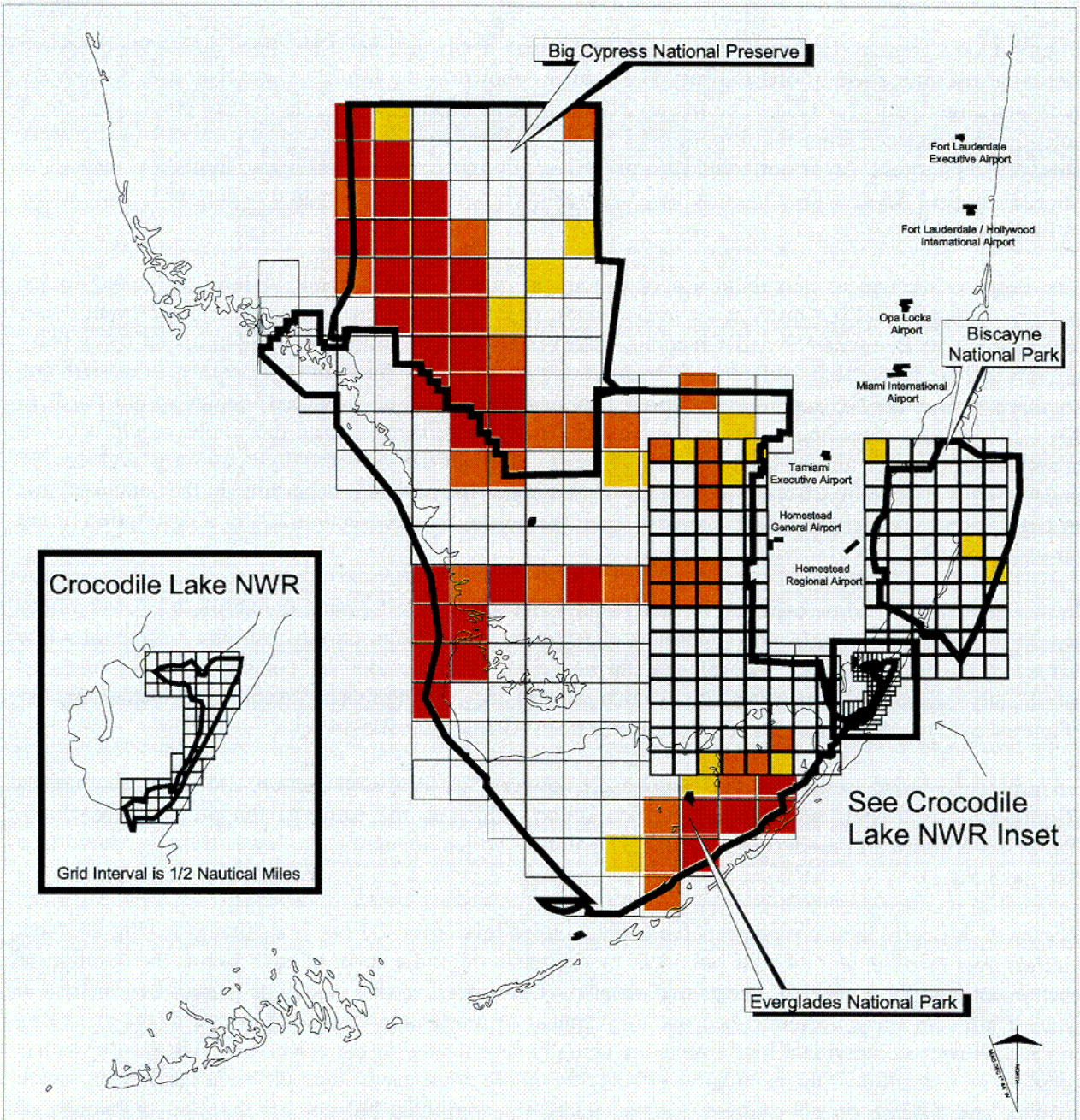
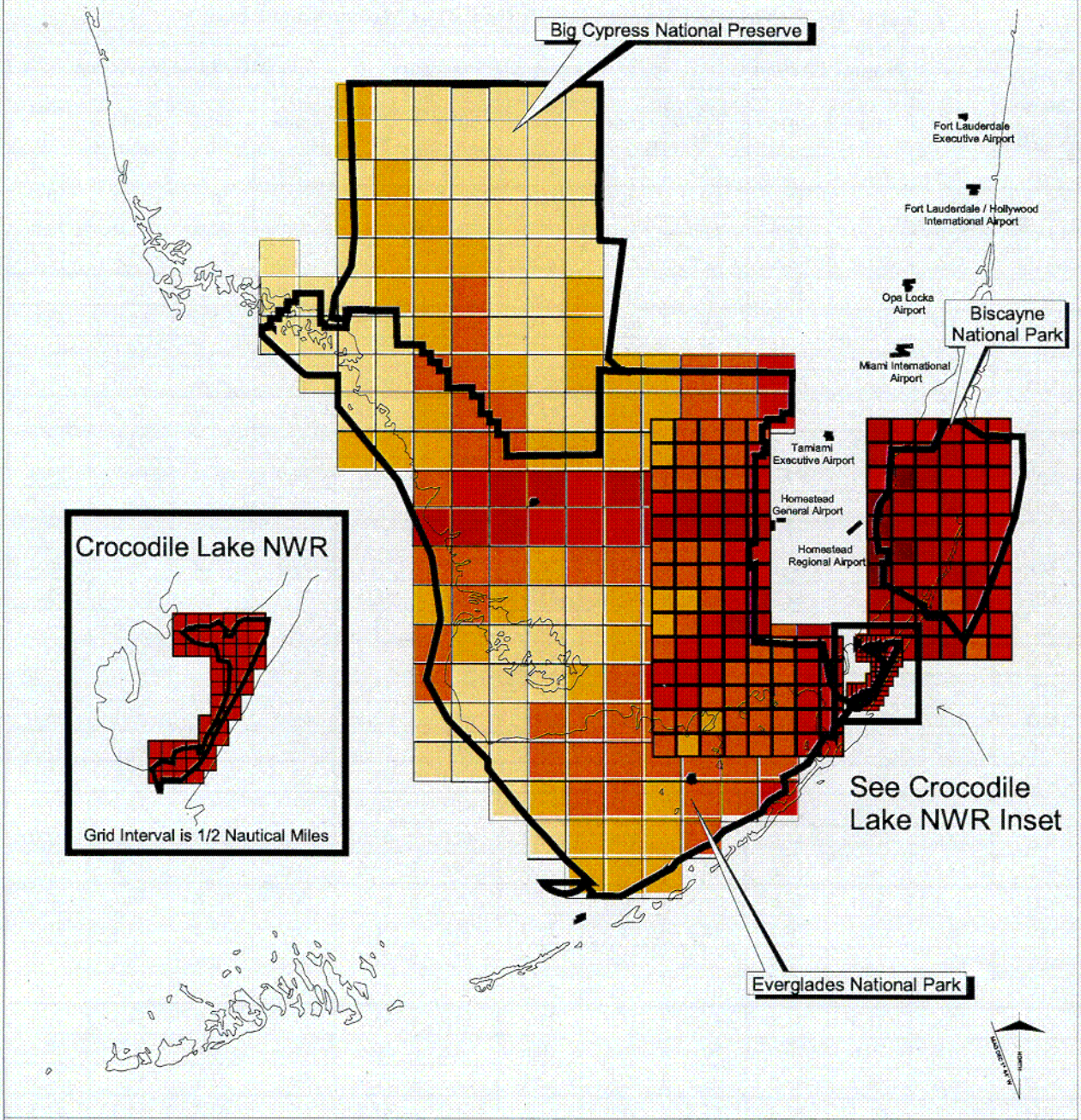


Figure 4.5-12
Differences in LAmax—Proposed Action vs. No Action at Maximum Use of One Runway

C-4



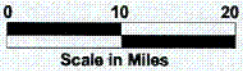
LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

LAmax Level

- <45 dB
- 45.1 - 55 dB
- 55.1 - 65 dB
- 65.1 - 75 dB
- 75.1 - 85 dB
- >85 dB

2045161960



Source:
Landrum & Brown 1999b

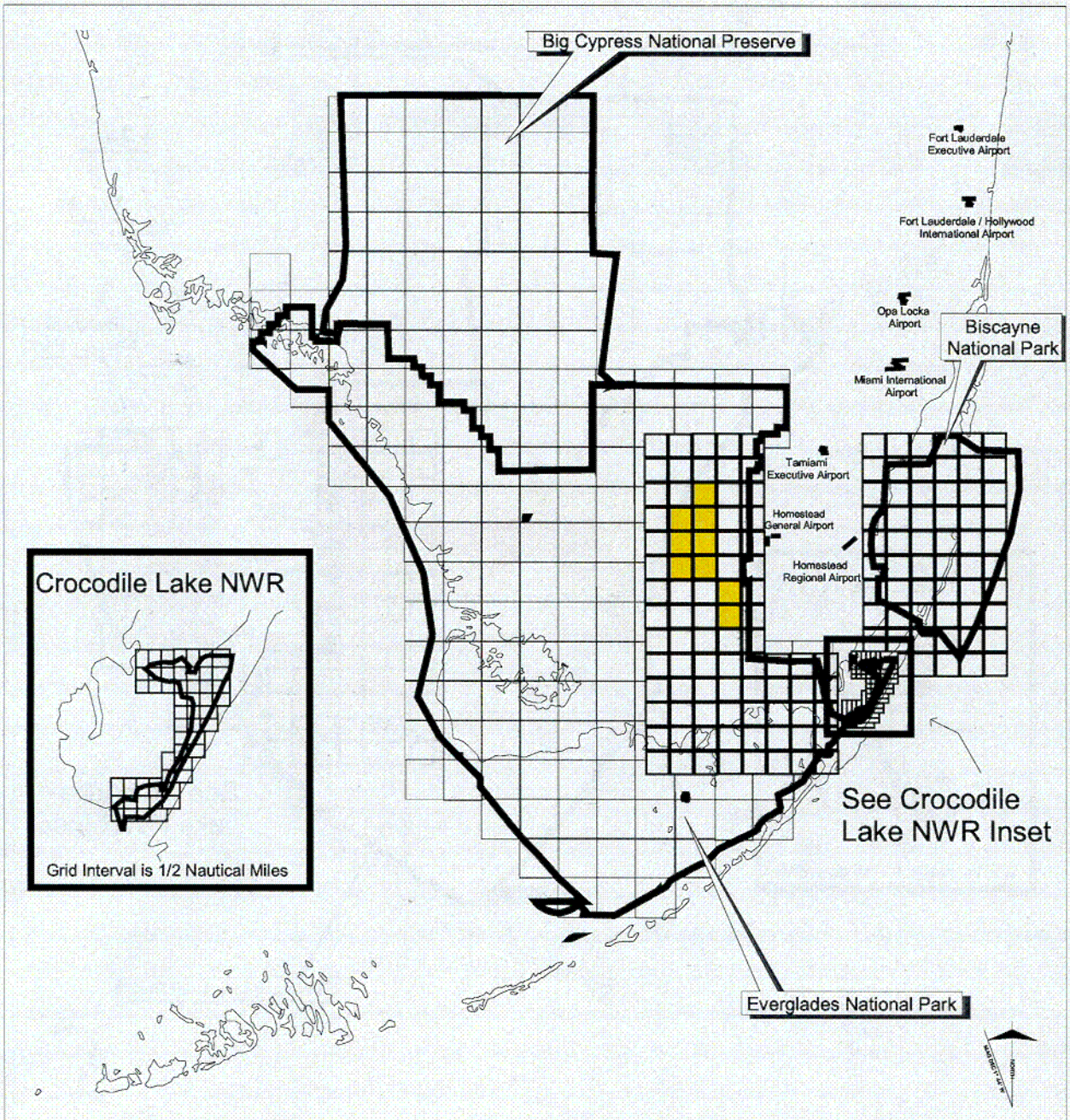
Figure 4.5-13
LAmax—Proposed Action at Maximum Use of One Runway

C-5

Table 4.5-6. Modeled LAmax Levels (in dB) at Measurement Points

Measurement Point[1]	Proposed Action				Commercial Spaceport				Mixed Use/No Action			
	2000	2005	2015	Max Use	2000	2005	2015	Max Use	2000	2005	2015	Max Use
MA	79.9	80.4	79.9	79.9	79.9	85.8	85.8	85.8	79.9	79.9	79.9	79.9
MAA	30.9	32.1	32.1	32.1	30.9	30.9	30.9	30.9	30.9	30.9	30.9	30.9
MAC	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0
MAD	72.6	72.6	72.6	72.6	72.6	72.6	72.6	72.6	72.6	72.6	72.6	72.6
MAE	35.6	38.5	38.5	38.5	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
MB	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9
MC	66.8	67.8	66.2	66.2	66.8	66.8	64.1	64.1	66.8	66.8	64.1	64.1
MD	66.6	69.7	69.0	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6
ME	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9
MF	94.7	94.7	94.7	94.1	94.7	94.7	94.7	94.7	94.7	94.7	94.7	94.7
MG	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0	94.0
MH	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7
MI	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
MJ	69.9	69.9	66.8	66.8	69.9	76.1	76.1	76.1	69.9	69.9	66.8	66.8
MK	62.3	62.3	62.3	62.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3
ML	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5
MM	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4
MN	42.7	51.3	51.3	51.3	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
MO	64.8	64.9	64.9	64.9	64.8	64.8	63.1	63.1	64.8	64.8	63.1	63.1
MP	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
MQ	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1
MR	62.4	62.4	62.4	63.4	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5
MS	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
MT	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
MU	56.8	59.4	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8
MV	78.2	78.2	78.2	78.2	78.2	78.2	78.2	78.2	78.2	78.2	78.2	78.2
MW	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4
MX	57.8	61.9	61.9	61.9	57.8	57.8	57.8	57.8	57.8	57.8	57.8	57.8
MY	45.8	51.5	51.5	51.5	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
SD1	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6
SD2	56.6	58.2	58.2	58.2	52.1	52.1	52.1	52.1	52.1	52.1	52.1	52.1
SD3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3	61.3
SD4	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
SD5	52.9	54.8	54.8	54.8	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5
SD6	23.5	32.7	32.7	32.7	19.6	19.6	24.8	24.8	19.6	19.6	24.8	24.8
SD7	35.1	40.8	40.8	40.8	18.7	18.7	24.4	24.4	18.7	18.7	24.4	24.4
SD8	27.7	30.8	30.8	30.8	21.9	21.9	27.7	27.7	21.9	21.9	27.7	27.7

Source: **Landrum & Brown 1999b.**
Note: [1] See Figure 3.5-4 for location of measurement points.



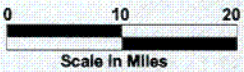
LEGEND

-1553746487

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

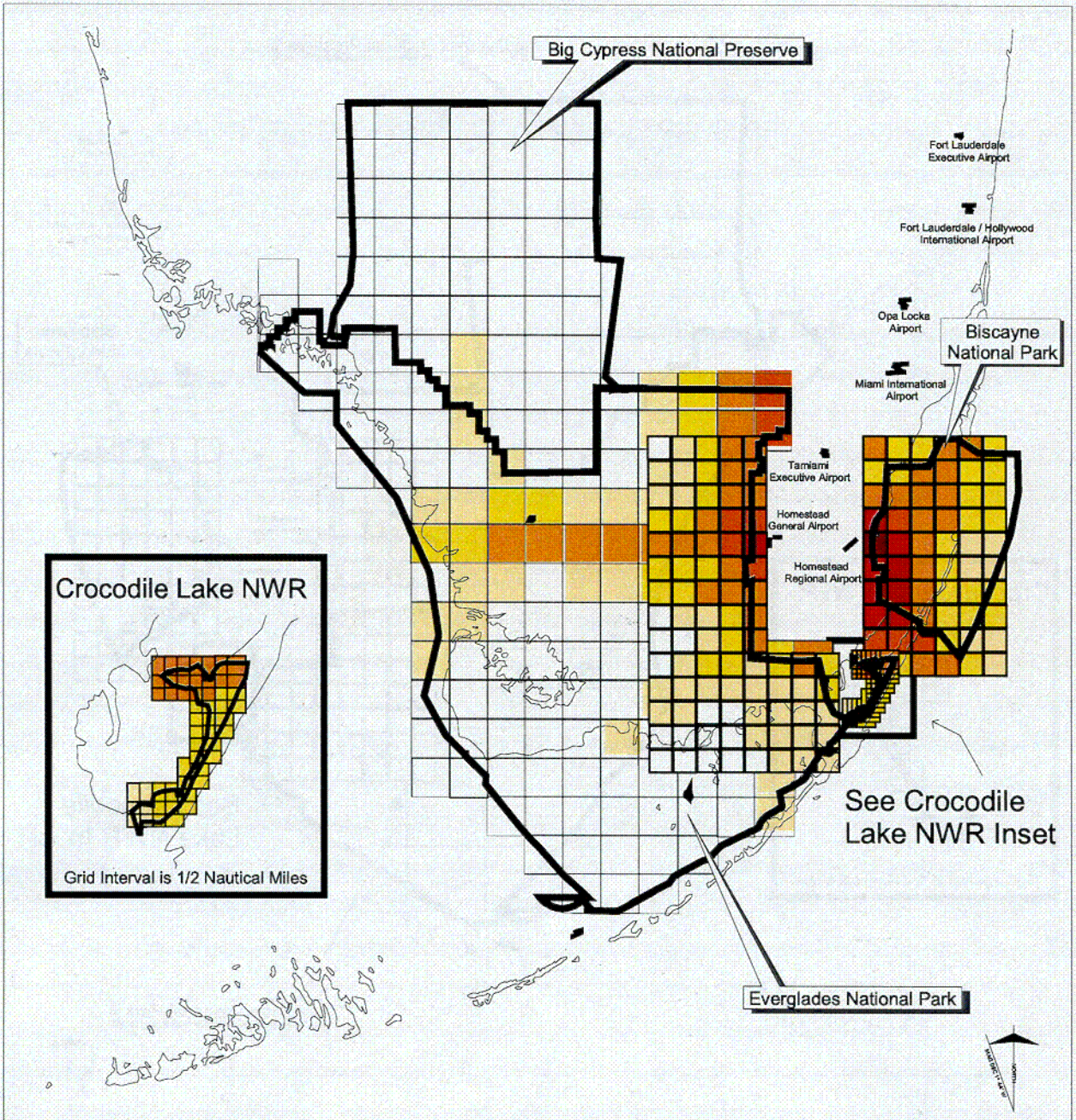
Change in Peak Leq (h)

- 15 dB or greater decrease
- 10 - 14.9 dB decrease
- 5 - 9.9 dB decrease
- no change
- 5 - 9.9 dB increase
- 10 - 14.9 dB increase
- 15 dB or greater increase



Source:
Landrum & Brown 1999b

Figure 4.5-14
Differences in Peak Leq(h)—Proposed Action vs. No Action at Maximum Use of One Runway



LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

Peak Leq (h) Level

- < 30.0 dB
- 30.0 - 35.0 dB
- 35.1 - 40.0 dB
- 40.1 - 45.0 dB
- 45.1 - 50.0 dB
- 50.1 - 55.0 dB
- 55.1 - 60.0 dB
- > 60 dB

-1827042730

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-15
Leq(h)—Proposed Action at Maximum Use of One Runway

C-7

There are peak Leq(h) increases from the Proposed Action that are less than 5 dB above both the projected baseline and the traditional ambient that are apparent in the absolute peak Leq(h) values mapped on Figure 4.5-15. Compared to the existing condition (see Figure 3.5-15), the maximum use of the single runway projects increases in absolute peak Leq(h) values. This would include Everglades NP along the concentrated approach overflights from the WORPP and FAMIN fixes and on the eastern edge of the park along the VFR flyway. Compared to existing conditions, peak Leq(h) absolute values would also be higher under the downwind approach and departure routes south of the airport in southeastern Everglades NP and Crocodile Lake NWR, and in Biscayne NP under the departure route to Caribbean destinations. The increases in peak Leq(h) reflect more time of exposure than louder peak noise levels. In most areas of the national parks and refuges that are more than a few miles from the airport, these absolute peak Leq(h) values from aircraft noise would still be below traditional ambient levels (i.e., all sounds except aircraft).

Table 4.5-7 lists computed Leq(h) levels for the Proposed Action and alternatives at the sites where ambient noise levels were measured and also shows the traditional ambient levels for those points.

Time Above Ambient. The TAamb metric has been selected to provide an indication of the amount of time during the average day that aircraft are likely to be above the traditional ambient level. As such, it is the metric most sensitive to changes in the number of aircraft operations, and captures the effect down to very low levels. It describes cumulative effects as increases in the number of minutes per day that aircraft are likely to be louder than ambient, and focuses on the duration of the noise exposure more than on its magnitude (loudness). The unit of measurement is therefore minutes rather than decibels. Decibel units are involved in the TA assessment, but only to define the traditional ambient levels as the threshold for calculating the amount of time above.

TAamb levels were computed for 305 points covering Everglades NP, Biscayne NP, Crocodile Lake NWR, and selected monitoring and supplemental analysis locations. Because no ambient noise levels are available for Big Cypress National Preserve, except at a few specific measurement sites, none of the 305 points apply to that area. Computed changes in TAamb durations from the Proposed Action at maximum use are graphically depicted in **Figure 4.5-16**. The sensitivity of the TAamb metric to increasing aircraft activity is immediately evident. Large areas of Biscayne NP, Everglades NP, and Crocodile Lake NWR are projected to experience increases in TAamb with maximum use of the single runway. The greatest increases of two hours or more per day would be along the approach to Runway 5 close to the airport in Everglades NP.

These areas would be affected by east departures on Runway 5 as they climbed into the right turn to the south and continued 270 degrees to a north heading, passing to the west of HST and gaining sufficient altitude to pass over the MIA airspace to the north. Arrivals to Runway 5 would pass under these departing aircraft west of HST over east Everglades NP. This overlapping of aviation activity with departures at higher altitudes and arrivals at lower altitudes accounts for the concentration of areas that would experience more than an hour of additional TAamb in east Everglades NP. The trail of darker cells (10 to 60 minute increases) cutting across the central portion of west Everglades NP is a result of east flow arrivals from the north and west in areas where there has been very little previous military activity.

Table 4.5-7. Modeled Leq(h) Levels (in dB) at Measurement Points

Measure-ment Point[1]	Traditional Ambient Sound Level	Proposed Action				Commercial Spaceport				Mixed Use/No Action			
		2000	2005	2015	Max Use	2000	2005	2015	Max Use	2000	2005	2015	Max Use
MA	51.8	46.8	47.8	49.6	49.3	46.6	50.5	52.6	52.6	46.6	46.6	46.4	46.4
MAA	45.4	9.3	11.3	13.8	15.0	7.7	8.2	9.6	9.6	7.7	8.2	9.6	9.7
MAC	40.8	35.0	35.8	37.5	37.0	34.8	34.8	35.0	35.0	34.8	34.8	34.9	34.9
MAD	39.2	35.2	36.3	38.5	37.9	35.0	35.0	35.2	35.2	35.0	35.0	35.1	35.1
MAE	43.5	15.2	16.2	18.2	19.6	14.2	14.1	15.2	15.2	14.2	14.1	15.1	15.2
MB	54.2	35.7	38.3	40.7	43.4	27.8	28.4	28.2	28.2	27.8	28.4	28.1	28.2
MC	48.2	36.5	37.5	37.1	38.2	36.0	36.6	34.6	34.6	36.0	36.3	33.6	33.6
MD	49.8	36.7	38.5	41.2	41.0	35.9	36.1	36.1	36.1	35.9	36.1	36.0	36.0
ME	51.6	30.8	33.4	36.2	37.5	28.1	28.3	28.6	28.6	28.1	28.2	28.5	28.5
MF	47.3	55.6	56.1	57.0	56.4	55.1	55.3	55.5	55.5	55.1	55.1	55.0	55.0
MG	56.2	55.0	55.6	56.7	55.9	54.3	54.5	54.6	54.6	54.3	54.3	54.2	54.2
MH	45.1	58.1	58.2	58.4	58.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
MI	48.6	34.3	35.5	36.8	37.3	33.9	34.3	34.1	34.1	33.9	34.1	33.7	33.7
MJ	54.9	41.9	42.2	39.1	39.3	41.9	44.5	45.1	45.1	41.9	42.1	38.6	38.6
MK	46.5	32.3	34.7	37.0	39.4	24.2	24.4	24.6	24.6	24.2	24.4	24.6	24.8
ML	56.2	40.1	40.5	38.5	39.0	39.9	41.7	41.5	41.5	39.9	40.1	37.1	37.1
MM	54.9	47.8	48.1	48.8	45.5	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8
MN	45.7	26.5	26.8	28.2	28.6	26.2	26.1	26.7	26.7	26.2	26.1	26.7	26.8
MO	41.0	40.4	41.2	41.8	42.2	39.8	40.5	40.1	40.1	39.8	40.5	40.1	40.1
MP	49.6	39.5	40.7	40.9	42.0	39.1	39.8	38.8	38.8	39.1	39.5	37.9	37.9
MQ	47.2	15.8	17.4	19.1	19.5	15.4	15.6	15.9	15.9	15.4	15.5	15.8	15.8
MR	36.0	34.4	37.0	39.4	42.1	25.6	25.8	26.1	26.1	25.6	25.8	26.0	26.1
MS	49.3	19.7	20.7	21.6	22.2	19.4	20.0	20.1	20.1	19.4	20.0	20.0	20.0
MT	42.0	12.7	15.6	18.4	19.1	11.4	12.0	13.0	13.0	11.4	12.0	12.9	12.9
MU	46.7	23.5	25.5	27.4	27.9	21.8	22.0	22.2	22.2	21.8	21.9	22.1	22.1
MV	31.2	40.2	41.3	42.5	43.9	35.5	35.6	35.9	35.9	35.5	35.6	35.9	36.0
MW	41.3	35.3	36.8	39.4	38.7	35.0	35.1	35.2	35.2	35.0	35.0	35.2	35.2
MX	39.9	25.0	28.8	31.7	31.7	23.6	23.7	23.9	23.9	23.6	23.7	23.8	23.8
MY	45.8	9.9	15.6	18.5	18.9	6.6	7.4	8.6	8.6	6.6	7.3	8.4	8.4
SD1	46.2	29.9	31.5	32.9	34.5	22.6	22.6	22.7	22.7	22.6	22.6	22.7	22.7
SD2	39.7	29.0	32.7	35.2	37.1	22.8	23.5	23.5	23.5	22.8	23.5	23.5	23.6
SD3	44.6	20.9	21.9	23.3	23.8	20.5	20.7	20.8	20.8	20.5	20.6	20.7	20.8
SD4	43.2	9.6	13.2	16.1	16.7	7.8	8.4	9.6	9.6	7.8	8.2	9.2	9.2
SD5	39.0	21.5	25.2	28.2	29.9	15.4	15.8	16.7	16.7	15.4	15.8	16.6	16.7
SD6	34.0	8.8	10.8	13.5	15.1	7.1	7.1	9.0	9.0	7.1	7.1	9.0	9.1
SD7	33.7	6.5	8.4	10.7	13.1	0.3	1.1	4.0	4.0	0.3	1.1	3.9	3.9
SD8	34.1	5.6	7.1	9.8	10.8	4.4	5.1	7.6	7.6	4.4	5.1	7.6	7.6

Source: **Landrum & Brown 1999b.**
Note: [1] See Figure 3.5-4 for location of measurement points.

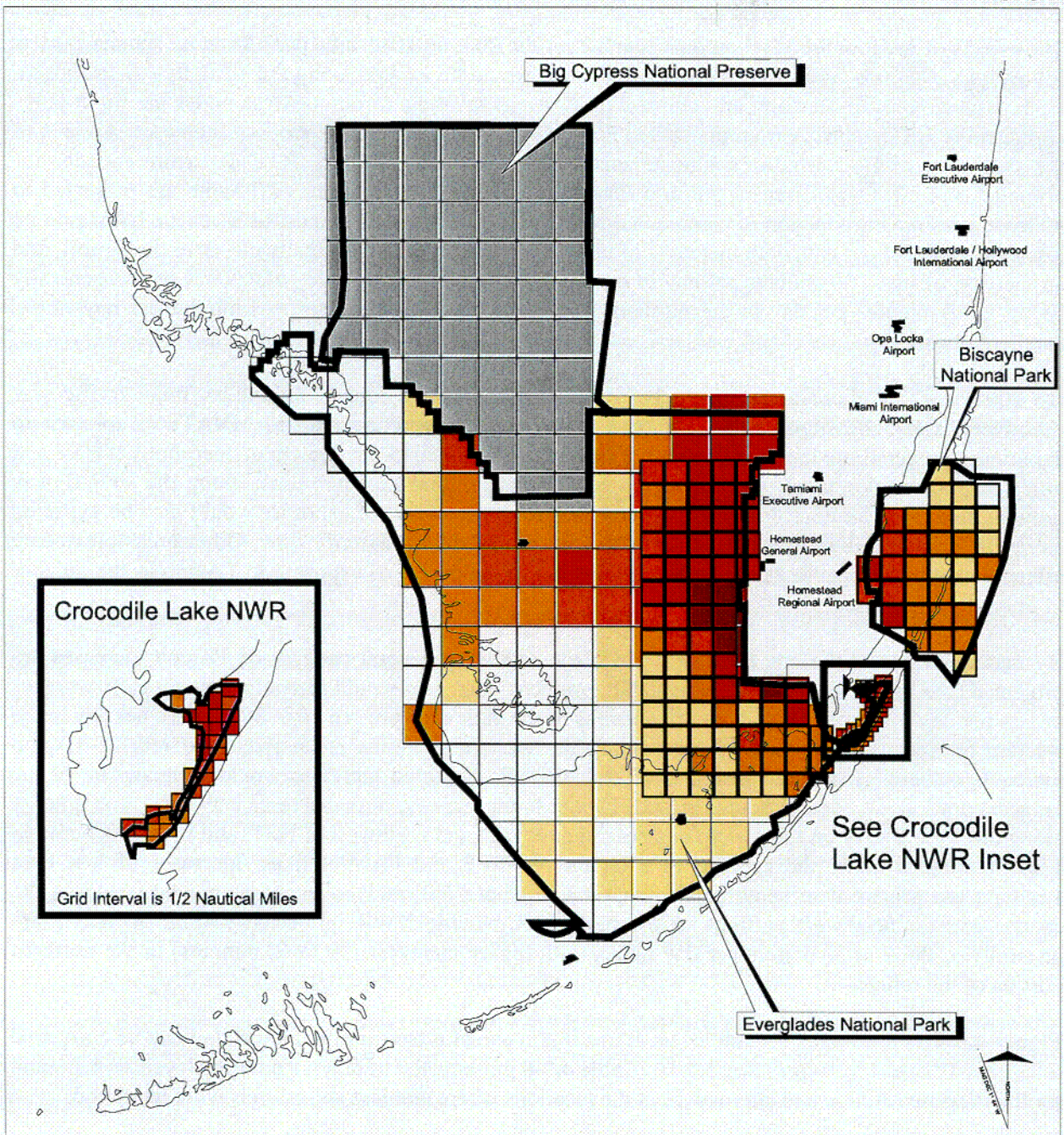


Figure 4.5-16
Differences in TAamb* — Proposed Action vs. No Action at Maximium Use of One Runway

* Traditional Ambient (excluding aircraft noise) is used to define ambient levels.

L-8

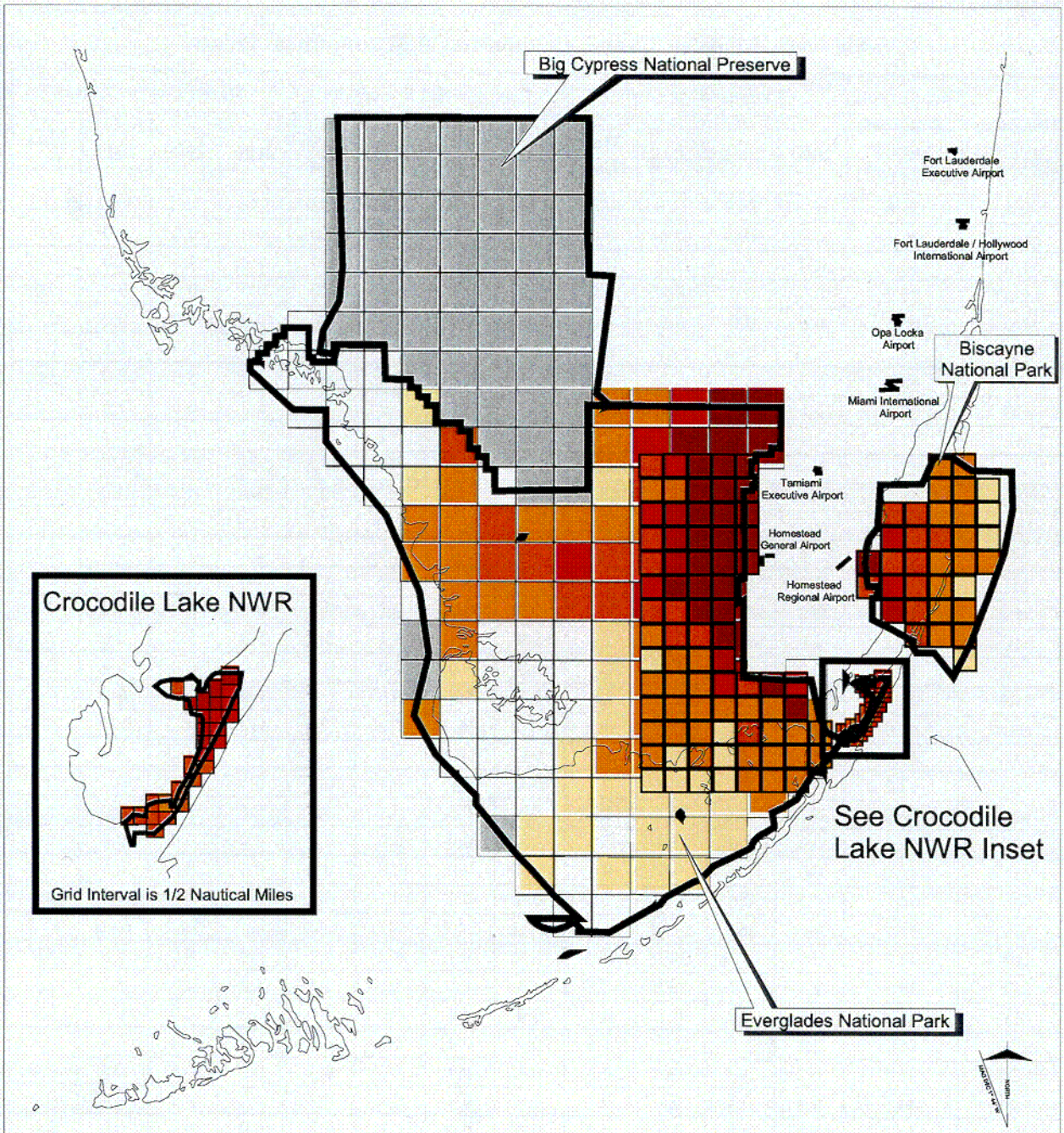
The effects of the Proposed Action on TAamb over the 2000 to 2015 time period can be summarized as follows: in 2000, the areas with the longest TAamb would be located along the VFR flyway leading to HST passing Kendall-Tamiami and Homestead General Aviation Airports. Areas under the flight paths approaching HST and MIA from the WORPP/FAMIN fixes would also experience increases. An area to the southwest of HST would experience smaller increases under the MNATE departure corridor for propeller aircraft. Over Biscayne NP and Crocodile Lake NWR, durations of TAamb are projected to increase with the introduction of commercial traffic at HST. Increases in most of Biscayne NP would be less than 1 minute per day, with increases of up to 10 minutes per day generally closer to the airport, and an increase of up to 30 minutes per day in one grid. Increases in Crocodile Lake NWR would generally be up to 10 minutes per day in the northern portion of the refuge and up to 1 minute per day in the southern portion.

By 2005, each of those areas would be anticipated to receive longer TAamb as more traffic was introduced along the flight paths. The area under the jet departure path to MNATE is forecast to experience longer TAamb, as would more of Biscayne NP. By 2015, the growth of operations at HST and other general aviation airports in the region could result in total exposure times along the VFR flyway growing to exceed an hour or more at several locations. This level of exposure would also be expected along the principal flight tracks leading to and from HST during easterly flow. Other areas previously affected would continue to experience a lengthening of the period of exposure to TAamb as the number of operations increased.

By maximum use of the one runway at HST, the following general patterns of TAamb increases are projected (see Figure 4.5-16). In Biscayne NP, projected increases would generally amount to 10 minutes or less per day in the central and eastern portions of the park and between 10 to 30 minutes per day in the western portion of the park. Two areas along the western shoreline are projected to receive TAamb increases of between 1 and 2 hours. In Everglades NP, projected increases would generally be of the longest duration (i.e., over 2 hours) in grids closest to the runway, with increases between 1 and 2 hours along the VFR flyway on the eastern edge of the park west and northwest of HST, and increases between 1 to 30 minutes under the approaches from the WORPP and FAMIN fixes. Increases of less than 1 minute are projected in south and southeast Everglades NP, and no increases are projected in the central and far northwest portions of the park. In Crocodile NWR, projected TAamb increases are generally in the 1 to 30 minute per day range, with higher increases (30 to 62 minutes) in the northern portion of the refuge.

Figure 4.5-17 shows total TAamb levels at maximum use of a one-runway airport and can be compared to current TAamb levels in Figure 3.5-16. **Table 4.5-8** presents the traditional ambient levels and TAamb for the Proposed Action and alternatives at the locations where ambient noise levels were measured.

Overall Findings. Overall, the data developed on LAmax, Leq(h), and TAamb indicate that projected increases in noise level and duration of exposure from the Proposed Action are generally highest in areas that currently have the lowest noise exposures. The lower the absolute level, the greater the potential for incremental increases above baseline conditions.



LEGEND

- Crocodile Lake NWR Grid Interval 0.5 Nautical Miles
- Eastern Everglades and Biscayne National Park Grid Interval 2.5 Nautical Miles
- Everglades National Park Grid Interval 4.0 Nautical Miles

TAamb* Level

- None
- <1 minute
- 1 - 10 minutes
- 10.1 - 30 minutes
- 30.1 - 60 minutes
- 1 - 2 Hours
- >2 Hours
- No Data

-1272835980

0 10 20
Scale in Miles

Source:
Landrum & Brown 1999b

Figure 4.5-17
Time Above Ambient Level—Proposed Action at Maximum Use of One Runway

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*** Traditional Ambient (excluding aircraft noise) is used to define ambient levels.**

Table 4.5-8. Modeled TAamb (in minutes) at Measurement Points

Measurement Point[1]	Traditional Ambient Sound Level (dB)	Proposed Action				Commercial Spaceport				Mixed Use/No Action			
		2000	2005	2015	Max Use	2000	2005	2015	Max Use	2000	2005	2015	Max Use
MA	51.8	16.4	18.9	31.8	36.2	14.6	15.9	15.0	15.0	14.6	15.1	13.2	13.2
MAA	45.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAC	40.8	4.0	5.9	20.2	16.0	4.2	4.0	4.0	4.0	4.2	4.0	4.0	0.4
MAD	39.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAE	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MB	54.2	17.4	25.0	57.9	102.5	0.9	1.3	1.3	1.3	0.9	1.3	1.3	1.4
MC	48.2	5.5	6.5	5.1	6.2	5.1	6.2	3.8	3.8	5.1	5.8	3.0	3.0
MD	49.8	5.6	6.8	11.8	14.0	5.2	5.8	5.9	5.9	5.2	5.6	5.6	5.6
ME	51.6	0.4	0.6	1.7	2.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MF	47.3	76.4	89.2	151.7	188.3	51.7	53.5	53.8	53.8	51.7	52.9	52.3	52.3
MG	56.2	27.6	29.8	45.1	47.7	19.1	19.2	19.7	19.7	19.1	18.8	18.8	18.8
MH	45.1	60.2	69.3	108.5	134.5	35.8	36.7	37.1	37.1	35.8	36.5	36.6	36.6
MI	48.6	2.4	2.6	4.1	4.7	2.3	2.4	2.6	2.6	2.3	2.2	2.1	2.1
MJ	54.9	7.0	8.0	2.9	2.9	7.0	8.6	4.2	4.2	7.0	8.0	2.9	2.9
MK	46.5	3.2	5.2	12.5	23.1	0.0	0.2	0.2	0.2	0.0	0.2	0.2	0.2
ML	56.2	5.0	5.5	2.1	2.1	5.0	6.1	3.1	3.1	5.0	5.5	2.0	2.0
MM	54.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MN	45.7	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MO	41.0	25.0	35.0	49.0	58.1	31.5	26.3	27.9	27.9	31.5	26.3	27.9	30.1
MP	49.6	10.1	11.8	12.2	14.6	9.6	11.2	9.1	9.1	9.6	10.7	8.0	8.0
MQ	47.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MR	36.0	23.7	31.6	70.4	112.2	5.4	5.6	6.1	6.1	5.4	5.6	6.0	6.1
MS	49.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MU	46.7	0.3	0.6	0.9	1.4	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1
MV	31.2	74.4	86.2	131.6	165.3	51.3	54.4	64.0	64.0	51.3	54.2	63.5	67.5
MW	41.3	10.0	13.9	38.0	47.1	8.9	9.1	9.2	9.2	8.9	8.9	8.9	8.9
MX	39.9	2.1	3.7	12.0	12.3	1.3	1.5	1.5	1.5	1.3	1.5	1.5	1.5
MY	45.8	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SD1	46.2	2.1	3.0	5.2	7.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
SD2	39.7	6.2	10.4	27.4	46.0	0.1	0.3	0.3	0.3	0.1	0.3	0.3	0.4
SD3	44.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
SD4	43.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SD5	39.0	1.1	2.1	6.8	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SD6	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SD7	33.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SD8	34.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: **Landrum & Brown 1999b.**
Note: [1] See Figure 3.5-4 for location of measurement points.
NA Not available

For the LAmax and Leq(h) metrics, large computed increases in noise levels were computed in areas with very low baseline levels. A number of factors contribute to this effect. First, most of the area is parks and refuges and those areas are intended to be quiet. Second, at locations that are relatively close to the airport, baseline levels are clearly dominated by the existing military aircraft operations with respect to both peak noise levels and hourly averaged noise levels. This dominance exists on both the east and west side of the airport for the Leq(h) metric, but for the LAmax metric the dominance is slightly smaller on the west side. This is because the military aircraft are at least 20 dB louder than the civil aircraft on departure, but are equivalent or only slightly louder on approach. This is the primary reason the Leq(h) metric shows no major increases in the central portions of Biscayne NP and Crocodile Lake NWR under the Proposed Action.

To the west, civil approaches would generally occur at lower altitudes and would be dominant across west Everglades NP and the central portion of east Everglades NP. In west Everglades NP and Big Cypress National Preserve, civil aircraft would be dominant because military aircraft are not using the airspace. However, the civil aircraft in those locations would be at high altitudes and using low levels of thrust. Consequently, the actual noise levels would be relatively low, with some computed increases below the measured traditional ambient levels.

The largest changes computed were in the amount of time above ambient. Ambient noise levels tend to be low, and consequently TAamb is very sensitive to changes in noise levels and the number of events occurring at low levels. As a result, the analysis found that the likelihood of detecting the presence of aircraft would be expected to increase proportionately with the increase in civil aircraft operations. Unlike LAmax and Leq(h) findings, however, the largest increases in TAamb from the Proposed Action would be closest to the airport, where the departure and arrival paths converge.

In summary, Figures 4.5-12, 4.5-14, and 4.5-16 show that differences in LAmax are concentrated in locations under proposed arrival tracks for civil aircraft, and there is almost no change in Leq(h) projected above the projected baseline and traditional ambient levels as a result of the Proposed Action. The largest differences over current conditions are depicted in TAamb, and with a few exceptions, those differences are concentrated in the areas closest to the airfield.

The potential effects of noise on the national parks and refuges appear to fall into three general categories:

- Effect on park visitors;
- Effect on animals, birds, and fish; and
- Impairment of the natural soundscape as a park resource.

Many people visit Biscayne NP, Everglades NP, and Big Cypress National Preserve. (Crocodile Lake NWR is closed to public use; access is by Special Use Permit only.) Studies in national parks by FAA, NPS, and Air Force show a correlation between increasing noise levels and visitor annoyance. Visitor annoyance is affected by the volume and intensity of noise (energy level), the amount of time aircraft are heard (duration), and the number of times that aircraft are heard (frequency). The strongest effects seem to be in response to energy level and duration.

Studies also indicate variability in park visitors' reactions to noise. It depends on where they are, what they are doing, their expectations regarding the park experience, and how much other noise they are hearing (both natural and man-made) including how much noise they are generating themselves. Generally, visitors are considered to be less sensitive to aircraft noise in areas of parks where there is substantial human activity and more sensitive to aircraft noise in areas where there is minimal human

activity and where natural sounds dominate. Visitors in groups or accompanied by children tend to be less sensitive to noise than people who are not surrounded by others.

Section 4.6 describes various studies and reports that have addressed visitor reactions to noise in national parks and recreation areas. Statistics in these studies and reports cannot be used to predict the percentage of visitors in the national parks around Homestead that would be annoyed by aircraft noise. More research is needed to develop generalized criteria for predicting visitor reactions to noise in national parks comparable to the body of data that has been developed for community noise. Such research should be targeted towards verifying the best metric(s) to use, establishing statistical confidence in relationships between increases in noise and park visitor annoyance, revealing differences in visitor annoyance based on park use and type of visitor activity, and reaching consensus on the measurement and role of ambient noise in parks.

With respect to potential noise effects on animals, birds, and fish, the projected increases in exposure to aircraft noise are not at levels that have been found in wildlife studies to affect behavior or reproductive success to a degree that suggests a potential for long-term population effects. Noise impacts are not anticipated to affect the viability or success of any species or habitat in the national parks or refuges, as assessed in greater detail in Section 4.11.

Natural sounds are identified as a resource by the NPS. Natural sounds include the wind blowing through the trees, the lapping of water, the calls of birds, the sounds of insects, and other unaltered sounds of nature. The NPS includes the management of natural sounds and soundscapes within the National Park System as part of its legal mandate for protecting park resources unimpaired. Refer to Sections 3.5 and 3.6 for a more complete description by NPS of the value of a national park soundscape and the ongoing work on a Soundscape Management Plan for Biscayne NP.

Biscayne NP, the closest national park to Homestead, currently has an abundance of man-made noises (mostly mechanical) at many sites where noise was measured. It is 95 percent water. The Intracoastal Waterway runs through the park, and motorboats are the predominant way in which visitors travel through and enjoy the park. The extent to which a soundscape plan may be able to remove or reduce man-made noises such as boats, mechanical equipment, and visitor noises is currently unknown. There is presently no basis on which to quantitatively predict that noise levels in Biscayne NP, even assuming the exclusion of aircraft, will be quieter in the future than the current levels. It should also be noted that the natural ambient sound level is not always the lowest relative to other ambient values. At some of the sites where ambient was measured, the sounds of nature at close range, in particular insect activity, were so loud that they effectively masked all other sounds that occurred at greater distances from the noise receiver. Refer to Table 3.5-1 for a comparison of the different ambients that were measured.

Reasonable people can disagree about the practical achievement of natural ambient in all areas of all national parks, but can probably agree that it is environmentally preferable to have less man-made mechanical noise in natural areas of national parks rather than more. The Proposed Action would add more aircraft noise to the south Florida national parks and refuges, which is contrary to NPS noise goals. However, the FAA cannot identify or quantify an "impairment" on park "resources" independent from the effects of noise on people and wildlife, previously discussed. Noise does not produce an effect apart from human and animal hearing and reactions. Noise does not linger in the environment as a permanent impact or impairment.

Florida Keys National Marine Sanctuary

Two points were selected in FKNMS, one in the northern part of the sanctuary and one farther south, to provide a sense of the level of aircraft noise that these areas could be exposed to under the Proposed Action. At the northern location, DNL was modeled at 34 dB with the Proposed Action at maximum use, compared to a DNL of 25 dB under the projected baseline. LAmax at this location would not change from the projected baseline of 65 dB. At the southern location, DNL was modeled to increase from 8 dB under the projected baseline to 17 dB with the Proposed Action at maximum use. LAmax at that location would be 52 dB, compared to a projected baseline of 30 dB. See Appendix E for more discussion of noise at these locations.

State Parks

Sample points were modeled at John Pennekamp and Bill Baggs Cape Florida State Parks and at Key Largo Hammocks State Botanical Site. DNL at John Pennekamp State Park for the Proposed Action at maximum use was modeled at 38 dB, an increase of 1 dB over the projected baseline. LAmax would remain the same at 79 dB. At Bill Baggs Cape Florida State Park, both DNL and LAmax for the Proposed Action at maximum use would remain the same as the projected baseline DNL of 42 dB and LAmax of 70 dB. At Key Largo Hammocks State Botanical Site, peak hour Leq would increase from 34 to 38 dB for the Proposed Action at maximum use. The corresponding DNL value at maximum use would be 35 dB. LAmax would remain the same at 73 dB. See Section 4.14 and Appendix E (including the Addendum) for more discussion of noise at these locations.

South Florida Water Management District Lands

A grid (grid B) was superimposed over a map of the SFWMD lands nearest to Homestead. LAmax, Leq(h), and DNL noise level information was calculated for each grid. At maximum use of the Proposed Action, LAmax would remain the same as the projected baseline throughout these areas. Within the Southern Glades Wildlife and Environmental Area, Leq(h) would increase at maximum use to a range of 34–50 dB, with decibel values decreasing as distance from the runway increases. By comparison, the projected baseline Leq(h) range would be 31–43 dB. In the Model Lands Basin, the Proposed Action maximum use Leq(h) range would be 36–58 dB, compared to the projected baseline range of 29–58 dB. In Frog Pond, the Proposed Action maximum use Leq(h) range would be 44–56 dB, compared to the projected baseline range of 39–56 dB. DNL values show similar patterns of aircraft noise to Leq(h), although DNL values are somewhat lower because Leq(h) calculates cumulative noise based on the busiest hour of the day. See Section 4.14 and the Addendum to Appendix E for more discussion of noise in SFWMD lands. The effects of noise on the Cape Sable seaside sparrow are addressed in Section 4.11.

Cumulative Impacts

Cumulative impacts involve the assessment of the effects of regional air traffic from other airports in the ROI combined with HST air traffic. (Estimates of future air traffic at other airports are provided in Appendix E.) With respect to LAmax, the contributions from other airports over the analysis years would be small, ranging from a high of 80 dB to a low of 20 dB. The higher LAmax levels are concentrated in the northern portion of Everglades and Biscayne NPs, as these areas are influenced by traffic from MIA. Above LAmax of 30 dB, the increase in noise levels over the period of analysis is estimated to be less than 3 dB, and therefore the influence of other regional air traffic on cumulative noise levels when considering the Proposed Action would be very small.

A similar pattern emerges when assessing changes in Leq(h) contributed by other airports. At maximum use of one runway at HST, Leq(h) levels range from about 56 dB to zero, with only 20 points above 40 dB and 80 above 30 dB. Above 30 dB, the average increase in noise level due to other airports is estimated to be less than 2 dB. Cumulative effects resulting from the addition of the noise contributions from other airports to the Proposed Action levels are therefore considered to be minor for Leq(h).

For the TAamb metric, the effect of other airports is more noteworthy, but contributions remain small on a relative basis over the analysis period. Over the analysis period, an overall increase in TAamb of 33 percent is forecast for all applicable points. The largest increase is projected to occur in the northern portions of Everglades and Biscayne NPs as they come under the influence of increasing traffic from MIA. The largest increase in this area is calculated to be from about 370 minutes in 1997 to 520 minutes under maximum use of a one-runway HST. Over a broader area, the relative contribution of other airports is projected to decrease over time under the Proposed Action. In 2000, 41 percent of the forecast TAamb is from other airports, but this decreases to 24 percent as operations at HST increase to their maximum one runway use.

Mitigation Measures

A number of possible flight track options for reducing noise levels in the national parks and refuges were considered in the development of three sound attenuation flight path alternatives as potential mitigation measures for the Proposed Action. NPS requested that consideration be given to flight paths that avoid the national parks altogether, but this was found to be infeasible. The three alternatives analyzed were developed in consultation with the National Park Service and FAA regional airspace managers. No alternative can eliminate aircraft overflights of national parks and refuges, as NPS would prefer. Three of the four national properties are particularly close to Homestead, at least in part, and the south Florida airspace dictates certain operating parameters for Homestead in relation to other aviation traffic. Even existing and projected future conditions will continue to place traffic using other airports and military and government flights using Homestead over the national parks and refuges. In FAA's judgement, the three alternatives analyzed represent the best available changes in flight path locations, consistent with safety and flight efficiency. In the view of NPS, these would continue to impair the soundscape in the national parks. A summary of the alternatives and their effects on the distribution and level of noise in the national parks and refuges is presented below.

Noise Abatement Flight Path Alternative No. 1. This noise abatement alternative includes a number of components (see Figure 2.11-1). In each case, the individual component routes would reduce noise effects in some areas and increase them in others. LAmax levels would not change, but there would be a shift in location associated with moving the FAMIN approach corridor farther south and the MNATE departure to the east. These changes do not translate into appreciable differences in Leq(h). No change of more than 5 dB was calculated at any grid point by 2005, and only three points indicated changes in Leq(h) of more than 5 dB by 2015.

The metric that best illustrates the effects of the noise abatement measures is TAamb. **Figure 4.5-18** shows the differences in TAamb between the abatement flight paths and the unmitigated Proposed Action flight paths at maximum use. Along the WORPP approach west of HST in northeastern Everglades NP, under the MNATE departure in southeastern Everglades NP, and in the western half of Biscayne NP, the TAamb would be less than with the unmitigated flight tracks. In contrast, the area along the extended centerline approach to Runway 5 from the relocated FAMIN approach, along the relocated FAMIN