EPA 904/9-75-006

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

City of Jacksonville, Florida
Wastewater Management Facilities
Arlington-East Service District

EPA PROJECT C120541

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IV
1421 PEACHTREE ST., N. E.
ATLANTA, GEORGIA 30309

DECEMBER 1975

SUMMARY SHEET FOR ENVIRONMENTAL
IMPACT STATEMENT

ARLINGTON-EAST SERVICE DISTRICT
WASTEWATER MANAGEMENT FACILITIES
CITY OF JACKSONVILLE, FLORIDA
PROJECT NO. C120541

Draft (X)

Final ( )

Environmental Protection Agency
Region IV
1421 Peachtree Street, N. E.
Atlanta, Georgia 30309

1. Name of Action

Administrative Action (X)

Legislative Action ( )

2. The subject action of this Environmental Impact Statement is the awarding of grant funds to the City of Jacksonville, Florida for the preparation of plans and specifications for regional wastewater treatment facilities to service the Arlington-East District. The project consists of a 10.0 million gallon per day (mgd) wastewater treatment plant located at Millcoe Road (Alternative 1q) and 13,900 feet of outfall line terminating at the edge of the maintained shipping channel in the St. Johns River.

3. The project will provide for:

(1) The removal of inadequately treated wastewaters from tributary streams.

(2) Treatment facilities to adequately service existing and future sources of wastewater.

(3) Alleviation of existing adverse conditions resulting from the operation of septic systems and small package plants.

(4) Allowance of orderly growth according to the Comprehensive Development Plan for 1990.

(5) Provision of additional odor and noise controls since the publication of the EAS.

(6) Construction only on the part of the site farthest from the nearby residential community and provision of a buffer zone of 118 acres adjacent to the site.

Adverse environmental effects are summarized as follows:

a. Construction Impacts

The construction of treatment facilities and interceptor lines represent a long-term commitment of 46.98 acres of land for the treatment plant site with subsequent loss of approximately half of this acreage as wildlife habitat. Short-term impacts due to construction will be minor but will include dust, noise, odor, vehicle emissions, traffic, and soil erosion. Construction activity in Mill Cove will cause the temporary disturbence of two acres of salt marsh and temporary impact on the aquatic animal community from sedimentation and turbidity. A short-term period of panic selling in the residential neighborhoods surrounding the plant site may also occur before the plant goes into operation.

b. Operational Impacts

The operation of the waste treatment facility will cause the discharge of initially 10 mgd and ultimately 25 mgd of secondary treated wastewater to the St. Johns River and will have other minor impacts related to resource use, operational noise and odor, and the movement of vehicles.

c. Secondary Impacts

Construction of the project will increase the potential for development of areas set aside for preservation and conservation and other sparsely populated sections of the service district with concomitant impact to terrestrial biota and wetland areas. Associated with this increased growth potential is the need for water supply, transportation, parklands, recreational areas, and other community services and facilities.

4. Structural system alternatives considered were:

(1q) Millcoe Road site and transmission system with Quarantine Island outfall.

(1b) Millcoe Road site and transmission system with Blount Island outfall.

(2q) Dunes Area site and transmission system with Quarantine Island outfall.

(2b) Dunes Area site and transmission system with Blount Island outfall.

(3) Dame Point-Fort Caroline Freeway Interchange site and transmission system.

(4) Site north of Craig Field and transmission system.

(5) Site east of Craig Field and transmission system "A".

(6) Site east of Craig Field and transmission system "B".

(7) Site inside eastern boundary of Craig Field and transmission system "A".

(8) Site inside eastern boundary of Craig Field and transmission system "B".

(9) Beacon Hills site and transmission system.

(10) Spanish Point site and transmission system.

(11) Quarantine Island site and transmission system.

(12) Site inside southern boundary of Craig Field and transmission system.

Non-structural systems, process subsystems, odor control, noise control, and effluent and sludge disposal alternatives are also analyzed in the statement. In addition, the "no action" alternative was given full consideration.

5. The following Federal, State, and local agencies and interested groups have been requested to comment on this impact statement:

Federal Agencies

Bureau of Outdoor Recreation
Coast Guard
Corps of Engineers
Council on Environmental Quality
Department of Commerce
Department of Health, Education and Welfare
Department of the Interior
Department of Transportation
Economic Development Administration
Federal Highway Administration
Fisheries & Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
National Park Service
Soil Conservation Service

Members of Congress

Honorable Lawton Chiles
United States Senate

Honorable Richard Stone
United States Senate

Honorable Charles E. Bennett
U. S. House of Representatives

Honorable Bill Chappell
U. S. House of Representatives

State

Bureau of Intergovernmental Relations

Coastal Coordinating Council
Dept. of Environmental Regulation
Dept. of Natural Resources

Department of State
Environmental Regulation Committee
Geological Survey

Honorable Reuben O'D. Askew, Governor

Honorable Daniel A. Scarborough
Florida Senate

Honorable Mattox Hair
Florida Senate

Local

City Pollution Control
Department of Pollution Control
Department of Public Works
Environmental Protection Board
Office of the Mayor
Jacksonville Area Chamber of Commerce
Jacksonville Area Planning Board
Office of City Council
Office of Intergovernment Affairs

Interested Groups

Audubon Society of Duval County
Beacon Hills Harbour
Citizens Advisory Committee to Jacksonville Area Planning Board
Citizens Committee of 100
Clifton Civic Association
Colony Cove Civic Association
Greater Arlington Civic Council
Holly Oaks Community Club
League of Women Voters
N. E. Fla. Air Conservation Council
St. Johns River Water Mgmt. District
Southeast Environmental Council
The Council of Clean Air

6. This draft environmental impact statement was made available to the Council on Environmental Quality (CEQ) and the public on December 26, 1975.

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I. Introduction

Section 102(2)(c) of the National Environmental Policy Act states "the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official..." This statement shall describe "(1) the environmental impact of the proposed action, (2) any adverse environmental effects which cannot be avoided should the proposal be implemented, (3) alternatives to the proposed action, (4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (5) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

The EPA, in response to this mandate, determined that the issuance of funds for design of the proposed Arlington-East Sewage treatment plant is a major Federal action significantly affecting the quality of the human environment. Accordingly, the EPA issued a "Notice of Intent" to prepare an Environmental Impact Statement on October 8, 1974.

The applicant for the funds to construct the proposed facilities is the City of Jacksonville, Florida. The grants project number for the Arlington-East facilities is C120541.

The purpose of the proposed action is to preserve and/or enhance the water resources of the Arlington-East area. This purpose is attained by the provision of control of sources of pollution to surface and groundwater resources while conforming with other major environmental and developmental objectives in the area.

The sources of pollution to be affected in the attainment of project objectives include (1) the upgrading of existing discharges or total removal of such discharges presently causing violations of water quality standards in local waterways, (2) the preservation of high quality waters for recreational, fish and wildlife and aesthetic purposes, and (3) the alleviation or prevention of groundwater contamination.

Examples of other environmental and developmental factors which are incorporated as secondary project objectives include (1) conformance with land use planning objectives, (2) alleviation of existing nuisance conditions from malfunctioning septic tank installations and small package plants, (3) maintenance and enhancement of a high quality of life in the Arlington-East area, (4) minimization of direct adverse effects on the environment, and (5) minimization of secondary adverse effects induced or supported by the project.

The project area may be seen on Figure 1-1 along with the proposed locations of interceptors, pumping stations, treatment facilities and sludge disposal sites. The proposed plant is to be constructed at Millcoe Road (Alternative 1g) with an initial capacity of 10 million gallons per day(mgd) and an ultimate capacity of 25 mgd. The wastewater will be treated by screening, preaeration, grit removal, primary settling, activated sludge aeration, secondary settling, sludge return facilities, and effluent chlorination.

Sludge processing includes holding, centrifuging, heat treatment, vacuum filtration, multiple hearth incineration, and ash disposal.

The proposed treatment plant site is a 46.98 acre tract, located between Merrill Road and Monument Road, on the east side of the proposed Millcoe Road. The closest residential area, Holly Oaks, lies to the east of the plant site. The nearest residence is approximately 1500 feet from the property line.

The site is located in a predominantly well-drained area approximately 40 feet above mean sea level. A 200-foot wide buffer zone and vegetative screen will be retained on the north, west and south sides. Additionally, a 114-acre wooded area will be purchased by the City and dedicated as a recreational area.

Treated plant effluent will be discharged through 13,900 feet of 48-inch force main, including 7,500 feet of subaqueous line, north across Mill Cove and Quarantine Island to the main channel of the St. Johns River.

The costs for the proposed system, first phase, are summarized below:

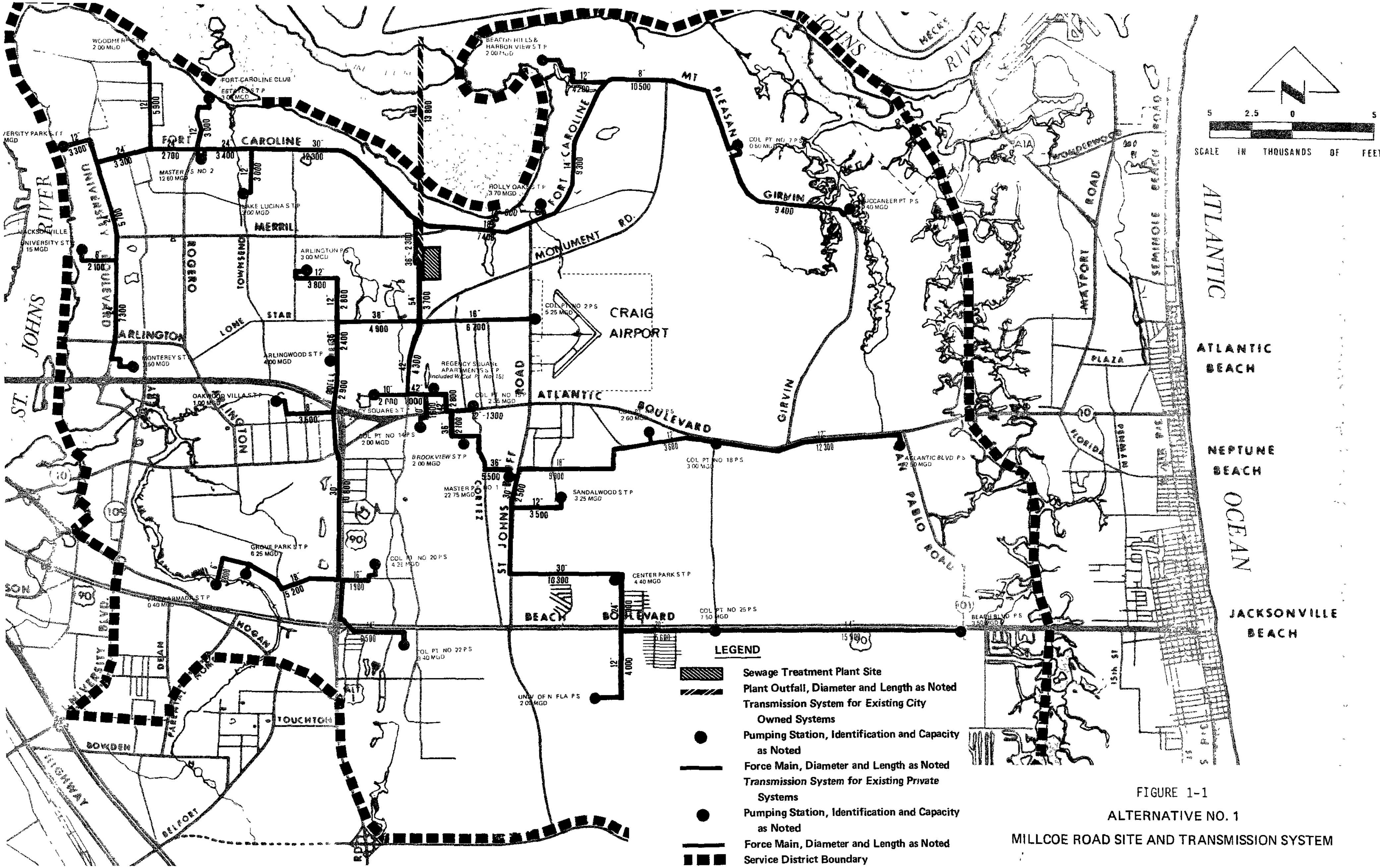


FIGURE 1-1

ALTERNATIVE NO. 1

MILLCOE ROAD SITE AND TRANSMISSION SYSTEM

Sewage Treatment Plant	27,167,500
Force Mains	7,227,200
Pumping Stations	4,325,000
Eng., Legal, Conting., etc. 22.8%	8,828,091
Land, 46.96 acres @ $63.00 plus 114 Acres @ $63.22	1,011,516
Project Cost	48,559,307

The Environmental Protection Agency finances 75 percent of eligible project costs. Certain appurtenant costs, not related to the treatment plant itself, are not eligible for Federal funding. The city and Federal contributions to the total project in dollar amounts and percentage of costs borne by each are given below.

	City	Federal	Total
Dollars	23,538,040	25,021,367	48,559,307
Percentage	48.5%	51.5%	100%

II. The Environment Without the Proposed Action

A. Natural Environment

1. Atmosphere

a. Climate

Jacksonville, located only seven degrees north of the torrid zone, has a climate often more tropical than temperate. The city is located about sixteen miles inland from the Atlantic Ocean and this location, combined with the largely level surrounding terrain and prevailing easterly winds, produces a maritime influence that moderates seasonal temperature changes.

Jacksonville's mean annual temperature is between 69 and 70 degrees. Average temperatures in the hottest months are above 80 degrees. Afternoon thundershowers or sea breezes usually occur on clear hot days; consequently, temperatures exceed 95 degrees only about ten times per year. Night temperatures in summer rarely stay above 80 degrees. The coldest winter months average in the middle fifties but temperatures do fall to freezing or below about twelve times per year. The average relative humidity is about 74 percent and ranges from about 90 percent in early morning to 55 percent during the afternoon.

Prevailing winds are northeasterly in the fall and winter and southwesterly in spring and summer. Wind movement averages slightly less than 9 mph overall, and less than 25 mph for 99 percent of the year. Surface winds have a well-defined diurnal variation, being generally higher during the day with maximum speeds in midafternoon, and lower at night with minimum speeds near sunrise. Seasonally, wind speeds are slightly higher in spring than in other seasons. A wind rose showing frequency and direction of winds at Jacksonville International Airport is included as Figure 2-1.

Rainfall in the Jacksonville area averages 53.4 inches per year. The greatest amount of rainfall--averaging over 33 inches--occurs during the late summer months primarily in the form of local thundershowers. Measurable precipitation during this period may be expected one day in two. Rainfall of an inch or more in 24 hours occurs about 14 times per year. Heavy rains, associated with tropical storms, occasionally reach amounts of several inches over a 24-hour period.

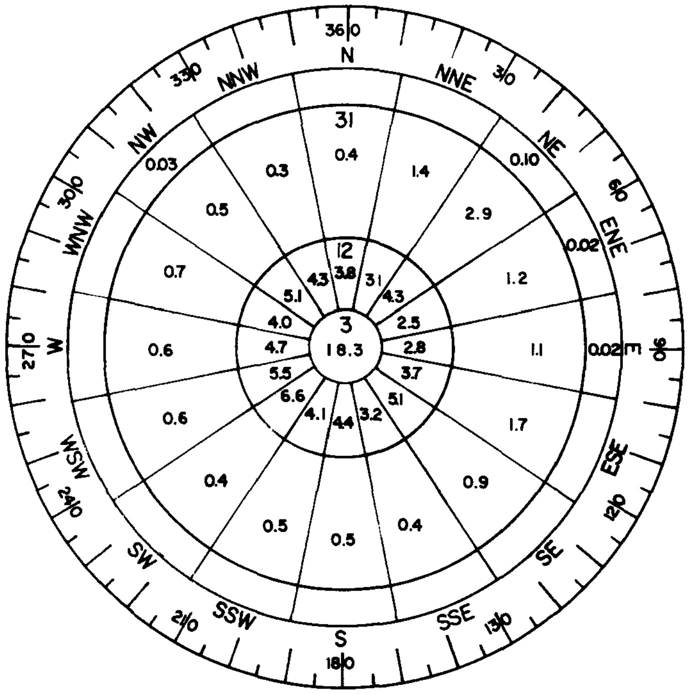


Figure 2-1

Wind Rose

Source: U.S. Weather Bureau - Imeson Airport
Jacksonville, Florida, 1951 - 1959

During the period 1900-1960, seven hurricanes have come within fifty miles of the Jacksonville area. All of these caused wind speeds of less than hurricane force in the Jacksonville area except for Hurricane Dora which passed just south of the city in September 1964 producing 82 mph winds from the north. In general, most hurricanes reaching this latitude tend to move parallel to the coastline, keeping well out to sea, or lose much of their force moving over land before reaching the area. "Nor-easters" infrequently occur along the northeast Florida coast and are characterized by winds of 20-30 mph, low stratus clouds, and drizzle. These occur mainly in late summer and fall, and sometimes persist for several days.

b. Air Quality

The Clean Air Act of 1970 required the Administrator of EPA to define air pollutant levels having an adverse effect on public health and welfare and whose presence in the ambient air results from mobile or stationary sources. These criteria were subsequently used in the establishment of national primary and secondary ambient air quality standards. The National Primary Ambient Air Quality Standards define levels of air quality which are judged necessary, with an adequate margin of safety, to protect the public health. National Secondary Ambient Air Quality Standards define levels of air quality which are judged necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. To implement, maintain, and enforce these standards, each state has been required to develop an implementation plan for submission to EPA. To further define air quality needs, each state has been subdivided into Air Quality Control Regions (AQCR) which are classified on a priority basis for each of five pollutants. The priority classifications range from I to III, I being the highest and representing violation of the National Secondary Ambient Air Quality Standards. Priority II indicates a violation of Primary Ambient Air Quality Standards while priority III represents levels of pollutants lower than primary air quality standards. Classifications were based upon measured ambient air quality data where available or, where data did not exist, upon estimated ambient air quality.

The priority classification for particulates and sulfur dioxide is divided into these three categories while those for carbon monoxide, nitrogen oxides, and photochemical oxidants are divided into only two, the reason being that only one ambient air quality standard has been promulgated by EPA for these pollutants. These latter three are defined as Priority I or III based on the air quality that was recorded in the local AQCR during the period July through September 1971. Criteria used to define priority classifications appear in Table 2-1.

Table 2-1

PRIORITY CLASSIFICATION CRITERIA

Pollutant	Priority I	Priority II	Priority III
	Greater Than (ug/m^3)	From - To (ug/m^3)	Less Than (ug/m^3)
Sulfur Oxides:			
Annual Arithmetic Mean	100 (0.04 ppm)	60-100 (0.02-0.04 ppm)	60 (0.02 ppm)
24 Hour Maximum	455 (0.17)	260-455 (0.10-0.17 ppm)	260 (0.10 ppm)
3 Hour Maximum	- - - - - - -	1300-1300 (0.50 ppm)	1300 (0.50 ppm)
Particulate Matter			
Annual Geometric Mean	95	60-95	60
24 Hour Maximum	325	150-325	150

Pollutant	Priority I	Priority III
	Equal To or Greater Than	Less Than
Carbon Monoxide:		
1 Hour Maximum	$55mg/m^3$ (48 ppm)	$55mg/m^3$ (48 ppm)
8 Hour Maximum	$14mg/m^3$ (12 ppm)	
Nitrogen Dioxide:		
24 Hour Average	$110ug/m^3$ (0.06 ppm)	$110ug/m^3$ (0.06 ppm)
Photochemical Oxidants:		
1 Hour Maximum	$195ug/m^3$ (0.10 ppm)	$195ug/m^3$ (0.10 ppm)

Upon completion, the classifications became part of the State Implementation Plan. Duval County is a focal point of the Jacksonville-Brunswick AQCR whose overall priority classification is as follows:

Pollutant	Priority Classification
Sulfur Dioxide (SO_2)	II
Particulate Matter	I
Carbon Monoxide (CO)	III
Photochemical Oxidants	I
Nitrogen Dioxide (NO_2)	III

The federal ambient air quality standards represent minimal values to be maintained; the states, however, may set more stringent standards for the entire state or any portion thereof. Table 2-2 shows the National Standards and associated information and Table 2-3, the State of Florida Ambient Air Quality Standards. The state and Federal standards are basically similar; Florida has not, however, defined primary and secondary standards according to protection of public health and public welfare, respectively. Rather, maximum limiting levels have been established as necessary to protect both human health and welfare collectively.

Each National and State standard specifies an averaging time, an allowable frequency of occurrence, and a maximum allowable concentration. Averaging times are 1, 3, 8 and 24 hours, and 1 year. Frequency parameters specify either annual maximum concentrations for averaging times of 24 hours or less, or an arithmetic or geometric mean for a one-year period.

Table 2-2

NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

Pollutant	Type of Standard	Averaging Time	Frequency Parameter	Concentration ug/m^3	Concentration ppm
Carbon Monoxide	Primary and secondary	1 Hour	Annual Maximum[1]	40,000	35
		8 Hour	Annual Maximum[1]	10,000	9
Nitrogen Dioxide	Primary and secondary	1 Year	Arithmetic Mean	100	0.05
Photochemical Oxidants	Primary and secondary	1 Hour	Annual Maximum[1]	160	0.08
Particulate Matter	Primary	24 Hour	Annual Maximum[1]	260	--
		24 Hour	Annual Geometric Mean	75	--
	Secondary	24 Hour	Annual Maximum[1]	150	--
			Annual Geometric Mean[2]	60	--
Sulfur Dioxide	Primary	24 Hour	Annual Maximum[1]	365	0.14
		1 Year	Arithmetic Mean	80	0.03
	Secondary	3 Year	Annual Maximum[1]	1,300	0.5
		1 Year	Arithmetic Mean	60	0.02
		24 Hour	Annual Maximum[1,3]	260	0.10
Hydrocarbons[4]	Primary and secondary	3 Hour (6 - 9 A.M.)	Annual Maximum[1]	160	0.24

1 Not to be exceeded more than once per year.

2 Guide to be used in assessing implementation plans to achieve the 24-hour standard.

3 Guide to be used in assessing implementation plans to achieve the annual standard.

Table 2-3

STATE OF FLORIDA AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Frequency Parameter	Concentration ug/m^3	Concentration ppm
Carbon Monoxide	1 Hour	Annual Maximum[1]	40,000	35
	8 Hour	Annual Maximum[1]	10,000	9
Nitrogen Dioxide	1 Year	Arithmetic Mean	100	0.05
Photochemical Oxidants	1 Hour	Annual Maximum[1]	160	0.08
Particulate Matter	24 Hour	Annual Maximum[1]	150	---
		Annual Geometric Mean	60	---
Sulfur Dioxide	3 Hour	Annual Maximum[1]	1300	0.05
	1 Year	Arithmetic Mean	60	0.02
	24 Hour	Annual Maximum[1]	260	0.10
Hydrocarbons[3]	3 Hour (6 - 9 A.M.)	Annual Maximum[1]	160	0.24

[1]Not to be exceeded more than once per year.

[2]Measured and corrected for interference due to nitrogen oxides and sulfur dioxide.

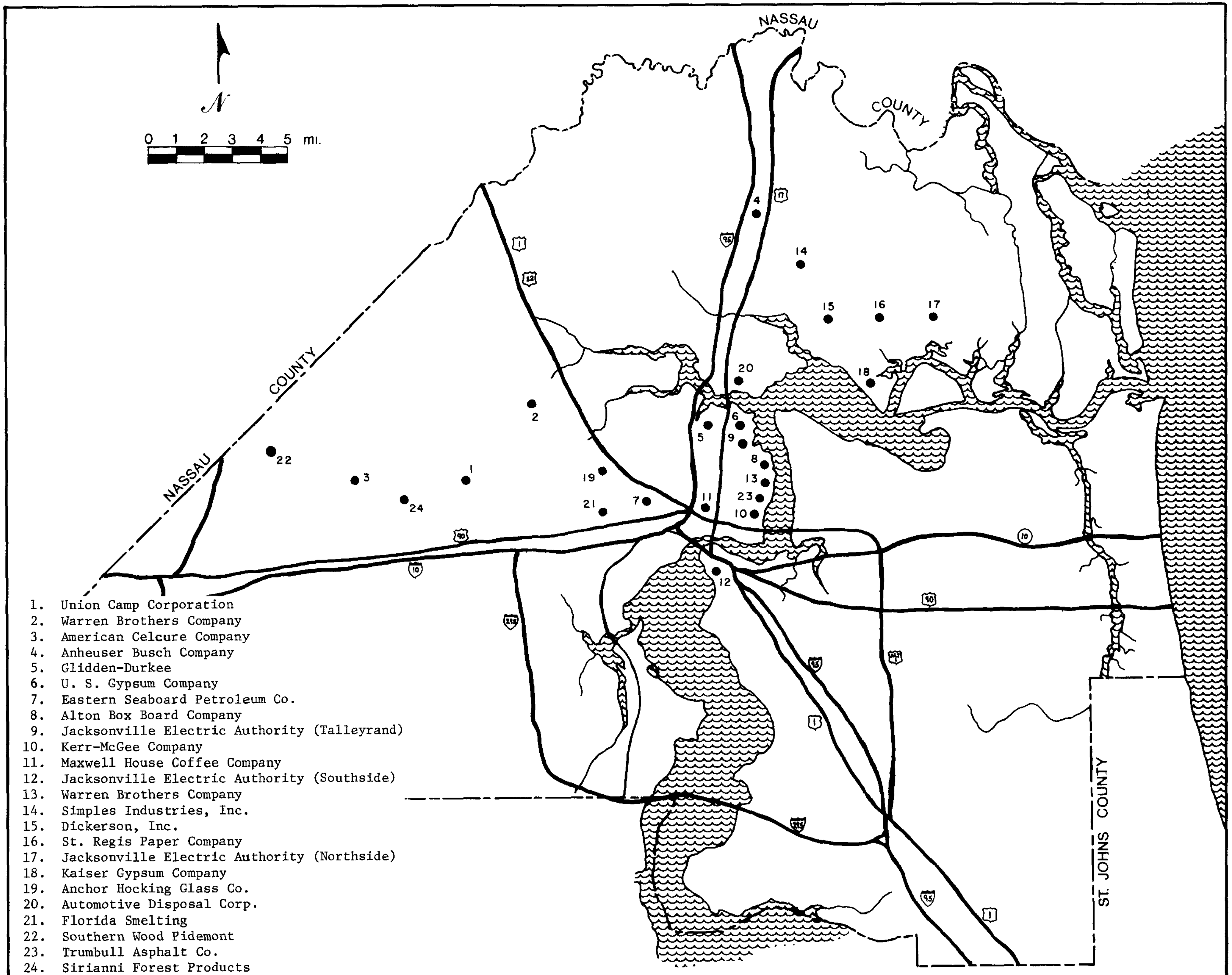
[3]Guide to be used in devising implementation plans to achieve oxidant standards. To be measured and corrected for methane.

Although a major source of air pollution, Jacksonville's industries account for a small portion of the total emissions produced by all sources in the area. In the Consolidated City of Jacksonville, transportation sources accounted for 83 percent of total air pollution emissions for 1970, while industrial process emissions, refuse disposal, solvents, and fuel combustion from stationary sources accounted for the remainder. Transportation sources produced by far the greatest amount of total carbon monoxide (97.4 percent), nitrogen oxides (68.5 percent), and hydrocarbons (77.9 percent) from all sources, while stationary sources accounted for most sulfur oxides (89.6 percent) and industry for the greatest portion of particulates (52.7 percent). The initial impression might be that transportation sources account for the greatest portion of Jacksonville's air quality problems. Some pollutants, however, are less of a problem to man and the environment than others; the Pindex weighting system suggests that transportation sources account for less than half of the local air pollution problem. Automobiles are the major source of carbon monoxide; that parameter however, is not considered a major problem in the Jacksonville area, as affirmed by its priority III classification in the Jacksonville-Brunswick AQCR.

Jacksonville's major industries are food processing, power, pulp and paper, chemicals, shipping, and shipbuilding and repair. As of October, 1974, there were 42 industrial point source facilities in Duval County emitting (or capable of emitting, assuming no pollution controls) 100 tons per year or more of any single pollutant for which a national ambient air quality standard has been established. Table 2-4 lists the area's major industrial sources and their actual emissions in tons per year for 1973. Relative locations are shown on Figure 2-2. It should be noted that the St. Regis Paper Co. has greatly reduced its SO2 and particulate emissions since 1972 but test figures are not yet available.

In general, the overall air quality in Jacksonville is poor but improving and is relatively good when compared to many other cities. For example, the annual geometric mean reported by EPA in Air Quality Data for 1967 (revised 1971) for suspended particulate concentrations in 12 major eastern cities shows Jacksonville second only to Miami in lowest concentrations.

Ambient air quality surveys are regularly conducted by Jacksonville's Bio-Environmental Services Division at the permanent sampling stations shown on Figure 2-3. Average total suspended particulate, sulfur dioxide, and nitrogen dioxide concentrations for all stations for 1974 and the first four months of 1975 are shown in Table 2-5.



1. Union Camp Corporation
2. Warren Brothers Company
3. American Celcure Company
4. Anheuser Busch Company
5. Glidden-Durkee
6. U. S. Gypsum Company
7. Eastern Seaboard Petroleum Co.
8. Alton Box Board Company
9. Jacksonville Electric Authority (Talleyrand)
10. Kerr-McGee Company
11. Maxwell House Coffee Company
12. Jacksonville Electric Authority (Southside)
13. Warren Brothers Company
14. Simples Industries, Inc.
15. Dickerson, Inc.
16. St. Regis Paper Company
17. Jacksonville Electric Authority (Northside)
18. Kaiser Gypsum Company
19. Anchor Hocking Glass Co.
20. Automotive Disposal Corp.
21. Florida Smelting
22. Southern Wood Pidemont
23. Trumbull Asphalt Co.
24. Sirianni Forest Products

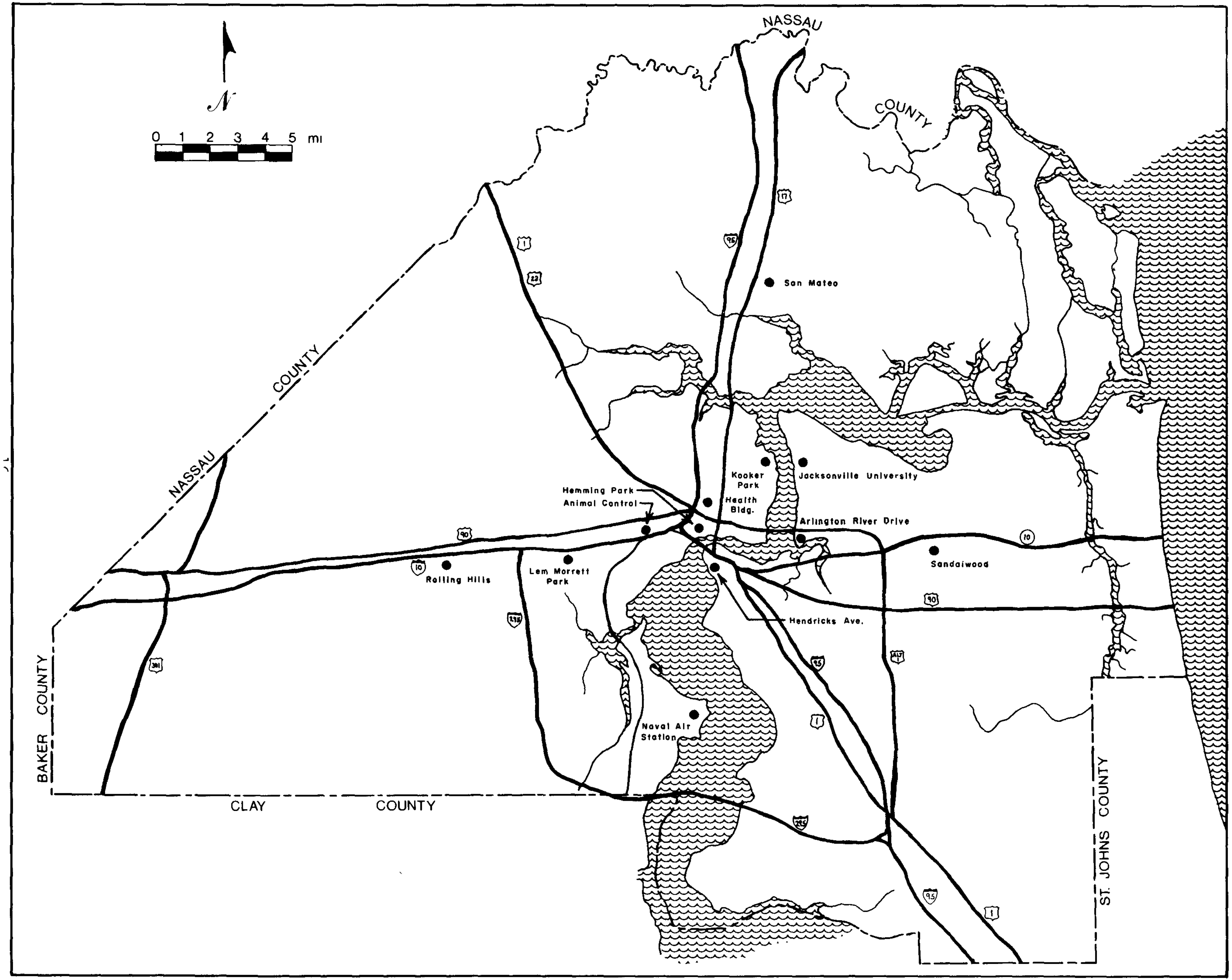


Figure 2-3 - Air Quality Sampling Stations in Duval County

Table 2-4

MAJOR AIR POLLUTANT POINT SOURCES AND THEIR EMISSIONS

	SOURCE	SOx	NOx	HC	CO	PARTICULATE
1.	Union Camp Corporation	158	68	0	0	3
2.	Warren Brothers Company	0	0	0	0	-14
3.	American Celcure Company	0	0	0	0	- 1
4.	Anheuser Busch Company	591	222	6	6	48
5.	Glidden-Durkee Company	2,931	371	13	26	213
6.	U. S. Gypsum Company	0	98	1	5	453
7.	Eastern Seaboard Petroleum Company	37	58	0	0	4
8.	Alton Box Board Company	1,922	796	106	2,412	1,500
9.	Jacksonville Electric Authority (Talleyrand)	10,801	4,412.5	177	269	453
10.	Kerr-McGee Company	0	0	0	0	-22
11.	Maxwell House Coffee Company	4	84	63	5	229
12.	Jacksonville Electric Authority (Southside)	15,335	4,412.5	323	485	475
13.	Warren Brothers Company	73		0	0	- 9
14.	Simplex Industries, Inc.	55	38	14	41	8
15.	Dickerson, Inc.	48	0	0	0	-29
16.	St. Regis Paper Company	7,280	2,009	163	195	5,100
17.	Jacksonville Electric Authority (Northside)	23,468	8,825	191	289	667
18.	Kaiser Gypsum Company	608	102	5	7	541
19.	Anchor Hocking Glass Co.	108	172	0	0	129
20.	Automotive Disposal Corp.	0	0	0	0	-40
21.	Florida Smelting Corp.	42	524	0	0	1
22.	Southern Wood Piedmont	28	49	9	10	88
23.	Trumbull Asphalt Company	0	0	0	0	-38
24.	Sirianni Forest Products, Inc.	7	5	37	50	40
	TOTAL EMISSIONS, MAJOR SOURCES:	63,496	22,246	1,113	3,800	10,105

(Tons/Year)

Table 2-5

AVERAGE CONCENTRATIONS OF POLLUTANTS MEASURED AT 12 AMBIENT AIR SAMPLING STATIONS IN JACKSONVILLE

Month	TSP	SO_2	NO_2
	1974		
January	55.0	12.6	32.2
February	53.5	13.1	30.4
March	63.6	11.6	12.2
April	55.3	13.2	27.7
May	45.6	11.9	13.3
June	42.8	12.5	18.3
July	42.9	7.5	23.7
August	47.9	8.3	25.5
September	36.7	11.3	17.9
October	64.3	14.3	28.5
November	59.7	16.1	27.4
December	48.8	11.8	20.2
1974 AVERAGE	51.3	12.0	23.1
	1975		
January	52.6	18.4	37.6
February	55.9	14.1	26.4
March	62.1	11.0	30.2
April	57.7	6.6	39.5
4-MONTH AVERAGE	57.1	12.5	33.4

--ALL FIGURES IN ug/m^3.

Carbon monoxide and ozone are monitored by the Division at the Hemming Park Station. Recent data appears below:

	Carbon Monoxide 8 HR. Avg., ug/m	Ozone 1 HR. Avg., ug/m
1972	Not Available	294
1973	10,000	284
1974	15,700	392

Of the twelve sampling stations maintained in the area, three--Jacksonville University, Arlington River Drive, and Sandalwood Avenue--are located within the Arlington-East Service District. Tables 2-6 (a), (b), and (c) show average and maximum recorded concentrations of measured pollutants at these three stations for 1974 and the first four months of 1975.

The most critical area of air quality concern in the Jacksonville area is located around the Gator Bowl Complex, particularly with regard to SO2 concentrations. With the exception of the area immediately to the north of the Complex, air quality improves noticeably as one moves outward into the less populous areas.

c. Noise

There is little doubt that as a by-product of our power-oriented technology, the environment is experiencing a rise in noise level. Based upon very limited historical data in areas of the United States where land use has not significantly changed, this increase has averaged approximately two decibels per decade. In comparison, it has been found that between 1938 and 1958, street noise in sections of the German cities of Berlin and Dusseldorf had risen at double that rate.

"The large city and especially its central business district is so characteristically a place of noise that a sudden wave of silence frequently proves to be oppressive to the urbanite for he is accustomed to distracting sounds of all kinds. Screeching brakes, screaming trolley cars, rumbling trucks, rasping auto horns, barking street vendors, shouting newsboys, scolding traffic whistles, rumbling elevated trains, rapping pneumatic hammers, open cut-outs, and now advertising sound trucks and aircraft with radio amplifiers, when added together, constitute a general din for which it would be difficult to find a precedent in the history of cities."

Tables 2-6 (a),(b),(c)

AVERAGE AIR POLLUTANT CONCENTRATIONS FOR SAMPLING STATIONS
WITHIN THE ARLINGTON EAST SERVICE DISTRICT

Table 2-6 (a)

Total Suspended Particulates (ug/m^3)

1974

	Jacksonville University	Arlington River Drive	Sandalwood Avenue
January	47	47	34
February	49	43	40
March	59	59	42
April	41	42	35
May	41	36	29
June	34	40	25
July	36	47	31
August	36	40	23
September	33	30	17
October	45	62	36
November	38	64	27
December	37	49	27
1974 Average	44	47	31
1974 Max. Average	73	91	63

1975

	Jacksonville University	Arlington River Drive	Sandalwood Avenue
January	37	49	32
February	44	56	30
March	46	68	42
April	39	48	34
1975 Average (4 Months)	42	55	35
1975 Max. Recorded (4 Months)	62	83	58

Table 2-6 (b)

Sulfur Dioxide (ug/m^3)

1974

	Jacksonville University	Arlington River Drive	Sandalwood Avenue
January	13.2	9.7	Not Recorded
February	17.8	6.1	
March	15.5	10.9	
April	14.6	24.8	
May	5.9	3.3	
June	6.2	3.1	
July	11.0	5.2	
August	6.0	2.0	
September	3.5	0.2	
October	5.6	5.4	
November	21.9	7.5	
December	10.4	6.4	
1974 Average	11.0	7.1	Not Available
1974 Max. Recorded	38.8	41.9	Not Available

1975

	Jacksonville University	Arlington River Drive	Sandalwood Avenue
January	12.4	5.3	Not Recorded
February	14.5	3.1	
March	18.1	9.8	
April	6.9	7.1	
1975 Average (4 Months)	12.0	6.3	Not Available
1974 Max. Recorded (4 Months)	37.8	24.8	Not Available

Table 2-6 (c)

Nitrogen Dioxide (ug/m^3)

1974

	Jacksonville University	Arlington Drive	Sandalwood Avenue
January	28.3	24.2	Not Recorded
February	19.9	27.8	
March	10.4	9.7	
April	19.2	26.5	
May	7.9	6.7	
June	4.1	17.2	
July	4.8	21.2	
August	13.6	13.9	
September	11.5	13.0	
October	Voided	Voided	
November	16.3	31.0	
December	15.6	19.0	
1974 Average	13.8	19.1	Not Available
1974 Max. Average	42.7	35.4	Not Available

1975

	Jacksonville University	Arlington Drive	Sandalwood Avenue
January	27.3	38.0	Not Recorded
February	23.3	17.6	
March	24.1	27.4	
April	27.2	40.4	
1975 Average (4 Months)	25.5	30.1	Not Available
1975 Max. Recorded (4 Months)	40.2	56.0	Not Available

The above quote is not a portion of the preamble to the "Noise Control Act of 1972." Rather, it is taken from a 1937 report by Congress. As our society evolves technologically, the sources of noise increase in number and variety. Increasing noise levels bring about increasingly severe effects on society yet, at the same time, society requires more machinery, operating at higher speeds with greater power output. Aircraft, for example, have continued to grow in number and noise level. Trucks and construction equipment require increasingly powerful engines to move more goods, materials, or earth faster and more economically. Wastewater treatment plants, not surprisingly, have also grown in size and complexity in order to treat greater and greater amounts of municipal wastes at higher treatment levels. Unfortunately, the noise levels often generated by these important services frequently become annoying, disturbing, and even, in some cases, intolerable. It is the purpose of this section to provide a discussion of ambient noise levels in the proposed project area as well as a very basic survey of the mechanics of sound and its acceptable limits in various situations. This information is to be used to provide a baseline and give greater meaning to the construction and operation noise sections which follow later.

Sound is generated by vibrating sources such as vocal cords, drums, and exploding gases. This vibration causes nearby air molecules to vibrate in turn, producing a variation in atmospheric pressure in the form of waves similar to ripples in a clear pond. These waves spread out radically and decrease in amplitude with travel distance. When they reach the ears of humans and animals, they actuate several processes which culminate with their perception by the brain as sound. Human response to these pressure waves is normally restricted to within a frequency range of 1,000 to 6,000 hertz (one hertz being equal to one cycle per second). The human ear responds logarithmically to sound pressure within this frequency range and, therefore, when measuring sound levels, measurements are weighted more in the frequency of human response. The logarithmic unit of measurement is the "A" weighted decibel (abbreviated dBA). A 10 dBA increase in noise level is perceived logarithmically as a doubling of loudness. Consequently, a noisy factory at 90 dBA seems twice as loud as a ringing alarm clock from 2 feet (80 dBA) and four times as loud as a vacuum cleaner (70 dBA). Figure 2-4 compares various sources of familiar sounds and their associated intensities in dBA.

Source/Distance	dB(A)	Source/Distance
	140	---Threshold of Pain
Rocket Engine (1,000')		
Hydraulic Press (3')		
Large Pneumatic Riveter (4')	130	---Boiler Shop
Pneumatic Chipper (5')		
Overhead Jet Aircraft, 4 engine (500')	120	---Jet Engine Test Control Room
Unmuffled Motorcycle		
Chipping Hammer (3')	110	---Construction Noise (Compressors & Hammers) (10')
Annealing Furnace (4')		---Wood Working Shop ---Loud Power Mower
Rock and Roll Band	100	
Subway Train (20')		
Heavy Trucks (20')		---Inside Subway Car
Train Whistles (500')		---Food Blender
	90	---Noisy Factory
10 H.P. Outboard (50')		---Inside Sedan in City Traffic
Smaller Trucks Accelerating (30')		---Heavy Traffic (24' to 50')
	80	---Ringing Alarm Clock (2')
Light Trucks in City (20')		---Office with Tabulating Machines
Autos (20')		
	70	
Dishwashers		---Vacuum Cleaner in Private Residence
		---Average Traffic (100')
Conversation Speech (3')		---Accounting Office
	60	
		---Window Air Conditioner
	50	---Private Business Office
		---Light Traffic (100')
		---Average Residence
	40	---Quiet Office
		---Soft Whisper (5')
	30	
		---Broadcasting Studio (Music)
	20	---Rustling Leaves
		---Average Threshold of Hearing
	10	

From "Noise Sound Without Value", Federal Council for Science and Technology

Figure 2-4

Sources of Familiar Sounds and Associated Intensities

Noise levels will decrease with distance from the source and also as a result of obstructions that block the pressure waves. However, noise levels may be increased by obstructions that reflect the sound pressure waves (as in the occurrence of echoes).

Most noise environments are characterized by day to day repetition with some variation imposed by differences between weekday and weekend activity, as well as some seasonal variation. For those situations where people are affected by environmental noise for extended periods of time, the logical choice duration is the 24-hour day. The symbol for equivalent sound level is L(eq); the equivalent sound level for a 24-hour period is thus represented as L(eq)(24).

In determining daily environmental noise, it is important to account for the difference in response of people in residential areas to noises that occur during sleeping hours as compared to waking hours. At night, exterior background noises generally drop in level from daytime values. This, coupled with the decreased nighttime activities of most households, causes noise events to become more intrusive at night.

A number of different noise magnitude assessment methods have been developed to account for the differences between daytime and nighttime exposures. Generally, nighttime noise is characterized as more severe than corresponding daytime events; that is, a weighting factor is applied that increases recorded values commensurate with their severity. One method of doing this involves dividing the 24-hour day into two periods, the waking and sleeping hours, with daytime extending from 7 A. M. to 10 P. M. and nighttime from 10 P.M. to 7 A.M. Daytime and nighttime equivalent sound levels (symbolized as L(d) and L(n), respectively) are combined into a 24-hour A-weighted average sound level (symbolized as L(dn)) with a 10 decibel weighting applied to nighttime sound. Examples of 1973 day-night noise levels computed with this method at typical locations are given in Figure 2-5.

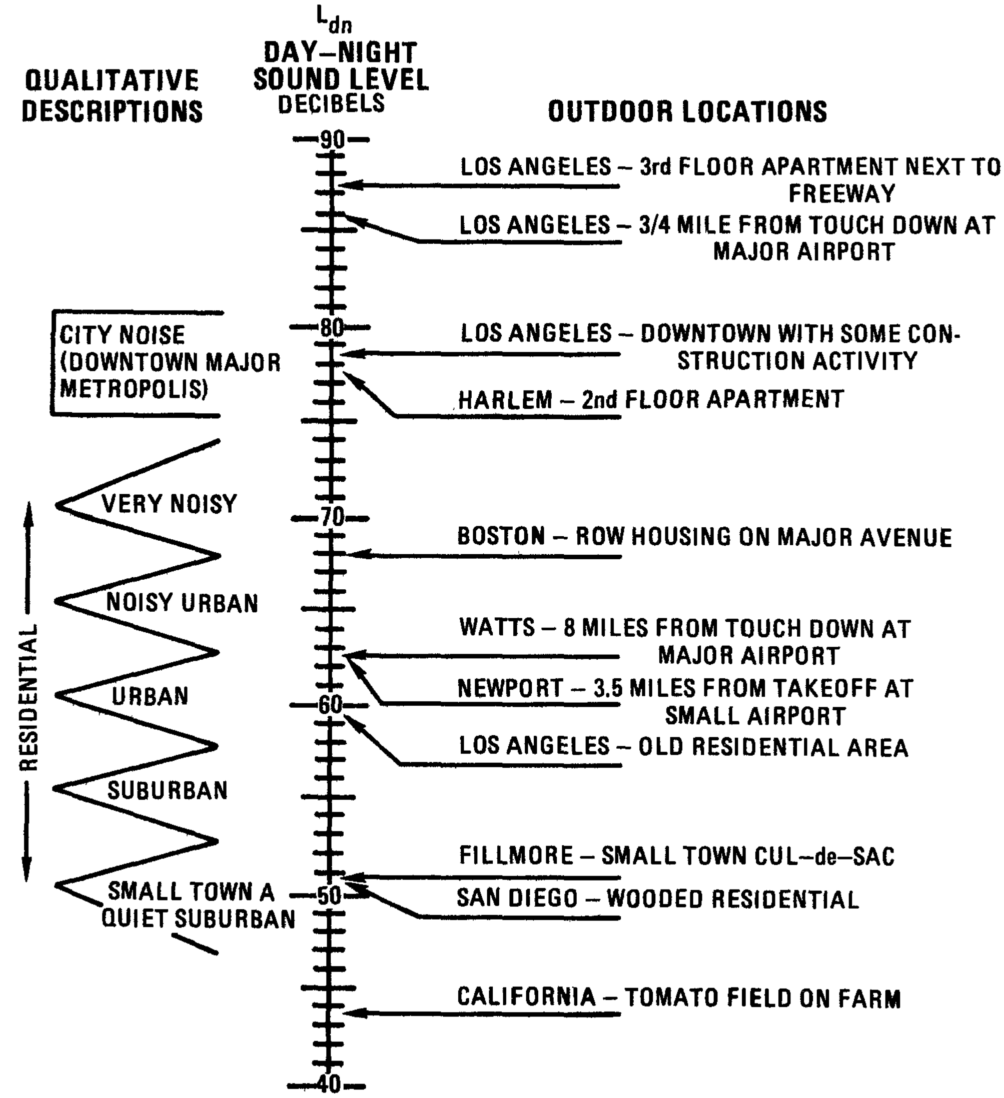


Figure 2-5

Day-Night Sound Levels
at Typical Locations (1973)

Noise pollution standards for non-occupational noise exposures have been suggested to guard against hearing loss. These standards specify relatively short exposure times; the shorter the exposure time, the higher the sound level which can be tolerated. For example, 70 dBA may be safely tolerated over an exposure time of 16-24 hours while 115 dBA may be safely endured for only 2 minutes daily. The long-term health and welfare effects of noise on the individual, however, are related to the cumulative noise exposure received over a lifetime. This, of course, is a function of lifestyle and the physical setting in which the exposure takes place. Thus, adequate protection of the public against involuntary exposure to environmental noise requires special consideration of the physical setting. Table 2-7 identifies noise levels determined by the U. S. Environmental Protection Agency to be requisite for protection of public health and welfare with an adequate margin of safety for both activity interference and hearing loss. Areas are classified according to the primary activities that are most likely to occur in each. Equivalent sound levels are presented as yearly averages of daily levels.

The City of Jacksonville has proposed a noise ordinance to "prevent noise which may jeopardize the health or welfare of its citizens or degrade the quality of life." Four occupancy use classifications--Residential, Commercial, Industrial Light, and Industrial Heavy--have been assigned to the area of jurisdiction for the purpose of establishing maximum permissible continuous sound levels caused by stationary sources of noise. Any area not classified must conform to Commercial standards. Table 2-8 sets forth sound level limits for occupancy use categories which shall not be exceeded more than 10 percent of any measurement period. This interval shall not be less than 10 minutes when measured at the property boundary or at any point within the property affected by the noise.

Table 2-7

YEARLY AVERAGE EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

		Indoor			Outdoor		
	Measure	Activity Inter- ference	Hearing Loss Consideration	To Protect Against Both Effects (b)	Activity Inter- ference	Hearing Loss Consideration	To Protect Against Both Effects (b)
Residential With Outside Space and Farm Residences	L_{dn}	45		45	55		55
	$L_{eq}(24)$		70			70	
Residential With No Outside Space	L_{dn}	45		45			
	$L_{eq}(24)$		70				
Commercial	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Inside Trans- portation	$L_{eq}(24)$	(a)	70	(a)			
Industrial	$L_{eq}(24)$(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq}(24)$		70			70	
Educational	$L_{eq}(24)$	45		45	55		55
	$L_{eq}(24)$(d)		70			70	
Recreational Areas	$L_{eq}(24)$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Un- populated Land	$L_{eq}(24)$				(a)	70	70(c)

Code:

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (See Figure D-2 for noise levels as a function of distance which allow satisfactory communication.)

b. Based on lowest level.

c. Based only on hearing loss.

d. An $L_{eq}(8)$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

NOTE: Explanation of identified level for hearing loss: The exposure period which results in hearing loss at the identified level is a period of 40 years.

Table 2-8

OCCUPANCY USE CATEGORY	TIME	SOUND LEVEL LIMIT (L(10) dBA)
Residential	7 A.M. to 10 P.M.	60
	10 P.M. to 7 A.M.	55
Commercial	7 A.M. to 10 P.M.	70
	10 P.M. to 7 A.M.	65
Industrial Light	7 A.M. to 10 P.M.	75
	10 P.M. to 7 A.M.	75
Industrial Heavy	7 A.M. to 10 P.M.	80
	10 P.M. to 7 A.M.	80

Further, stationary sources of noise are prohibited which create noise levels greater than 75 dBA for Residential occupancy use, 85 dBA for Commercial occupancy use, 90 dBA for Industrial Light occupancy use, and 95 dBA for Industrial Heavy occupancy use for more than one percent of any measurement period. This interval shall not be less than 10 minutes when measured from the property boundary.

Each of the occupancy use classifications is represented in the Arlington-East Service District. Most of the eastern half of the district has been zoned Open Rural which is not classified according to the four occupancy use classifications of the local noise ordinance. This area, consequently, must conform to Commercial occupancy use classification standards. The much more developed western half of the service district has had Residential occupancy use assigned to most of its area. Commercial and Industrial Light classifications follow in the western service district, each having been assigned to approximately the same percentage of area and distributed primarily along Atlantic, University, and Beach Boulevards, the Arlington Expressway, and to Craig Airport itself. The Industrial Heavy classification has been assigned to very small areas of the western service district in the northwest and south central vicinities.

A noise survey to determine baseline levels was conducted in the Jacksonville area in 1973 by the U. S.

Department of Transportation.• One-hour measurements were taken at various locations, five of which are located within the Arlington-East Service District. One of these, a site near Corporate Square in the southwest area and 100 feet from Southside Boulevard, was evaluated at peak and off-peak hours. At the peak hour of 4:15 to 5:15 P.M., the L(10) was measured at 66 dBA, and between 9:50 and 10:50 P.M. at 60 dBA.

Two sites in the service district's northwest area were evaluated to obtain representative background noise levels in residential areas with nearly complete absence of highway noise. Mid-afternoon L(10) levels were found to be 52 and 53 dBA.

Another northwest area site was evaluated during the peak traffic hour approximately 100 feet from Merrill Road. The measured L(10) of 62 dBA is considered representative of the peak highway noise in that area.

The last site evaluated in the service district is located in the extreme western section near the Arlington River and 100 feet from Alternate 1. The high midafternoon L(10) level of 69 dBA recorded was due to the large volume of traffic on Alternate 1 in the downtown area.

Overall, the 1973 study found L(10) dBA levels near most major arteries to range from the mid to upper sixties during peak hours. Near major thoroughfares in the downtown area, however, peak hour levels were in the high sixties and low seventies. In residential areas away from major arteries, the noise level was essentially background with L(10) dBA levels ranging over the low fifties.

Craig Airport is located in the north central area of the service district. It is, due to its very nature, a source of noise to the area. However, no noise level studies have been performed and none are planned for the airport or its approaches.

d. Odor

Point sources of annoying odor in the Jacksonville area are largely industrial. Five companies have been found to be primarily responsible, although in varying degrees. Of these, three--the Union Camp Corp., the Glidden-Durkee Co., and Reichhold Chemicals, Inc.--are engaged in chemical

•

processing or production, and two--the St. Regis Paper Co. and the Alton Box Board Co.--produce paper and packaging materials. All have continuous odor emissions and, with the exception of St. Regis, all are located in or near downtown Jacksonville. Their relative locations, with the exception of Reichhold Chemicals, may be seen by referring back to Figure 2-2.

The two paper companies produce crude sulfate turpentine (CST) and dimethyl sulfide (DMS) as by-products which results in a sometimes nauseating sulfide odor at each plant. It should be noted that St. Regis has only recently greatly reduced its odor problem with the installation of a noncondensable gas system. The CST and DMS produced by the paper plants are used as feedstocks in the operations of Union Camp which produces food flavorings, and Reichhold which manufacturers polyester and paint resins.

Reichhold's resinous odor emissions are slight and localized. Union Camp, however, has a greater problem in that its odor problem affects a larger area and has been described as pungent and penetrating, not unlike that of burned oil. Odors at both plants result primarily from spills and loading-unloading operations.

The Glidden-Durkee Co. produces perfumes and at times emits a strong odor of turpene.

The State Ordinance, as well as the Air Pollution Control Board Rules of the City of Jacksonville Code, state: "No person shall cause, suffer, allow, or permit the discharge of air pollutants which cause or contribute to an objectionable odor." In March 1975, the Jacksonville Division of Bio-Environmental Services began a daily odor survey of all three chemical plants at various locations surrounding each. A summary of the number of days on which odor was detected during the period March through June 1975 is as follows:

	Faint	Moderate	Strong
Reichhold	30	14	4
Union Camp	9	28	25
Glidden-Durkee	22	50	6

Another industrial point source of odor, although not generally considered annoying, is the Maxwell House Division of General Foods Corporation. The company is located in downtown Jacksonville as shown on Figure 2-2 and emits a generally continuous odor of coffee.

The two greatest municipal point sources of annoying odor in the Jacksonville area are the Buckman Street and Sewer District No. 2 regional sewage treatment plants located across the St. John's River approximately west and southwest, respectively, of the Arlington-East Service District. Odor emissions have caused sporadic citizen complaints; more so for Buckman Street than for Sewer District No. 2. These complaints, however, are not generally caused by the odor of sewage but by the industrial wastes which these plants treat. The Buckman Street plant's odor problems are caused primarily by waste slugs from the Glidden-Durkee Co. which produce an odor not unlike that at the Glidden-Durkee site. Annoying odors at the Sewer District No. 2 plant are caused chiefly by the discharge of the Anheuser-Busch, Inc. brewery and are characterized by the odor of wet mash.

There are no major municipally-caused odor problems in the Jacksonville area although scattered complaints are received from time to time by the Bio-Environmental Services Division concerning odors from various smaller plants around the city. These complaints are summarized for 1974 and the first six months of 1975 as follows:

	1974	1975 (thru June)
Arlington Area	5	5
Remainder of County	28	15

The above figures include only those against sewage treatment plants and not against broken sewer lines, or sewage in ditches. Three complaints were received against the Buckman Street plant and none against the Sewer District No. 2 plant during the 18-month period. In addition, there were 20 complaints county-wide concerning overflowing lift stations.

The Monterey sewage treatment plant is the largest existing treatment facility in the Arlington-East Service District and has not been the subject of any citizen complaints during the period of record.

2. Land

a. Physical and Chemical

1) Topography

The Florida peninsula is divided into three physiographic zones separated along trans-peninsular lines; the Southern or Distal Zone, the Central or Mid-Peninsular Zone, and the Northern or Proximal Zone. These zones are further divided into distinct physiographic sub-areas. Duval County covers approximately 840 square miles in the extreme eastern portion of the Proximal Zone and is primarily within the Coastal Lowlands subdivision, a region characterized by flat, undissected terrain with streams generally flowing in shallow channels essentially at the level of the surrounding land. The county's topography is largely defined by a series of ancient marine terraces formed by the advance and recession of the sea earlier in the Pleistocene Epoch. Each time the sea fell to a lower level, a part of the sea floor was left exposed as a level plain or terrace which today is usually marked by a low scarp or beach ridge at its landward edge. In the Jacksonville area, the terraces trend parallel to the present Atlantic shoreline and become progressively higher from east to west although their original shorelines and level plains have been modified by stream erosion from higher and older terraces.

These terraces have been studied in considerable detail with differing interpretations. The elevations of those generally recognized as occurring within Duval County are as follows:

Coharie (170-215 ft. above mean sea level--MSL)
Sunderland (100-170 ft. above MSL)
Wicomico (70-100 ft. above MSL)
Penholoway (42-70 ft. above MSL)
Talbot (25-42 ft. above MSL)
Pamlico (10-25 ft. above MSL)
Silver Bluff (0-10 ft. above MSL)

The Coharie terrace is the oldest and is found in the extreme southwest corner of the county. Its highest altitude in Duval County is 190 ft. MSL and occurs along the eastern slope of a prominent topographic feature known as

Trail Ridge. The Ridge is the only remnant of the Coharie remaining in the county.

The Sunderland is also found only in the southwest corner of the county. It has been extensively eroded; remnants consist chiefly of rolling hills.

The Wicomico terrace trends northwestward and forms an area of extensive uplands in the western portion of the county.

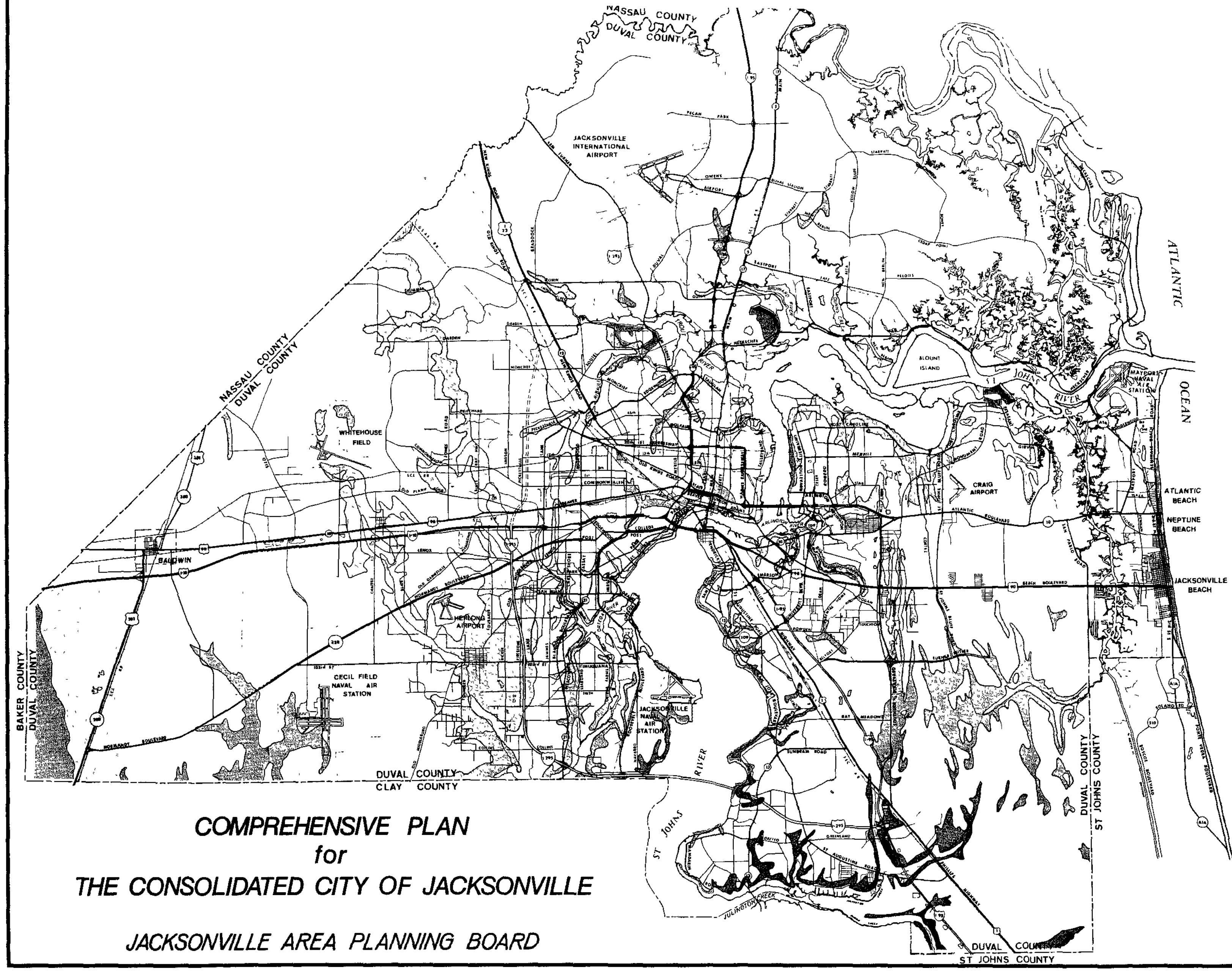
Due to severe erosion and dissection by numerous streams, the Penholoway and Talbot terraces are not well defined in this area. Remnants consist of a series of long and narrow sand ridges--known as the coastal ridge--between the St. Johns River and the coastline. The coastal ridge ranges from 25 to 70 feet MSL and extends through north-central and southeastern Duval County. Ancient dunes on the ridge form a series of narrow, sandy, and small ridges also oriented parallel to the coast but interspersed with low-lying, swampy areas.

Land surface slope of Duval County is shown on Figure 2-6. The county's land surface is largely in slope of less than one percent; that is, there is a change of less than one foot in duration per 100 feet of horizontal distance. Much of the central and eastern portions of the county consist of a low coastal plain formed by remnants of the Pamlico and Silver Bluff terraces. This plain is quite flat, its maximum elevation being about 25 feet above MSL. Some dunes along the coast, however, exceed 50 feet MSL but these are relatively unstable features formed independently of the marine terraces. In the central and southern portions of the county, where the coastal ridge is more pronounced, the coastal plain slopes toward the St. Johns River west of the ridge and toward the ocean east of it. In northern

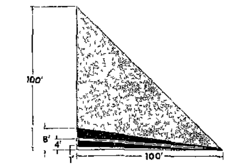
FIGURE 2-6

LAND SURFACE SLOPE

OF DUVAL COUNTY, FLORIDA



LEGEND



SLOPES ON THIS MAP ARE EXPRESSED IN PERCENT A CHANGE OF 4 FEET IN ELEVATION PER 100 FEET OF HORIZONTAL DISTANCE EQUALS 4 PERCENT SLOPE.

- LESS THAN 1%
- 1 TO 4%
- 4 TO 8%
- GREATER THAN 8%

SOURCE U S GEOLOGIC SURVEY WATER RESOURCES DIVISION IN COOPERATION WITH JAPB

GRAPHIC SCALE

JUNE 1973

THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

Duval County, however, the plain slopes only eastward.

Surface drainage in the county is largely directed by the ancient marine terraces. Remnants of their beach ridges, paralleling the ancient shorelines, direct runoff so that the major streams flow roughly parallel to them. Principal drainage basins are shown in Figure 2-7.

Drainage in the western and central portions of the county is through the St. Johns and Nassau Rivers and their tributaries. The St. Johns is tidal throughout its length in Duval County and its tributaries are tidal in their lower reaches. It receives drainage on the west from tributaries flowing off the upland terraces and on the east from streams flowing away from the coastal ridge. East of the ridge, sluggish and brackish streams drain either into the channel of the Intracoastal Waterway or directly into the ocean. In the flat and marshy areas of the northeastern part of the county, formed by the Pamlico and Silver Bluff terraces, drainage is sluggish and the streams form a dendritic pattern. Because of the low relief over this area, so little erosion has occurred that it is often difficult or impossible to define drainage divides.

Of the seven ancient marine terraces found in Duval County, the four lowest in elevation--Penhaloway, Talbot, Pamlico, and Silver Bluff--are represented in the Arlington-East Service District. As is true for the county as a whole, the topography and drainage of the service district is largely defined by the terraces and the erosional forces which have modified them. The district is bounded almost completely on three sides by water; the Intracoastal Waterway on the east, the St. Johns River and Mill Cove on the north, and the St. Johns for a portion of the western boundary.

Topographic relief is shown on Figure 2-8. The easternmost portion of the service district is part of the coastal plain with drainage away from the coastal ridge toward the Intracoastal Waterway and the St. Johns River. The coastal ridge comprises the central and northwest portions of the district with elevations generally from 30 to 50 feet MSL but exceeding 70 feet at the highest point. This relatively high area accounts for the largest portion of the service district. The southwest portion is lower than the coastal ridge but somewhat higher than most of the coastal plain. Elevations are generally from 20 to 30 feet MSL with several streams occupying shallow channels and flowing from the coastal ridge to the St. Johns River.

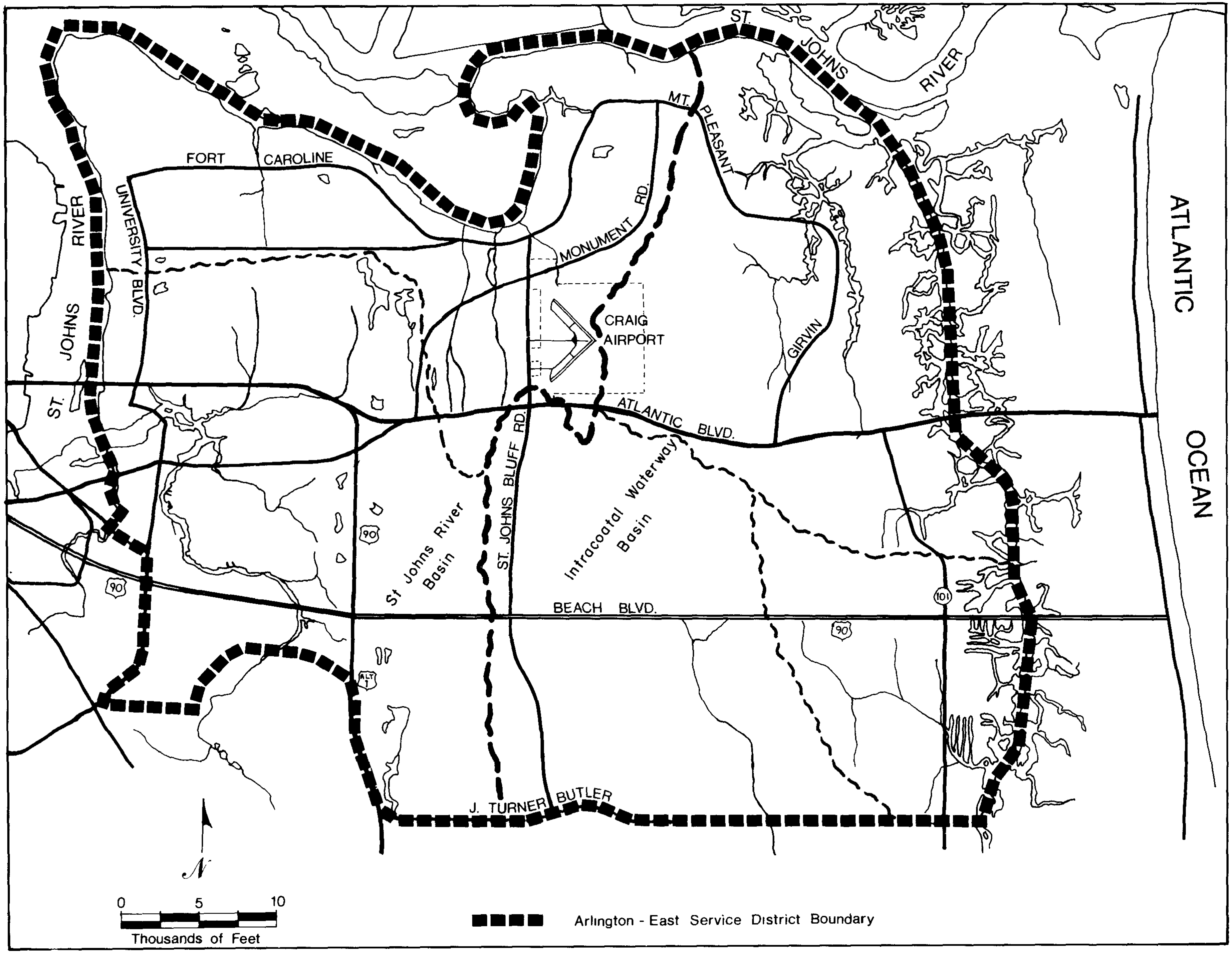


Figure 2-7 - Principal Drainage Basins in the

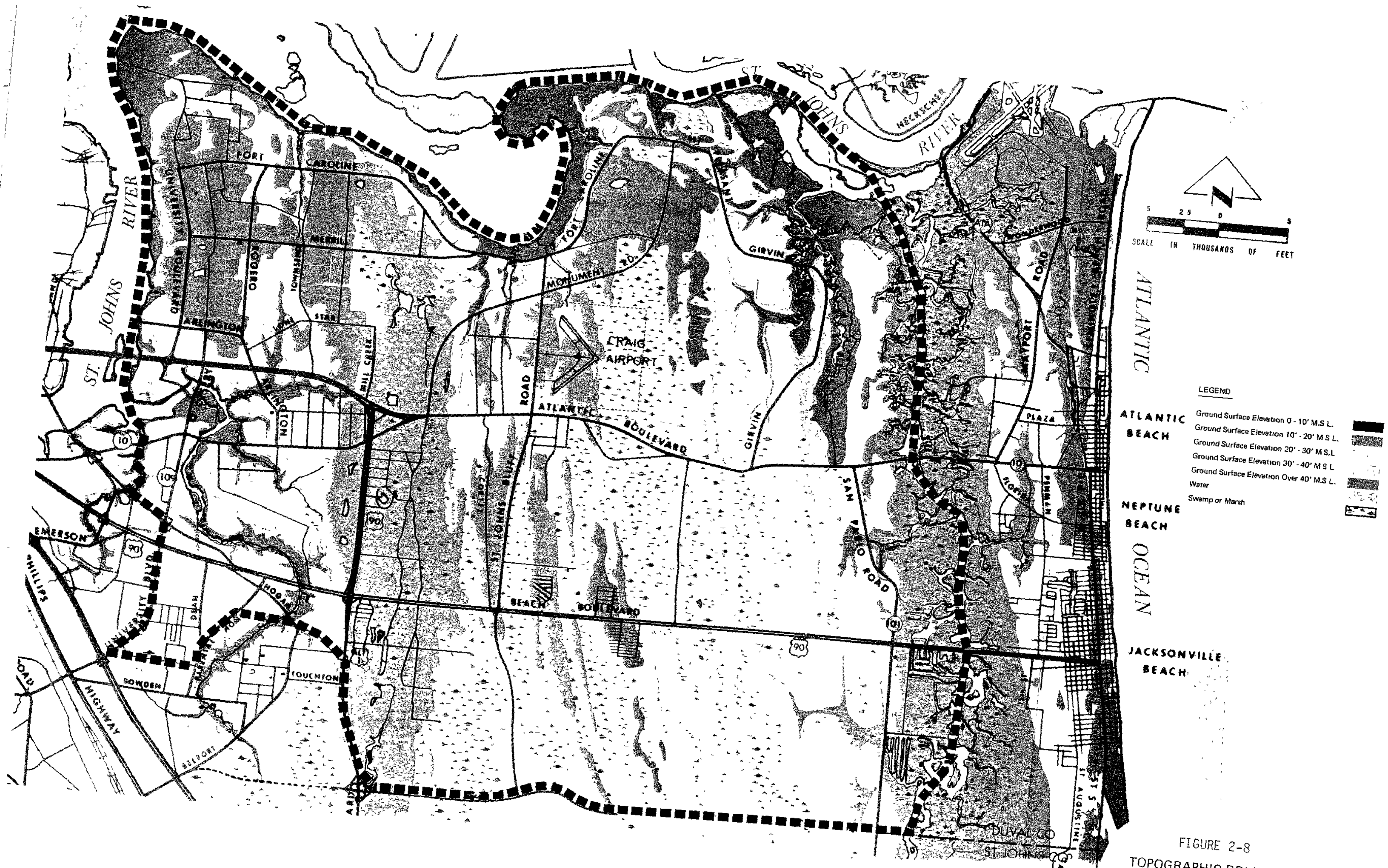


FIGURE 2-8
TOPOGRAPHIC RELIEF MAP
ARLINGTON - EAST DISTRICT
Source. U.S.G.S. 1:24,000 Quadrangle Maps

Approximately 90 percent of the service district's land surface is in slope of less than one percent. Small and isolated areas with slope from 1 to 8 percent occur along the St. Johns River shoreline. More extensive areas with slope greater than 8 percent occur as bluffs across the northern portion of the district, generally paralleling the St. Johns River and Mill Cove and reflecting the northern boundary of the coastal ridge in this area. Other areas of slope exceeding 8 percent also occur along the western slope of the coastal ridge and along the stream channels of the southwest portion of the district.

2) Geology

Much of the Jacksonville area geomorphology has of necessity been included in the topography discussion. One last comment, however, has to do with the orientation of the area's most important surface hydrologic feature, the St. Johns River. The river flows north for approximately 200 miles and then, at Jacksonville, its terminal reach turns perpendicular to the coast. This deflection seaward is caused by the delta of the St. Mary's River, a network of meandering sediment laden streams superimposed on the Coastal Plain.

Fresh water supplies in Duval County are obtained entirely from wells drilled into the geologic formations that compose the three local aquifer systems. Detailing these systems provides a comprehensive description of the underlying geology in the Jacksonville area to a depth of about 2,100 feet below mean sea level, the lowest penetrated depth of the Floridan aquifer in the area.

The three types of aquifers are the surficial sand beds; the relatively thin limestone, shell, and sand beds between 50 and 150 feet below the surface; and the thick limestone and dolomite beds below 300 to 600 feet. The latter beds comprise the Floridan aquifer which is the principle source of potable water in the area. The overlying beds are utilized primarily for domestic supplies, some air conditioning, and lawn sprinkling.

Each of the three aquifer types is found in the Arlington-East Service District. Figure 2-9 shows a generalized geologic cross-section across the southern portion of Duval County; geology of the service district may be seen in the eastern half of the section which is an east-west line roughly paralleling Atlantic and Beach Boulevards.

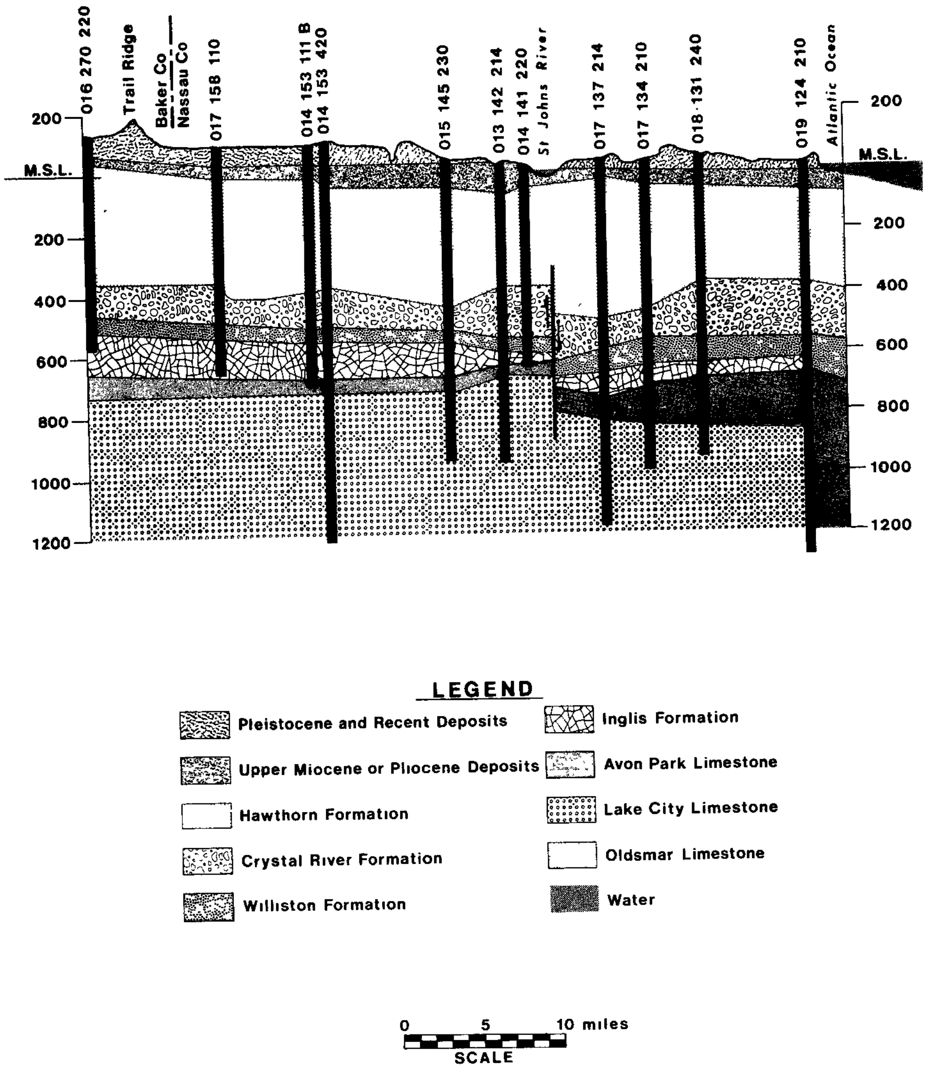


Figure 2-9

Generalized Geologic Cross-Section Across Southern Duval County (after Leve, 1966)

Surficially, the service district, as well as the county as a whole, is covered with undifferentiated marine and estuarine terrace deposits of Pleistocene and Recent age. Except for areas where they have been completely eroded by streams, these sediments comprise the surficial sand aquifer. They consist primarily of medium to fine-grained loose quartz sands and average about 20 feet in thickness in this area. The sands contain several heavy minerals which, in the past, were strip-mined along the coastal ridge.

The thin limestone, shell, and sand aquifer beds are believed to be Pliocene and upper Miocene in age. They comprise a distinct aquifer system separated from the Floridan aquifer by the relatively impermeable and confining Hawthorn Formation. In some places, these beds are absent or not sufficiently thick to supply usable quantities of water. In the service district, however, they average about 80 feet in thickness and occur to depths of 100 feet below mean sea level.

The Hawthorn Formation of middle Miocene age consists mainly of clays, sands, pebbles, and sandy limestone and occurs, in the service district, at depths averaging about 80 to 100 feet below mean sea level and in thicknesses averaging about 300 feet. It serves throughout most of northeast Florida primarily as a confining layer which retards upward movement of water from the underlying Floridan aquifer. However, in parts of eastern Duval County, zones of pebbly sand within the formation are topped by wells.

The Floridan aquifer is composed of limestone and dolomite formations which unconformably underly the Hawthorn Formation and generally dip to the north and east in Duval County. It is locally composed of seven formations--the Ocala Group (Crystal River, Williston, and Inglis Formations), the Avon Park Limestone, Lake City Limestone, Oldsmar Limestone, and a portion of the Cedar Keys Limestone. All are Eocene in age except the Cedar Keys which is Paleocene. Most of the water drawn from the Floridan Aquifer in the Jacksonville area comes from the five youngest formations; the Ocala Group, Avon Park, and Lake City collectively comprise the area's principle source of potable water as well as the primary source of groundwater used for municipal, utility, and industrial purposes. The Oldsmar limestone is relatively impermeable but is used for water supply to some extent. The Cedar Keys

Limestone, the oldest formation of the Floridan Aquifer, contains highly mineralized water below depths of about 2,100 feet below mean sea level. Water in the Floridan Aquifer system is artesian throughout most of Duval County.

The major structural feature of the area is a north-south trending fault which underlies the St. Johns River Basin in Southern Duval County. The fault is clearly seen in Figure 2-9; the upthrown side is to the west with a vertical displacement of about 125 feet to the Ocala Group and the Avon Park Limestone. The vertical displacement of the fault decreases to the north and probably does not extend beyond northern Duval County. Its principle economic effect is that it has somewhat increased the depth to the major water bearing formations of the Floridan Aquifer located on its downthrown side. There is also some speculation that it may be blocking a portion of the recharge from the southwest.

3) Soils

A knowledge of soils in the project area is necessary for three primary reasons. First, their physical properties will directly affect the location, construction design, and cost of the proposed facilities. Second, their drainage and chemical characteristics will influence the location, method, and effectiveness of land disposal alternatives. Finally, their drainage, chemistry, and extent will affect the size of facilities needed or even the choice of planning alternatives. For example, the occurrence of soils suitable for septic tank absorption fields, in combination with other factors, such as anticipated growth, might obviate the need for treatment facilities altogether.

Eleven soil associations have been recognized and documented in Duval County. A soil association represents a group of soils that occur together in nature to form a distinctive landscape. It consists of one or more major soils and at least one minor soil, and is named for the major soil(s). In Duval County, these associations have been evaluated for limitations and features which affect their suitability for selected uses. Their overall rating is based on the rating for the dominant soil and is expressed as slight, moderate, or severe. Slight means that soil properties are generally favorable for the rated use or that limitations are minor and easily overcome. Moderate means that some soil properties are unfavorable but may be overcome or modified by special planning and design. Severe means that properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance is required. Table 2-9 describes the six soil associations found in the Arlington-East Service District along with their suitability ratings for pertinent uses. Their areal distribution is shown on Figure 2-10.

Soil properties considered in evaluating suitability for septic tank absorption fields are those that affect both absorption of effluent and construction and operation of the system. Absorption is affected by permeability, depth to water table or rock, and susceptibility to flooding. Construction and operation is influenced by slope in connection with facility layout, risk of soil erosion, lateral seepage, and downslope flow of effluent. Properties considered in evaluating suitability for shallow excavations are good soil workability, moderate resistance to sloughing, gentle slope, absence of rock outcropping or large stones, and relative freedom from flooding or the absence of a high water table. Soil properties to be considered in the construction of industrial or other large facilities are those that affect load-supporting capacity and settlement under load, such as wetness, flooding, texture, plasticity, density, and shrink-swell behavior. In addition, properties affecting excavation, such as wetness, flooding, slope and depth to bedrock, are considered.

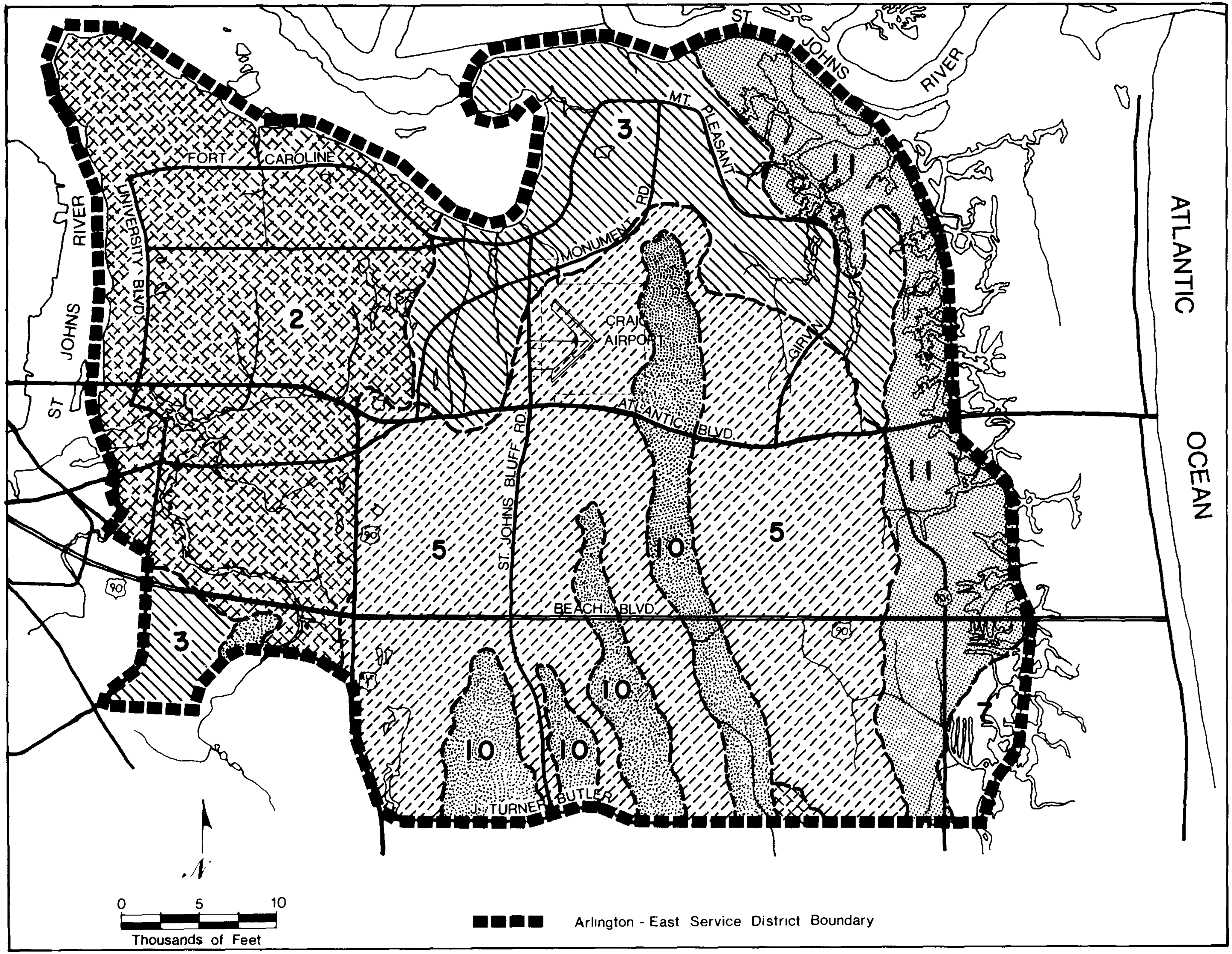


Figure 2-10 - Areal Distribution of Soils in the Arlington -East Service District Boundary

Table 2-9

SOIL ASSOCIATIONS OF THE ARLINGTON-EAST SERVICE DISTRICT

Map Symbol	Association Name	Description	Degree of Limitation: Septic Tank Absorption Fields	Shallow Excavation	Light Industry
2	Lakeland-Tavares,	Broad ridges of excessively drained and moderately well-drained yellow sands.	Slight	Severe	Slight
3	Tavares, Variant-Leon	Nearly level to gently sloping, moderately well-drained soils, sandy throughout and poorly drained sandy soils with weakly cemented sandy subsoil.	Moderate	Severe	Slight
5	Leon-Pomello, Variant-Rutlege	Nearly level to gently sloping, poorly drained and moderately well-drained sandy soils with weakly cemented sandy subsoil, and very poorly drained soils, sandy throughout.	Severe	Severe	Severe
7	Wabasso, Thermic, Variant-Leon	Nearly level to gently sloping, poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil, and poorly drained sandy soils with weakly cemented sandy subsoils.	Severe	Severe	Severe
10	Fresh Water Swamp	Nearly level, very poorly drained soils subject to prolonged flooding.	Severe	Severe	Severe
11	Salt Water Marsh	Level, very poorly drained soils subject to frequent flooding by tidal waters.	Severe	Severe	Severe

The largest part of the service district is for the most part, poorly drained. Extensive areas of well or moderately well drained soils do, however, occur in the northern and western portions of the district. In addition, smaller tracts of well-drained sandy soils are found in the central portion along the coastal ridge. Existing and planned development, as well as relatively shallow depths to the water table, combine to eliminate most of the larger areas of good drainage from consideration as feasible sites for land disposal (i.e., spreading) of sludge. There are, however, at least two undeveloped areas which deserve consideration as land-spreading sites. The abandoned strip-mine areas in the north central and south central service district consist primarily of the Fripp Series of dry and sandy soils. These soils typically have grayish-brown fine sand surface layers underlain by pale yellow and very pale brown fine sand which grades to white at lower depths. The topmost layers, having been stripped off the mined areas, are presently covered with pale yellow to white fine sand -- the lower portion of the Fripp Series now exposed. Left undisturbed, these ridges could support a bayberry-palmetto vegetative community. Presently, however, the strip-mined areas are barren. This misuse combines with adequate acreage and excellent drainage to warrant consideration for improvement through land spreading of sludge from the proposed Arlington-East sewage treatment plant.

The primary physical process which is changed when sewage sludge is applied to soil is retention of soil water. Sewage sludge and sewage compost increase the retention of soil water at any tension but most effectively in coarse-textured, singlegrained soils such as sands. When applied to these otherwise inert soils, the sludge serves as a conditioner by its presence as a surface-active and water-absorbing additive. Nutrient absorption capabilities are increased, resulting in a much more productive soil.

Soil structure, particularly aggregation, affects soil water, soil air, mechanical impedence, and root distribution. Organic matter, through the activity of microorganisms, increases soil aggregration; application of sewage sludge has been shown to increase stable aggregrates by 16 to 33 percent.

Finally, erosion, the end result of dislodgement and transport of soil particles, can be reduced markedly by the addition of organic matter such as sludge. Infiltration can be increased, thus reducing the amount of water available for soil particle transport.

b. Biota

1) Terrestrial Plants

Five dominant arboristic cover types are found in the Arlington-East Service District. Figure 2-11 shows these cover types as well as areas presently developed, strip-mined areas, salt water marshes, and water. Aerial photographs taken January 14, 1975 for the Florida State Department of Transportation were used to prepare this map. Stereoscopic coverage enabled more accurate study of the area. Trained foresters from the Jacksonville District Office, Florida Division of Forestry, assisted with ground truth identification and photo interpretation work.

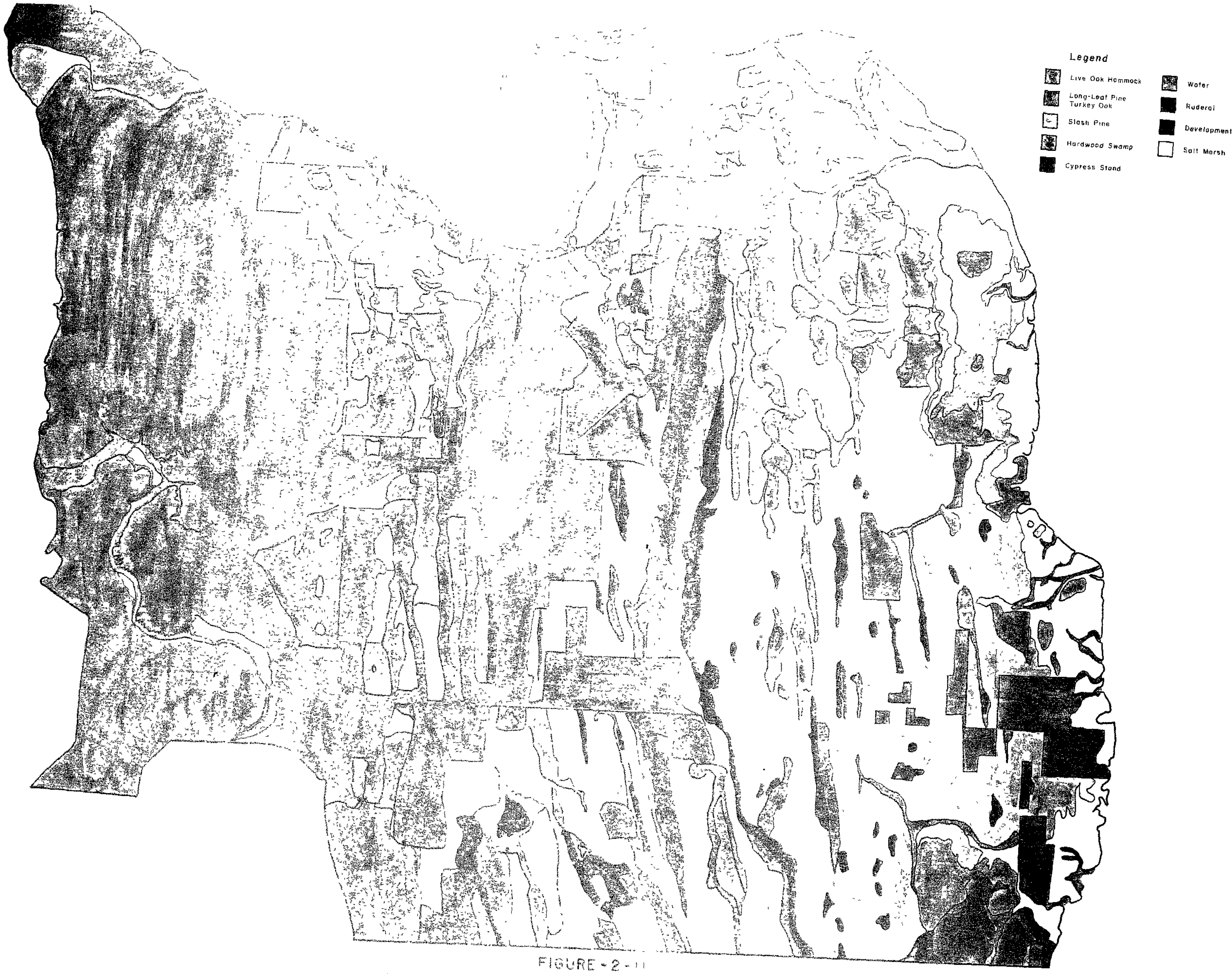


FIGURE - 2 - 11

ARBORISTIC COVER TYPES IN THE ARLINGTON - EAST SERVICE DISTRICT

The five readily distinguished cover types found within the Arlington-East service district are the hammock, longleaf-turkey oak flatwood, slash pine flatwoods, hardwood swamp, and cypress swamp. These were named according to the species most dominant in the existing tree canopy. Land under cultivation, or pastureland, was considered developed. Pine plantations were considered a natural cover type even though they are altered areas.

The hammock is found in upland areas with well-drained sandy soils. It is dry but not quite as dry as a sand dune situation. A climax association exists due to an absence of fire. The dominant species found here is live oak. Subdominants include laurel oak, magnolia, mockernut hickory, and scrub live oak. The live oaks provide 90-100 percent shade cover. Understory species include cabbage palm, saw palmetto, and staggerbush. When fire or logging removes the larger climax types, a scrub will exist in low thickets. Species here are dwarf live oak, scrub live oak, sand-post oak, bluejack oak, turkey oak, myrtle oak, persimmon, and some long-leaf pines. This cover association is highly desirable for parks and home development.

Two pine flatwood associations exist within the service area; the slash pine and the longleaf pine/turkey oak. They can be closely associated. An example is along the unique "finger ridges" which lie on a north-south line in the eastern area of the service district.

Longleaf pine/turkey oak association is found at higher elevations than the slash pine. Other species evident here are bluejack oak and myrtle oak with ground cover of saw-palmetto and ground oaks. Few large stands of longleaf pine remain due to logging, a situation which permits the slower growing oaks to become dominant.

Slash pine is the dominant cover species within the entire service district. It is a hearty, vigorous grower planted extensively for pulpwood and has replaced the longleaf in this respect. Where pulpwooding has removed large pines and where fire has been removed as a control, a mesic hammock will exist within the flatwoods. This is a nearly pure stand of hardwoods but difficult to differentiate because fast growing slash pines integrate it.

The slash flatwoods is characterized by poor drainage due to flat terrain and a hardpan usually only several feet below the soil surface. Surface soils are porous sands.

A hardwood swamp characteristically occupies ground elevations somewhat below the slash pine flatwoods and above the cypress stands. River and creek bottomland is the floodplain area upon which the hardwood swamp association can be found. The hardwood canopy is tall and dense in a mature stand causing light to be a limiting factor for the understory. It tends not to be subject to brush fire because of high humidity and damp soils. The soil here is more organic than upland areas in the service district. Species to be found in the hardwood swamp are loblolly bay, redbay, and bayberry. Undercanopy types are ironwood, dogwood, hop-hornbean, and redbud. Associations are sometimes poorly defined. Slash pine could be interspersed as might other pine species.

The Fish and Wildlife Service has classified wetland areas in their Circular 39, "Wetlands of the United States." Portions of the hardwood swamp can be classified Type 1, seasonally flooded basins or flats. Particularly, the Arlington-East district's creek bottomland would be seasonally freshwater flooded and hardwood stands in flatwoods depressions would infrequently have standing water.

Cypress stands are prevalent in the service district wherever water stands above ground most of the year. The wetland classification is Type 7, wooded swamps. They are the drainage sinks where nutrients and excess water drain from the higher flatwoods, which completely surround them. Only at locations in the periphery of the service district would these cypress swamps be contiguous with brackish tributaries. Periods of excessive rains would be the only time nutrients escape to the estuary. The largest cypress stands occur to the east of Craig Airfield and in between the "finger ridges."

Areas called bayheads are considered to be part of this cover type. Frequently, assemblages of bay tree species ring a cypress stand and are the dominant undercanopy below immense bald cypress.

Appendix X inventories plant species of the Arlington-East Service District according to the six habitat areas.

The following is a list of plants extracted from the state list of protected plants, Senate Bill No. 233, Section 865.06, Preservation of Wild Trees, Shrubs, and Plants. These plants occur or probably occur within the Arlington-East area.

Sevenoa serrulata (saw palmetto)
Sarracenia minor (pitcher plant)
Zamia spp. (coontie)
Cercis canadensis (Redbud)
Erythrine Arborea (Cherokee or coral bean)
(Possible on high dry sites)
Gelsemium sempervirens (yellow jasmine)
Gordonia lasianthus (loblolly-bay)
Ilex cassine (dahoon holly)
Ilex myrtifolia (myrtle leaved holly)
Ilex *opaca* (American holly)
Lobella cardinalis (cardinal flower)
Rhododendron austrinum (azalea)
Rhododendron caneseens (azalea)
Pinckneya pubens (fever tree) along flowing streambanks.
Salpingostylis coelestina
Vierna baldwinii (dwarf clematis)
Cornus florida (dogwood)
Cornus alternifolia (dogwood)

2) Terrestrial Fauna

Although developing rapidly, the service district provides varied habitats for numerous animals. It is difficult to characterize the fauna of the five vegetative zones because considerable overlap occurs due to seasonal changes in food, shelter, or migratory behavior. However, some generalizations may be stated.

Dry hammock areas are inhabited by species able to exist where standing ground water seldom accumulates. The gopher tortoise, an armored, nocturnal reptile, is a common inhabitant. Ground cover is prevalent enough to attract many snakes, lizards, rats, mice, rabbits, toads, and the gopher frog. Squirrels, sparrows, predacious hawks and owls, along with common scavenger vultures utilize the high live oak canopy.

Pine flatwoods have a greater ground cover and sparse canopy unlike the hammock. Palmetto, wire grass, gallberry, and numerous grasses and sedges provide excellent cover for terrestrial animals. Many herbivores and omnivores attract natural predators such as the bobcat, hawks, owls, and numerous snakes.

Animals and birds of the lower hardwood swamps and cypress stands are not uncommon in the flatwoods areas. Some exceptions are those which require or prefer standing surface water. Egrets, herons, turtles and water snakes are common in cypress stands. Many animals which frequent drier areas are attracted to the hardwood swamp and cypress areas. A need for water, seasonal foraging, or abundant aquatic and terrestrial prey cause these lowland areas to be essential to numerous species.

The wetlands of the hardwood swamp and cypress stand are utilized by waterfowl. Seasonally flooded areas in the hardwood swamp where wetland vegetation is present on the ground could attract migrating waterfowl. Cypress swamps are particularly important to waterfowl during times of drought. At these times the cypress swamps are the only shallow fresh water available.

Appendix XI inventories the species of amphibians, reptiles, birds, and mammals found in the service district according to six habitat areas. For birds, the seasonal occurrence is provided to consider the migratory movements of many species. Species which appear on the U. S. Fish and Wildlife Service or Florida Fish and Game Commission lists as being endangered or threatened are so indicated.

Endangered Species - Animal species presented here include those listed as threatened by extinction according to the United States Department of the Interior Fish and Wildlife Service. Some have not been sighted for years but are included since the service district is within the species' geographical area and habitat does exist which could support them.

Alligator (Alligator mississippiensis)

The alligator does occur in Duval County and quite possibly in or around the service district wetlands. Sightings have been made in a sawgrass marsh in upper Dunn Creek, north of the service district.

Red-cockaded Woodpecker (<u>Dendrocopos</u> <u>borealis</u>)

This species prefers large, old pine trees for nesting sites. This type habitat does exist within the service district.

Southern Bald Eagle (<u>Haliaeetus</u> <u>leucocephalus</u>)

Probably one of the most intolerant birds to the presence of man. It tends to inhabit remote areas close to its preferred hunting areas such as marshes and freshwater swamps. The bird nests in the highest trees where the nest is used year after year.

Brown Pelican (<u>Pelecanus</u> <u>occidentalis</u>)

Frequently seen in the project area. It stays close to its fishing waters, open coastal waters, river deltas and can be seen in "flying armadas" patrolling the ocean beaches.

Florida Manatee (Trichechus manatus latirostris)

A mammal, this endangered species ranges throughout the state. Its numbers are now limited but it does occur in the St. Johns estuary. Recent sightings near Mill Cove indicate that manatees frequent the lower estuary as well as freshwater reaches.

Florida Panther (<u>Felis</u> <u>concolor</u> <u>coryi</u>)

This predator is usually restricted to large uninhabited areas in central and south Florida, particularly in the Everglades. It is not likely to be found in the project area.

3. Wetlands and Water/Land Interface

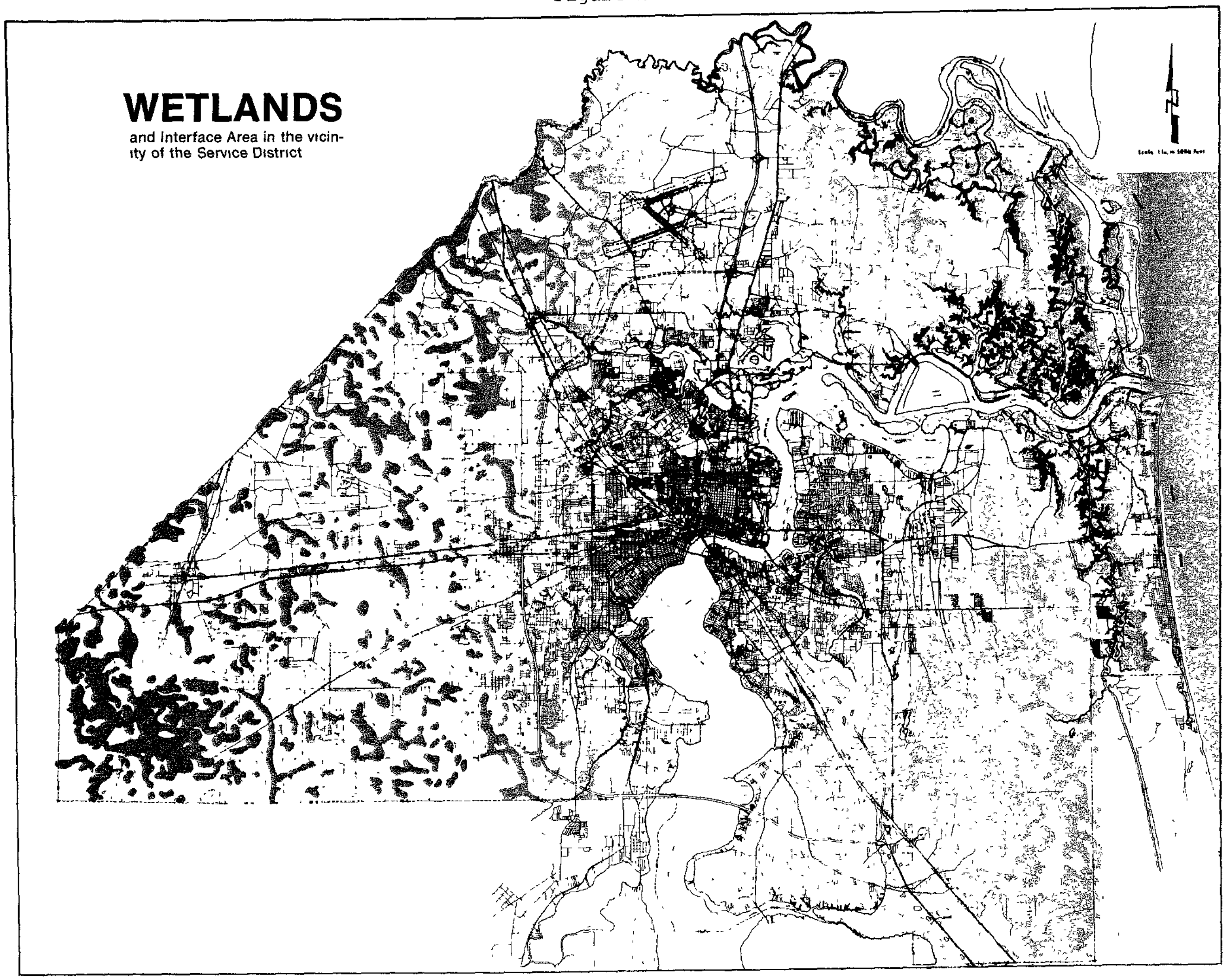
Extensive wetlands and water/land interface areas exist in and around Duval County and the Arlington-East Service District. Primary areas of concern are the Atlantic beaches and dunes, the estuarine reach of the St. John's River and its tributaries, the coastal salt marshes, and the freshwater swamps located inland from the coast. These areas are shown in the vicinity of the service district area on Figure 2-12.

a. Physical and Chemical

Of the above areas, those that will receive the greatest direct impact from the planned project are the estuaries and coastal marshes. The marshes constitute a transition zone between the terrestrial, freshwater, and marine environments. In many cases, they have been subjected to man-made changes (such as artificial introduction of nutrients) which alter their natural condition. Such changes may then influence the surrounding estuarine area.

Tidal marshes depend in large part for their biological richness on the normal quantity and quality of nutrients from inland or upland sources. However, when nutrient rich effluents enter a marsh-estuarine system, the nutrients are effectively topped by the tidal circulation pattern and efficient vertical mixing of fresh and salt water. Ideal conditions are thus created for the cycling of nutrients between sediments and water and their ultimate assimilation. Marsh-estuarine ecosystems have developed adaptations to high nutrient levels and have a large capacity to buffer nutrient changes. Sediments act as both source and sink, effectively neutralizing the effects of, for example, large additions of phosphate to the ecosystem. On the other hand, untreated organic materials greatly stress the marsh-estuarine aquatic system. Detailed waste assimilation analyses have shown that marshes and estuaries are particularly vulnerable to the artificial introduction of large amounts of organic matter; naturally high in organic detritus, their dissolved oxygen levels are undesirably reduced when subjected to these effluents. If, however, large BOD loadings are reduced through secondary treatment, the natural systems at work in the estuarine environment can effectively carry out tertiary treatment without appreciable reduction in water quality.

Figure 2-12


WETLANDS
and Interface Area in the vicin-
ity of the Service District

Natural siltation is an integral process in the coastal marsh-estuarine environment. These deposits are partly organic and partly inorganic. They are either autochthonous, having been formed in the estuary itself by life or physical-chemical processes, or allochthonous, having been introduced from outside the estuary by inflowing water. Due to density differences and the reduced velocity of water movement where fresh and salt waters meet, suspended materials generally cause a high degree of turbidity in the estuary.

High turbidity levels limit light penetration and thus excessive growths (blooms) of dinoflagellates are less of a problem than in correspondingly enriched but less turbid waters. In the St. John's estuary, however, the marshes are threatened by direct deposition of dredge spoil and by excessive siltation due to dredge and fill operations and runoff of solids. Siltation rates presently vary from nine inches per month at the Talleyrand Docks to a foot per year in Back River.

The single most important physical factor in the estuary and coastal marshes is the tide. Tides affect the exchange of water and their vertical range determines the extent of tidal flats which may be exposed and submerged with each tidal cycle. At high water, chemicals and minerals and organic matter are converted into food for aquatic life through photosynthesis. At low water, the solids, filtered through the grasses, settle into rich sediments.

In most estuaries there is a net discharge of water from the estuary equal to the amount of river discharge. Because of tidal action, however, the exchange of water in large estuaries such as the St. John's is not completed in a single tidal cycle and several days or tidal cycles may be required for a given particle of river water to reach the sea. Indeed, the average net or freshwater flow at Jacksonville is about 14 percent of the average tidal induced flow. Sea water, moving upstream from the mouth of the St. John's River mixes with the fresher water already in the river channel to form a zone of transition. This zone moves upstream when insufficient fresh water is stored in the estuary to keep its level higher than that of the ocean. Chloride concentrations in this zone vary from that of sea water to that of the freshwater imput. During a particular tidal cycle, the magnitude and range in chloride concentration in the river at Jacksonville depends on the length and gradient of the zone of transition and on the volumes of the tidal flows. About 80 percent of the time, the chloride concentration at the Main Street Bridge exceeds 250 milligrams per liter.

At the mouth of the St. John's River, the tidal range averages 4.9 feet. The tidal generates progressive tidal waves which move up the river in cycles accompanied by tidal currents. The amplitude of these waves gradually diminishes, causing the tidal range at the Main Street Bridge in Jacksonville to be only 1.2 feet.

Extensive flood-prone areas exist in Duval County. Available information depicting areas which are inundated by the 100-year frequency flood is shown on Figures 2-13.

b. Biota

The configuration of the shoreline along the Lower St. Johns River has been considerably altered. Bulkheads have replaced gradual sloped beaches and, in some areas, marshes. Bulkheads do support a unique biological community of encrusting or attached animals and plants. However, pollutional factors and constant harbor wave turbulence renders the port terminals' bulkheads unsuitable for many marine species. At present, the East Arlington service district has less than 5 percent of bulkhead shoreline.

Estuarine access depends on the preservation of natural shorelines. Extensive migratory movements by juvenile fishes and invertebrates are along shallow near-shore areas. This behavior is primarily for protection from larger predacious fish which are restricted to deeper water.

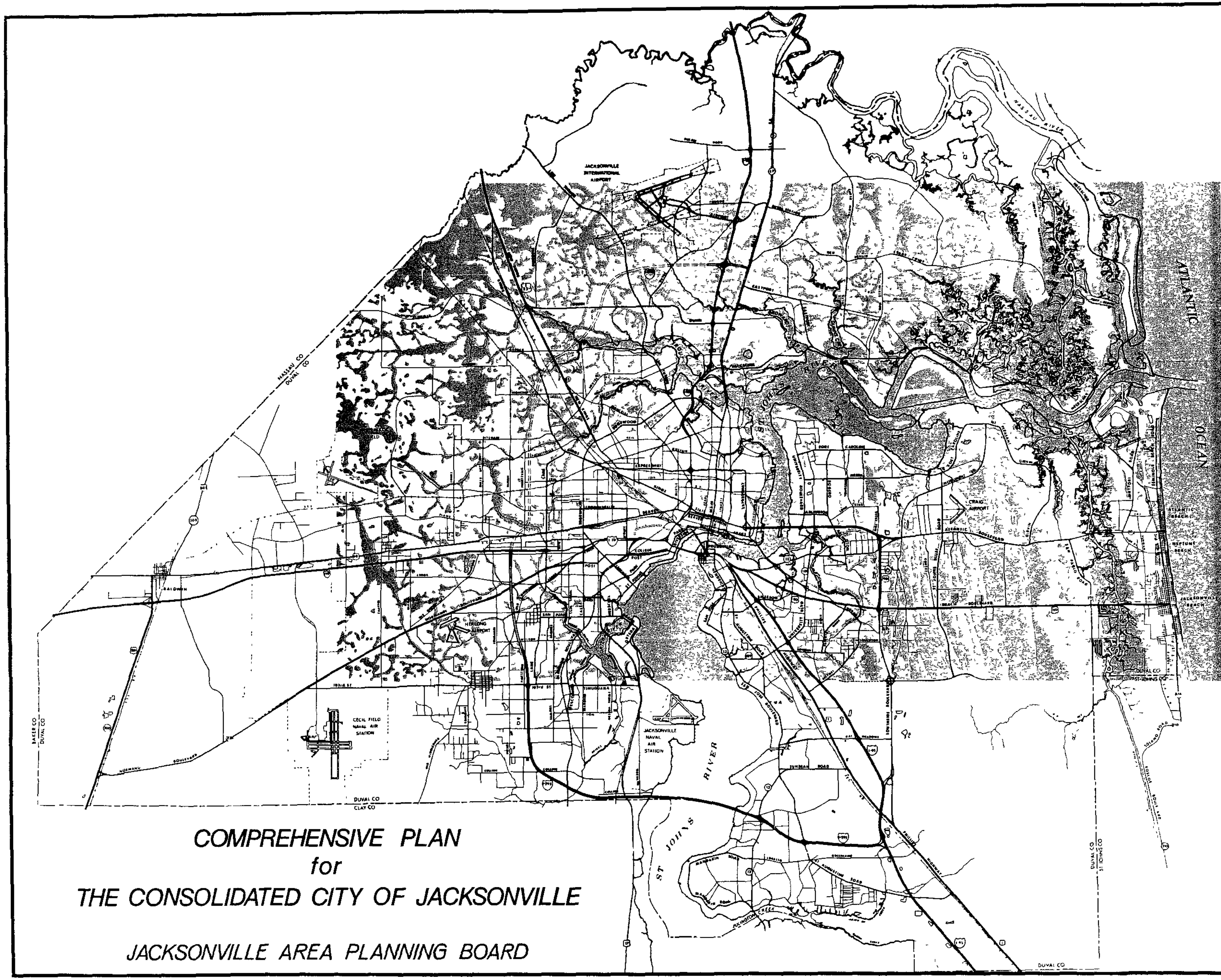
Most background data for land-water interfaces was extracted from a two-part estuarine survey performed by Frederick Tone in 1972 for the Blount Island EIS. August sampling work compares stations in Mill Cove with other stations in the Blount Island area. Figure 2-14 locates shore zone stations.

Littoral Fauna - The beach zone between high and low tide is the littoral zone. It can be a high energy area where wave action and shore currents cause a continual movement of beach material. For this reason, a high energy beach is usually devoid of any attached vegetation. Few aquatic species can exist here and those that do must tolerate regular exposure to air. Consequently, the benthic populations are expected to be minimal.

FIGURE 2-13

FLOOD PRONE AREAS

100 YEAR FREQUENCY



COMPREHENSIVE PLAN
for
THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

LEGEND

-FLOOD PRONE AREAS

NOTE EXTENT OF AVAILABLE INFORMATION IS DEPICTED BALANCE OF AREA SHALL BE DEPICTED WHEN IT BECOMES AVAILABLE

SOURCE U S GEOLOGIC SURVEY FLOOD PRONE AREA QUADRANGLE SERIES

GRAPHIC SCALE

JUNE 1973

THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

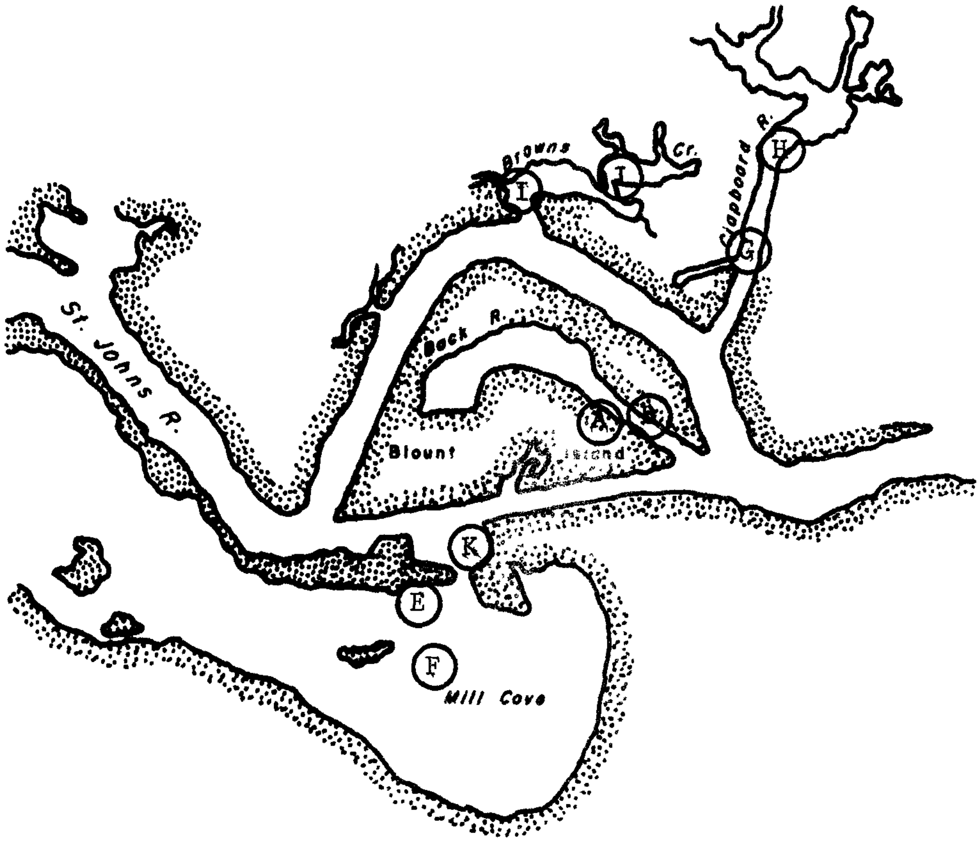


Figure 2-14

Estuarine shore zone stations sampled

by Frederick Tone, August 1972.

Frederick Tone surveyed the littoral beach zone for benthic invertebrates. Mill Cove was found to be marginally productive while three other sites not as near to Arlington-East were unproductive. Data for this 1972 work is shown in Table 2-10. Certain amphipods such as those obtained in the survey (Haustoriidae family) are common in large numbers in clumped distributions. Another family, Oedicerotidae, can be expected in this zone in similar aggregations. Fiddler crabs (Uca sp) also quite common, were collected at a Mill Cove station. Littoral areas on mud flats adjacent to marsh vegetation offer a better habitat for invertebrates. The substrate is more stable and has more organic content for deposit feeding worms and mollusks. Some crustaceans, such as juvenile crabs, penaid shrimp, or the common grass shrimp (Palaemonetes pugio), frequent the area at high tide.

Even though benthic populations can be insignificant in the beach zone, the near-shore waters are extremely important to the nekton. Seining will sample juveniles and smaller fish species that utilize the near-shore area for protection from larger fish. Shore zone seining, performed by Tone, yielded a good diversity of fish. The survey yielded 23 species, indicating the great importance of the shallow, near-shore areas to the productivity of the estuary. This work was a comparative survey of several areas in the lower estuary. Collections were dominated by the Atlantic silversides, striped killifish, striped mullet and redeqe mullet. Complete seining data at four stations samples are in Table 2-11.

Benthic infauna and the sizable migrations of juvenile fish fall prey to birds in the beach zone. Terns, plovers, sandpipers and herons all feast on schools of juvenile fish.

Marsh Flora - Salt marshes, those areas which come under some degree of tidal influence, are known to be more biologically productive in terms of grams of carbon per unit area than the most intensively worked farmland. Many benefits are derived from salt marsh areas; biological productivity, water table recharge, and filtration are considered vital to the rest of the estuary.

Table 2-10

INTERTIDAL INVERTEBRATES (Sampled by Tone; August 1972)

Organisms/M^2

	Back River		Mill Cove		Clapboard Creek		Brown's Creek	
	A	B	E	F	G	H	I	J
Annelida								
Polychaeta								
Capitellida				16				
Capitellidae			48	48				
fragments								
Mollusca								
Gastropoda								
Neogastropoda								
Nassariida								
Ilyanassa obsoleta						32		
Bivalvia								
Heterodontida								
Solecurtidae								
Tagelus plebeius				32				
Arthropoda								
Crustacea								
Amphipoda								
Haustoriidae			3376					
Decapoda								
Palaemonidae								
Palemonetes sp.				32				
Ocypodidae								
Uca sp.			16					128
TOTAL NUMBER ORGANISMS	0	0	3440	128	0	32	0	128
TOTAL NUMBER SPECIES	0	0	2	3	0	1	0	1

Table 2-11

Shallow Water Seining Performed by Tone; August, 1972

	BACK RIVER				MILL COVE				CLAPBOARD CREEK				BROWN"S CREEK			
	A		B		K		E		G		H		I		J	
FISH SPECIES	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm	No.	A.T.L. mm
Brevoortia patronus									1	141.0						
Dorosoma cepedianum					1	143										
Anchoa hepsetus									12	52.9	2	54.5				
Anchos mitchilli							1	56.0	4	48.3					1	45
Urophycis earlli					1	98										
Strongylura marina	1	26.0														
Cyprinodon variegatus			1	36.0	2	31.0										
Fundulus chrysotus					2	31.0										
Fundulus heteroclitus	1	39.0			33	38.9									1	45.0
Fundulus majalis			329	38.1	5	47.6	6	45.3							3	34.3
Menidia menidia	189	45.8			20	60.7	85	58.2	126	50.9	10	60.1	42	54.1	290	49.0
Eucinostomus gula			5	103.0												
Eucinostomus lefroyi					1	55.0			1	larvae	10	larvae			2	26.0
Gerres cinereus	5	44.2														
Lagodon rhomboides									2	118.5						
Bairdiella chrysura									31	92.4						
Cynoscion regalis	2	45.0														
Leiostomus xanthurus	4	78.8			15	76.1										
Micropogon undulatus	1	69.0														
Mugil cephalus	449	60.9			67	53.5					2	106.0				
Mugil curema							1	123.0							[illegible]	84.0
Mugil gaimardianus			108	43.0												
Sphaeroides maculatus											1	larvae	3	larvae		
TOTAL NUMBER	652		443		148		93		177		25		45		298	
INVERTEBRATE SPECIES																
Callinectes sapidus	3		3	40.0			1	10.0					8	35		
Panaeus fluviatilis	123	40.0			1	78.0										

Key: No. - number
A.T.L. - average total length

It is estimated that 6 percent of Duval County is salt marsh. The service district is bordered by considerable marsh. Two wetland types are predominant according to circular 39, "Wetlands of the United States." Type 18, the low marsh is that portion which is regularly flooded by diurnal tidal cycles. Dominant vegetation is Spartina alterniflora, the most abundant salt tolerant emergent species on the east coast of the U. S.

Type 17 is the high marsh portion which is infrequently flooded at lunar tides or by freshwater floods. The dominant species is salt tolerant, black needlerush (Juncus roemerianus).

About 85 percent of Mill Cove is bordered by marshgrass. The intracoastal waterway, the eastern boundary of the service district, and Chicopit Bay, at its confluence with the St. Johns, are bordered by the same two common species of grass. Quantities of Spartina decrease southward along the intracoastal waterway away from the greater tidal fluctuations close to the St. Johns River.

Big Pottsburg Creek drains a heavily populated portion of the southwestern sections of the service district. Sections of shoreline have been dredged and bulkheaded. Some energent grass does remain in the lower reaches of the creek near Atlantic Boulevard. The marshgrass directly benefits residents on the creek by functioning as a filter for run-off. Culverting or otherwise rapidly channeling this water into the creek has defeated its purpose.

Emergent vegetation has been retained in Little Pottsburg Creek. Black needlerush is the dominant species.

Productivity of salt marsh areas in the lower estuary was measured by Frederick Tone, August 1972. The results shown on Figure 2-15 compare dry weight biomass measurements at four sites, including one in Mill Cove. The randomly selected sites are so few that this data does not indicate species distribution or differences within the Jacksonville. area. It does, however, indicate small differences in productivity from marsh to marsh.

Type 12, wetlands coastal shallow fresh marshes are present around creek headwaters. This area typically exists on the landward side of saltmarsh grasses and is adjacent to the hardwood swamp. Sufficient freshwater input enables sawgrass, threesquares, and cattails (Typha latifolia) to exist.

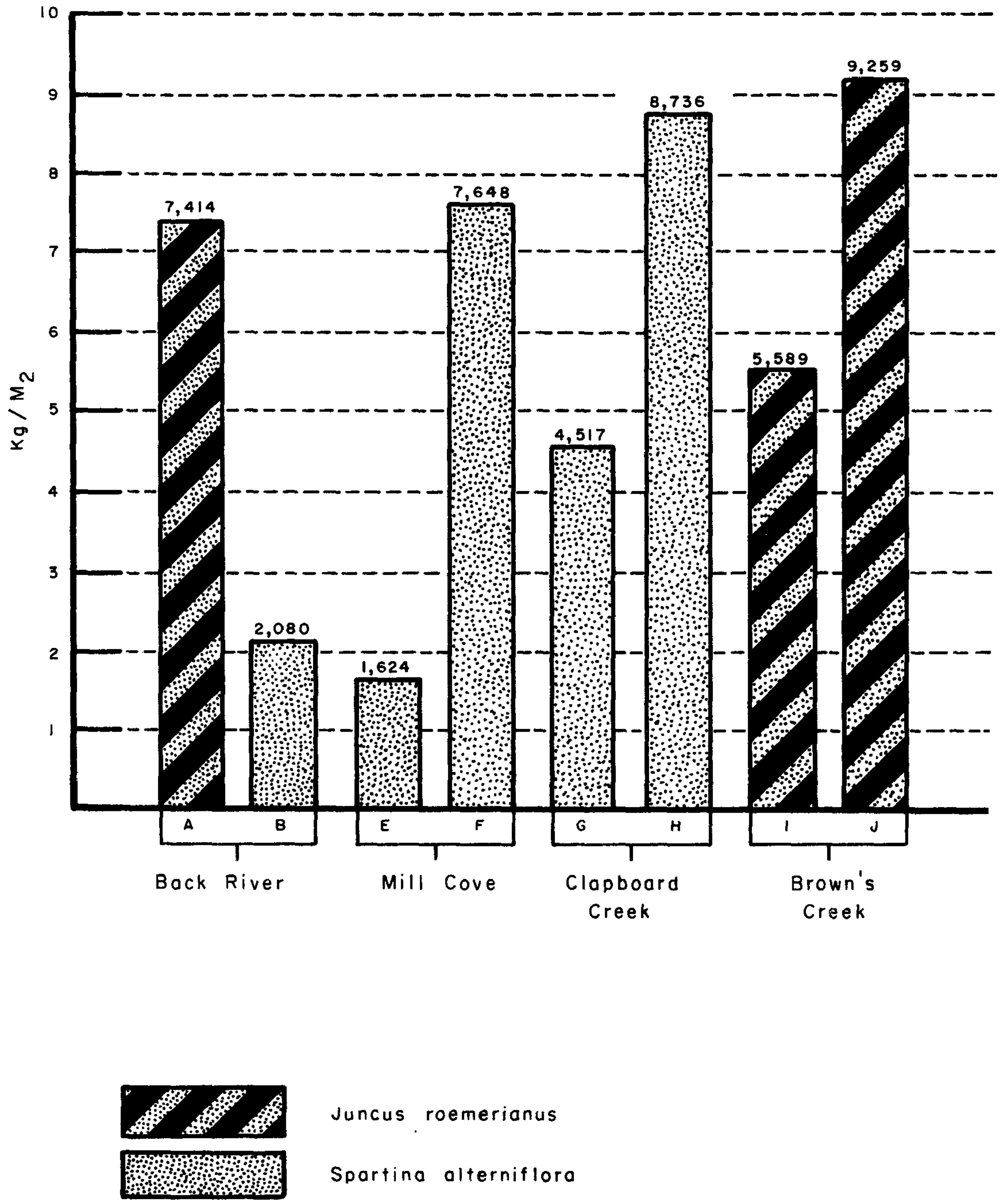


Figure 2-15

Marsh Flora Sampled by Tone; August, 1972

Numerous animal species have life histories interconnected with wetlands. The fauna associated with the inland freshwater swamp is mentioned with terrestrial animal life because of a closer association with these inhabitants.

To the animals of the estuary, phytoplankton is a major, basic source of food supply but not the only one. Detritus, dead plant material from marsh plants especially saltmarsh cordgrass is another readily available food for animals of the estuary. Many animal species will frequent the marsh, but few directly consume the living plant material. First, the plants are decomposed to the usable detrital form. Even then only a small fraction of it is consumed by invertebrates within the marsh. Most detritus is washed into the water to be available to aquatic forms.

High and low salt marsh areas provide only minimal food sources for migratory waterfowl. Most of the hunted species are uncommon or rare in Duval County, even though extensive wetlands are present. Many other birds are dependent on salt marsh areas as the species inventory, Table 2-12, plainly indicates. Sixty-seven species known to exist in or near the service district prefer salt marshes as transient, seasonal, or permanent residents.

The abundant salt marshes provide habitat for many intertidal animals. Numerous invertebrates, especially mud crabs, mollusks, juvenile shrimp, and insect larvae exist here. The August 1972 Tone survey sampled area salt marshes for invertebrates living in the highly organic substrate. The fiddler crab, Uca sp., was most abundant in the Spartina bordering on Mill Cove. Mill Cove stations had healthy populations of Nereis succinea, a common polychaete worm. With these two exceptions, populations do not vary significantly between the four sites he surveyed near Quarantine Island. Survey data is shown in Table 2-12.

In addition, numerous amphibians, reptiles, and mammals that are at least partially dependent on the marsh frequently enter it in search of food. These three classes of vertebrates are inventoried with habitat preference in Appendix XI.

Table 2-12

Phylum
Class
Order
Family
Genus

MARSH FAUNA (Collected by Tone; August, 1972)

Organisms/M[2]*

	Back River		Mill Cove		Clap.Creek		Brown's Creek	
	A	B	E	F	G	H	I	J
Annelida								
Polychaeta								
Phyllodocida								
Nereidae				64				
Nereis succinea			32	34				
Capitellida								
Capitellidae		16						
fragments			32	64				
Mollusca								
Bivalva								
Pteroconchida								
Mytilidae								
Modiolus demissus	128					16		
Heterodontida								
Solecurtidae								
Tagelus divisus			48					
Arthropoda								
Crustacea								
Isopoda								
Anthuridae								
Cyathura sp.					16			
Amphipoda								
Gammaridae							16	
Decapoda								
Xanthidae								
Panopeus herbstii						32		
Grapsidae								
Gesarma reticulum	16		16			64		96
Ocypodidae								
Uca sp.	112	112	256		192	112	112	128
TOTAL NUMBER ORGANISMS	256	128	384	162	208	224	128	224
TOTAL NUMBER SPECIES	3	2	4	2	2	4	2	2

4. Water

a. Physical and Chemical

1) General

The dominant surface water body in the project area is the St. Johns River. Draining an area of some 9,430 square miles, the St. Johns discharges about one tenth of the average daily surface runoff from the State of Florida. At Jacksonville, the river is part of a tidal estuary that may, for practical purposes, be considered to end at Lake George, 106 miles upstream. From the ocean to Jacksonville, it ranges in width from about 1,250 feet at the Main Street Bridge to more than 2 miles at Mill Cove. The U. S. Army Corps of Engineers maintains a navigation channel in the river which, from the ocean to Jacksonville, is 34 feet deep and 400 to 900 feet wide. Principle uses of the river in the project area are waste disposal, transportation, heat disposal, fisheries, and recreation.

The physical make-up of the bottoms of the streams and marshes in the area is largely reflective of the diverse sedimentation conditions found in the marsh-estuarine environment, most particularly salinity and velocity. Local sediments consist chiefly of organic matter, sands, and clays. In general, the estuarine sediments have a much higher sand content than the marsh or freshwater sediments since the river channels are subject to swift currents that wash away slowly settleable particles. More quiet areas, such as Back River, enable the finer silts and organic materials to settle out of the water column, resulting in fine-grained, high moisture content, low sand sediments. Recent core borings show the sediment in Back River to vary in thickness from 3 to 8.5 feet. Areas within the river-estuary environment itself which are susceptible to fine silting are creeks and boat slips having relatively deep water with little current. Most notable in this respect are the marine facilities near downtown Jacksonville. The most detrimental alteration to the physical make-up of the bottoms of local waterways is undoubtedly to the St. Johns River bed through the downtown area. Here, sludge blanket deposits cover portions of the bottom of the river as a cumulative result of over 70 years of raw municipal and industrial wastewater discharge. Both the shallow and Floridan aquifer underlie the entire area of Duval County. Approximate depths to the top of the Floridan Aquifer in the Jacksonville area are shown on Figure 2-16.

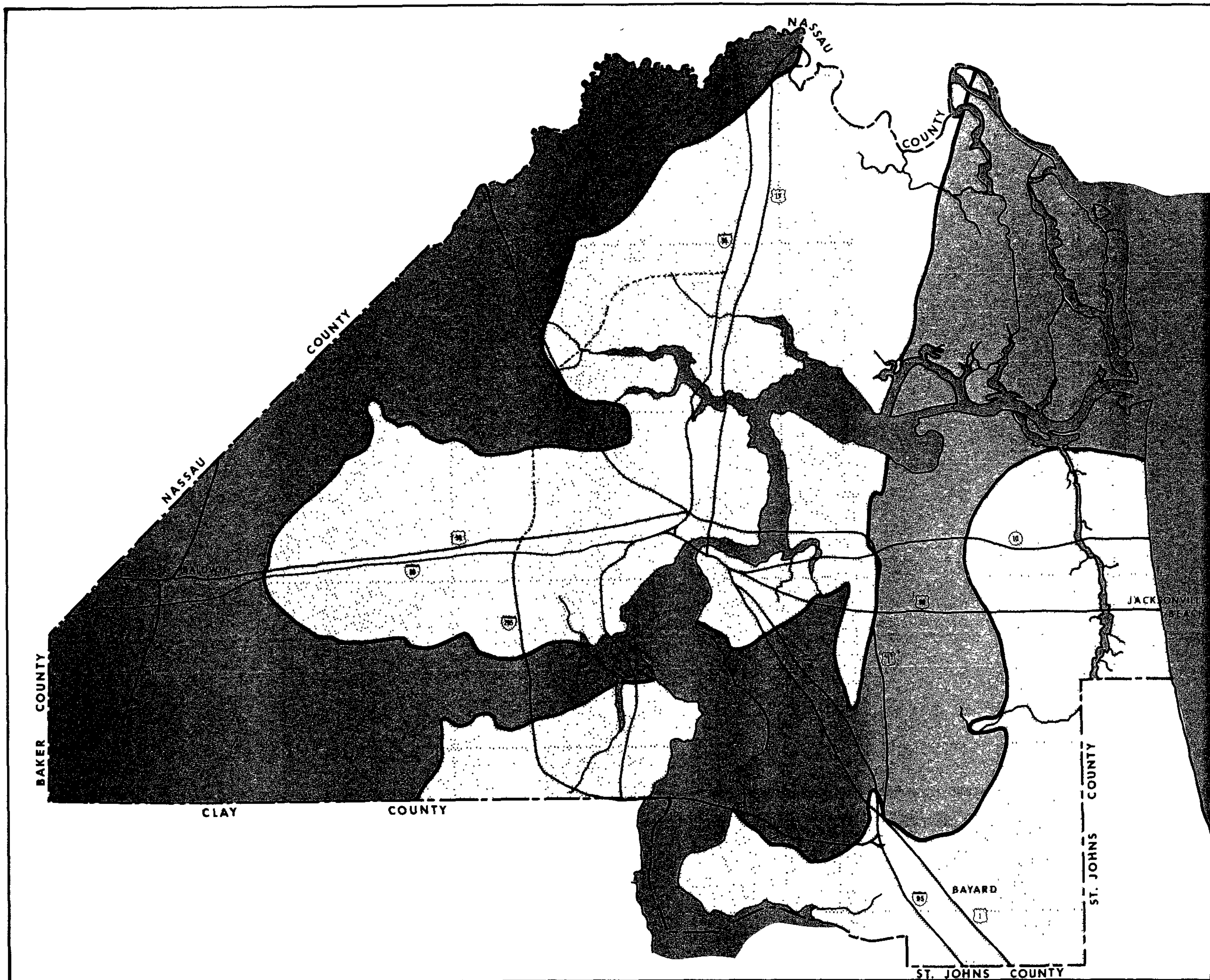


FIGURE 2-16

DEPTH TO THE TOP OF THE ARTESIAN AQUIFER IN THE JACKSONVILLE AREA

LEGEND

200 - 400

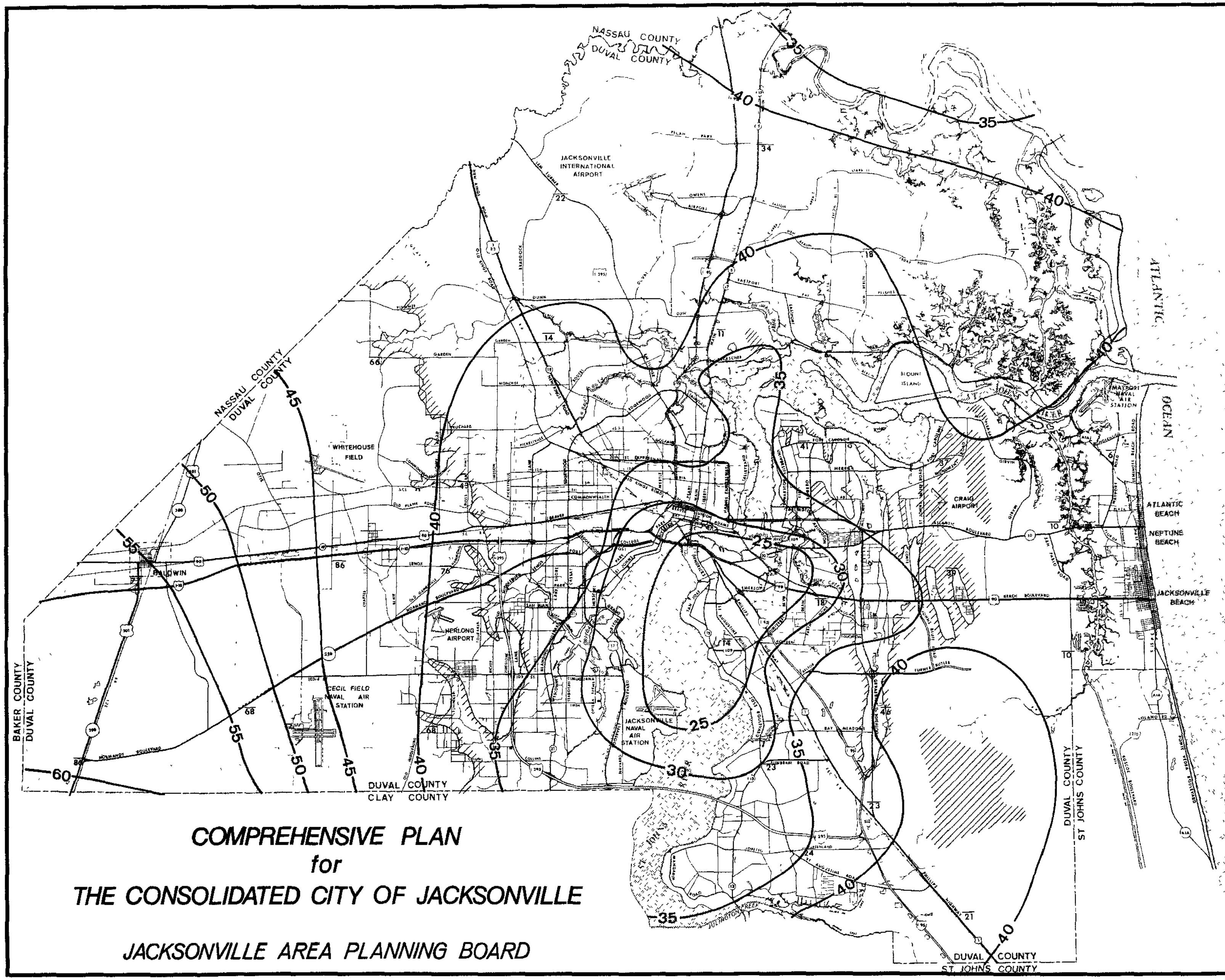
400 - 500

500 - 700

SOURCE- LEVE, G.W., U.S.G.S IN COOPERATION WITH THE FLORIDA GEOLOGICAL SURVEY, JACKSONVILLE'S WATER, LEAFLET NO.6, 1965

Recharge to the shallow aquifer system is primarily from local rainfall. Water levels respond rapidly to rainfall and are highest during the rainy season (June to October) and lowest during the dry season (November to May). Ten to sixteen inches of rainfall annually is estimated as necessary to recharge the shallow-water aquifer in Duval County. The main recharge areas are the regions of highest altitude in the western third of the county and along the high sand ridges east of Jacksonville. Discharge is through springs and seeps, by evapotranspiration, by pumping from wells, and by downward percolation to the Floridan Aquifer.

The principal recharge area of the Floridan Aquifer system in northeast Florida is located southwest of Duval County in western Putnam and Clay Counties and eastern Alachua and Bradford Counties. Within this recharge area water enters the aquifer through leaches in the aquiclude caused by sinkholes, by downward leakage where the aquiclude is thin or absent, and directly into the aquifer where it is exposed at the surface. Duval County is primarily a discharge area of the Floridan Aquifer system principally through the numerous wells which penetrate it and possibly through some natural discharge from the aquifer system into the Atlantic Ocean off the coast. However, extensive areas of possible recharge do occur in the county as noted above where the potentiometric surface -- the imaginary surface to which water from an artesian aquifer will rise in cased wells that penetrate the aquifer -- is relatively high. These possible recharge areas and their relationship to the potentiometric level of the Floridan Aquifer are shown in Figure 2-17.



COMPREHENSIVE PLAN
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JACKSONVILLE AREA PLANNING BOARD

FIGURE 2-17

POSSIBLE RECHARGE AREAS

TO FLORIDAN AQUIFER IN DUVAL COUNTY, FLORIDA

LEGEND

AREAS OF POSSIBLE RECHARGE

- POTENTIOMETRIC SURFACE IS BELOW LAND SURFACE AND WATER TABLE
- INSUFFICIENT DATA TO DEFINE AS RECHARGE OR DISCHARGE

AREA OF DISCHARGE

- POTENTIOMETRIC SURFACE IS ABOVE LAND SURFACE

-30- CONTOUR INDICATING ALTITUDE IN FEET ABOVE MEAN SEA LEVEL OF POTENTIOMETRIC SURFACE OF FLORIDAN AQUIFER CONTOUR INTERVAL 5 FEET

86 WATER TABLE IN FEET ABOVE MEAN SEA LEVEL

NOTE SEE FIGURE 1-3 FOR FURTHER EXPLANATION OF THIS MAP

SOURCE: U S GEOLOGIC SURVEY WATER RESOURCES DIVISION IN COOPERATION WITH JAPB

GRAPHIC SCALE

JUNE 1973

THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

2) Water Quantity

a) Surface Water

In the estuary of the lower St. Johns River, the current flows both upstream and downstream. The current first increases in one direction from zero velocity (slack water) to maximum velocity, then decreases to slack water once again. The process is then repeated in the opposite direction with the entire local tidal cycle (from one low tide to the next low tide) occurring over a period of approximately 12.5 hours. Thus, there are generally two high and two low tides each day. Peak velocities in the estuary average approximately 1.6 knots for the incoming tide and 2.2 knots for the ebb tide. Variations in river discharge, such as runoff from a high intensity storm, will exert short-term effects on the tidal currents. However, the maximum tidal current between Blount Island and the ocean exceeds 3.0 knots only a few times annually.

The greatest influence on the flow regime of the St. Johns River at Jacksonville is the tide. Various non-tidal factors such as wind, rainfall, and evapotranspiration act in combination to continually affect the flow but are virtually self-cancelling and have no significant cumulative effect on the flow of the river. The only factor having such an effect is freshwater drainage from the river basin (the net oceanward flow).

Upstream conditions in the estuary may sometimes combine to produce a net upstream flow per tidal cycle. During these times, storage in the estuary is relatively small and losses by evapotranspiration are high. More water is thus permitted to flow upstream into the estuary than flows out. During the period 1956 through 1966, there were 21 months during which the average net flow was upstream. Except for February 1966, which followed the very dry year of 1965, these all occurred during the dry season in exceptionally dry years.

Selected flow and volume statistics for the St. Johns River at Jacksonville computed by the U. S. Geological Survey (USGS) and based on records for the period March 1, 1954 to September 30, 1966, are as follows:

	Downstream	Upstream
Average discharge, cfs*	46,419	40,536
Average net discharge, cfs	5,883	-
Max. daily net flow, cfs	87,000	-
Min. daily net flow, cfs	-	51,500
Average volume per tidal cycle, mcf**	2,076	1,812
Average net volume per tidal cycle, mcf	263	-
Max. volume per tidal cycle, mcf	5,280	4,410
Min. net volume per tidal cycle, mcf	0	0

*cubic feet per second
**million cubic feet

The expression of minimum flow occurrence in the St. Johns River for purposes of waste assimilation capability must consider tidal flows as well as upstream and downstream movement. The total volume of moving water in the estuary--be it upstream or down--is nearly always very great. In general, however, more water moves downstream with greater frequency than upstream. For example, the average recurrence interval of monthly minimum upstream flow of zero per tidal cycle at the Main Street Bridge in Jacksonville is about 96 months while that for downstream flow per tidal cycle of 500 million cubic feet or less is greater than 16 years.

Limited flow data is available from the USGS for several smaller streams in Duval County. For the majority of streams in the county, however, the seven-day average low flow reoccurring once in a ten-year period approaches zero. In the Arlington-East Service District, available records show a seven-day once-in-ten low flow of 0.20 cfs for Jones Creek and 0.26 cfs for Pottsburg Creek.

a) Ground Water

Water from the shallow-aquifer system is used for domestic, industrial, commercial, and agricultural purposes. Most of the water withdrawn is used for washing, toilets, drinking, swimming pools, and lawn irrigation. The most common industrial use is for heat-exchange units in large air-conditioning systems. The shallow aquifer system is present throughout all of Duval County but without benefit of the shallow limestone beds in the Arlington area and along the coastline from Mayport to Ponte Vedra. From 55,000 to 65,000 wells penetrate this system in the county with a total discharge of 10 to 25 million gallons per day
.

(mgd). These wells range in depth from 20 to 200 feet and are most commonly privately owned and 2 inches or less in diameter. Most obtain water from highly permeable limestone except in the Arlington area where many obtain water from coarse sand and shell beds 75 to 100 feet below the surface.

The thickness and lithology of the components of the shallow water aquifer vary both vertically and laterally, thus making the amount of water available from them dependent on the location and depth of the wells. The surficial sand beds generally yield about 10 to 25 gallons per minute (gpm) to small diameter wells and the deeper limestone, shell, and sand beds between 15 and 20 gpm. Locally, however, a 2-inch well may yield as much as 80 gpm where the limestone or shell aquifer is relatively thick.

Groundwater of the shallow aquifer system is generally nonartesian but some shallow wells in low areas immediately adjacent to the St. Johns River and its tributaries do yield artesian water. Artesian heads range from a few inches to more than 20 feet above land surface. Some wells do not flow during the dry season when the potentiometric level is below land surface.

The Floridan aquifer system is the principal source of fresh water in northeast Florida; all public water and most industrial and private water supplies in Duval County are drawn from it. Jacksonville is one of the largest cities in the world to obtain its entire water supply from deep artesian wells. Some 92 wells with depths of approximately 1,000 to 1,500 feet presently supply public water to the city. In 1974 they produced an approximate average of 58 mgd as compared with a withdrawal of some 27 mgd in 1950. This figure, however, includes some wells taken over by the city after its consolidation. In addition, a number of privately owned water utilities in the area, each of which has at least one artesian well, draw from the Floridan Aquifer. Other users of the aquifer in the area such as naval installations, pulp and paper mills and other commercial facilities, the smaller municipalities, and numerous private users combine to bring the total estimated average discharge from wells in the vicinity of Jacksonville from 150 to 200 mgd. An additional 50 to 70 mgd is drawn from artesian wells at Fernandina Beach.

The yield of wells in the Floridan aquifer system in Duval County depends upon well construction and depth, artesian pressure head, and water transmitting capacity of the zones penetrated. Wells drilled into the deeper zones of the aquifer system generally yield more water, under higher pressure, than those in the shallower zones. The major water-bearing zone in the Jacksonville area is in the Lake City Limestone at depths between about 950 and 1,200 feet. This zone has yielded 50 to 90 percent of the water produced by selected test wells in Duval and Nassau Counties. Well diameters range from 2 inches in small domestic wells to 20 inches in some industrial wells. The average yield of the smaller wells between 2 and 6 inches in diameter is generally less than 500 gpm but some 6-inch wells do yield as much as 1,000 gpm. Wells 8 to 12 inches in diameter generally average less than 2,000 gpm; although some 10 and 12-inch wells in the deeper zones may yield as much as 6,000 gpm. These are all natural flows which are by no means constant. Some 14 to 20-inch industrial wells in Fernandina Beach and in the vicinity of Jacksonville continually yield 4,000 to 5,000 gpm with the aid of deep turbine pumps.

A general decline in artesian pressures in northeastern Florida is attributed primarily to a great increase in the use of artesian groundwater and, to a lesser extent, to a relatively long-term decline of rainfall on the Floridan aquifer recharge areas in north-central Florida. Several major cones of depression have formed in the potentiometric surface of the Floridan aquifer system in Duval and Nassau Counties as a result of discharging wells which lower the artesian head and create a hydraulic gradient toward the area of discharge. Water-level records show that the irregular but continual decline in artesian pressure in these areas exceeds the general decline as these cones deepen and enlarge. In the Jacksonville area, the potentiometric surface has generally been depressed to less than 30 feet msl. Test wells have shown an artesian pressure decline of about 12 to 22 feet during the period 1946 to 1963. The greatest declines in pressures are in wells closest to the center of the cone of depression which, in Jacksonville, is located adjacent to the southwest corner of the Arlington-East Service District. The potentiometric surface has been depressed to about 20 feet msl in the center of this cone but may be leveling off as development, with attendant demand for groundwater, moves out from the central city area.

Artesian pressure in the area will continue to decline if withdrawals of water continue to increase. The rate of decline will be faster during years of below average rainfall. Above average rainfall may cause the pressure to stabilize or even increase. However, if the rate of discharge continues to increase, the artesian pressure will most likely decline even during periods of maximum recharge. At the present rate of decline of approximately 0.5 to 2.0 feet per year, it will take 100 to 400 years to lower the water 200 feet in most Floridan aquifer wells. The wells would not then cease to yield water but would require pumping to bring it to the surface.

3) Water Quality

a) Surface Water

Surface Water - The Florida Pollution Control Board has established that the following minimum conditions are applicable to "all waters, at all places, and at all times." Within the territorial limits of the State of Florida, all such waters shall be free from:

1) Settleable Substances - substances attributable to municipal, industrial, agricultural, or other discharges that will settle to form putrescent or other objectionable sludge deposits.

2) Floating Substances - floating debris, oil, scum, and other floating materials attributable to municipal, industrial, agricultural, or other discharges in amounts sufficient to be unsightly or deleterious.

3) Deleterious Substances - materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, or other conditions in such degree as to create a nuisance.

4) Toxic Substances - substances attributable to municipal, industrial, agricultural, or other discharges in concentrations or combinations which are toxic or harmful to human, animal, plant, or aquatic life.

In order to develop a "comprehensive program for the prevention, abatement, and control of the pollution of the waters of the State," all waters of the State of Florida have been classified in five classifications made in accordance with most beneficial present and future uses and are briefly described as follows:

Class I - Public water supplies
Class II - Shellfish harvesting
Class III - Recreation - Propagation and management of fish and wildlife
Class IV - Agricultural and industrial water supply
Class V - Navigation, utility, and industrial use

Pursuant to the criteria of water classifications I through V, the waters of the State are classified by river basins or sub-basins as Class III with individual exceptions to that class listed within each basin. The entire St. Johns River Basin and all its sub-basins within Duval County are thus classified as Class III. The only exception to this classification in the vicinity of the proposed project is the Intracoastal Waterway and its tributaries from the confluence of the Nassau and Amelia Rivers, south to Flashing Marker 72, thence eastward along Ft. George River to Ft. George Inlet and including Garden Creek, and both prongs of Simpson Creek. These reaches are classified as Class II. In addition, the above described Class II and III waters are further designated as having "Special Stream Classifications" which means that they shall be maintained at a minimum dissolved oxygen level of 5.0 milligrams per liter. The criteria for Class II and III waters are presented in Table 2-13.

Table 2-13

FLORIDA POLLUTION CONTROL BOARD CRITERIA FOR CLASS II AND III WATERS

CLASS II

The following criteria are for classification of waters in areas which either actually or protentially have the capability of supporting recreational or commercial shellfish propagation and harvesting. Harvesting may only occur in areas approved by the Division of Health, Florida Department of Health and Rehabilitative Services.

(1) Bacteriological Quality, Coliform Group — areas classified for shellfish harvesting, the median coliform MPN (Most Probable Number) of water cannot exceed seventy (70) per hundred (100) ml., and not more than ten (10) per cent of the samples ordinarily exceed an MPN of two hundred and thirty (230) per one hundred (100) ml. in those portions of areas most probably exposed to fecal contamination during most unfavorable hydrographic and pollutional conditions.

(2) Sewage, Industrial Wastes, or Other Wastes — any industrial wastes or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(3) pH — of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than six (6.0) and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes, outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(4) Dissolved Oxygen — the concentration in all surface waters shall not average less than 5 mg/l in a 24-hour period and never less than 4 mg/l. Normal daily and seasonal fluctuations above these levels shall be maintained. Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 4.0 mg/l except in naturally dystrophic waters. In those cases where background information indicates prior existence under unpolluted conditions of lower values than required above, lower limits may be utilized after approval by the regulatory authority. Sampling shall be performed according to the methods approved by the Florida Pollution Control Board.

(5) Toxic Substances — free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(6) Odor — threshold odor number not to exceed 24 at 60°C as a daily average.

CLASS III

The following criteria are for classification of waters to be used for recreational purposes, including such body contact activities as swimming and water skiing; and for the maintenance of a well-balanced fish and wildlife population. All surface waters within and coastal waters contiguous to these basins, including off-shore waters, not otherwise classified shall be classified as Class III; however, waters of the open ocean shall be maintained at a dissolved oxygen of not less than five (5.0) ml/l. Streams specifically listed in Section 17.3.21 by a separate listing designated as "Special Stream Classification" shall similarly be maintained at a minimum dissolved oxygen level of five (5.0) ml/l.

(1) Sewage, industrial wastes, or other wastes — any industrial waste or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(2) pH — of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than (6.0), and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(3) Dissolved Oxygen — the concentration in all surface waters shall not average less than 5 mg/l in a 24-hour period and never less than 4 mg/l. Normal daily and seasonal fluctuations above these levels shall be maintained. Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 4.0 mg/l except in naturally dystrophic waters. In those cases where background information indicates prior existence under unpolluted conditions of lower values than required above, lower limits may be utilized after approval by the regulatory authority. Sampling shall be performed according to the methods approved by the Florida Pollution Control Board.

(4) Bacteriological — in those waters designated for body contact recreation, fecal coliform shall not exceed a monthly average of 200 per 100 ml of sample, nor exceed 400 fecal coliform per 100 ml of sample in 10 percent of the samples, nor exceed 800 fecal coliform on any one day, nor exceed a total coliform count of 1,000 per 100 ml as a monthly average, nor exceed 1,000 per 100 ml in more than 20 percent of the samples examined during any month; nor exceed 2,400 per 100 ml on any day. In those waters not normally used for body contact recreation, fecal coliform shall not exceed a monthly average of 500 per 100 ml of sample, nor exceed 750 fecal coliform per 100 ml of sample in 10 percent of the samples. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period. MPN of MF counts may be utilized.

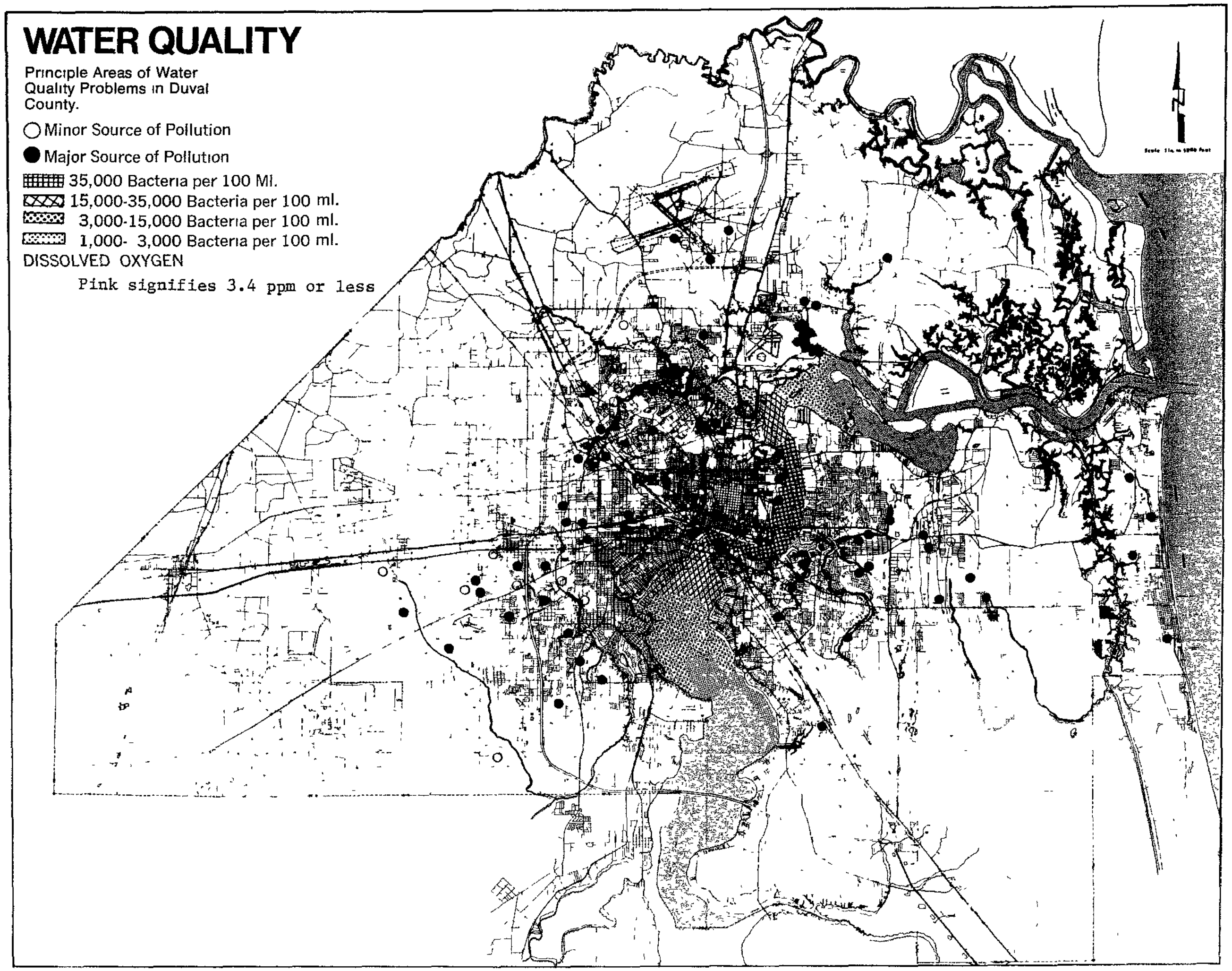
(5) Toxic substances — free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(6) Deleterious — free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor or other conditions in such degree as to create a nuisance.

(7) Turbidity — shall not exceed fifty (50) Jackson units as related to standard candle turbidimeter above background.

Discussion of surface water quality in the project area will be limited primarily to the problems of dissolved oxygen and coliform bacteria. Dissolved oxygen--the amount of free oxygen in the water--is, in general, directly related to overall quality and necessary for the self-purification of streams. Low levels of dissolved oxygen adversely affect fish and other aquatic life and its total absence will lead to the development of anaerobic conditions with attendant odor and aesthetic problems. Generally, the range of 3 to 6 milligrams per liter (mg/l) is the critical level of dissolved oxygen for nearly all fish. Below approximately 3 mg/l, further decreases are important only insofar as the development of local septic conditions is concerned. In other words, the major damage to fish and aquatic life will already have been done. Available data indicate that dissolved oxygen depletion is a serious problem in the St. Johns River and an acute problem in its tributaries. Figure 2-18 shows areas of severe dissolved oxygen depletion in the major tributaries.

Figure 2-18


WATER QUALITY
Principle Areas of Water Quality Problems in Duval County.
Minor Source of Pollution
Major Source of Pollution
35,000 Bacteria per 100 Ml.
15,000-35,000 Bacteria per 100 ml.
3,000-15,000 Bacteria per 100 ml.
1,000- 3,000 Bacteria per 100 ml.
DISSOLVED OXYGEN
Pink signifies 3.4 ppm or less

Dissolved oxygen concentrations of less than 4 mg/l have at times been measured on the main stem of the St. Johns River from the confluence of the Ortega River downstream to Blount Island--a distance of nearly fifteen miles. In summer, levels at the Main Street Bridge are depressed with regularity to below 4 mg/l and have been measured as low as 2.9 mg/l. An oxygen profile was measured from Palatka to the ocean during a three-day sampling program in July 1972. Figure 2-19 plots this profile showing a pronounced dissolved oxygen dip throughout the downtown reach of the river and subsequent recovery in the vicinity of Blount Island. Seasonal trends of average dissolved oxygen concentrations in the St. Johns River at Jacksonville under ebb tide conditions for 1959 and 1968 are shown in Figure 2-20. Major contributing factors to these depressed levels are the biochemical oxygen demand (BOD) from a number of industrial discharges and raw municipal sewer outfalls. In addition, a significant number of small package treatment plants and other municipal sewage treatment plants discharge either directly to this 15-mile sector of the river or to tributaries that feed it. Since the July 1972 survey, however, the new Buckman Street secondary sewage treatment plant has eliminated many of the Core District raw outfalls and the St. Regis Paper Company--the largest single wastewater producer in the county--has opened its secondary treatment facility. More than any other single pollution abatement activity in the county, the implementation of this facility has aided in reducing the BOD loading to the St. Johns River.

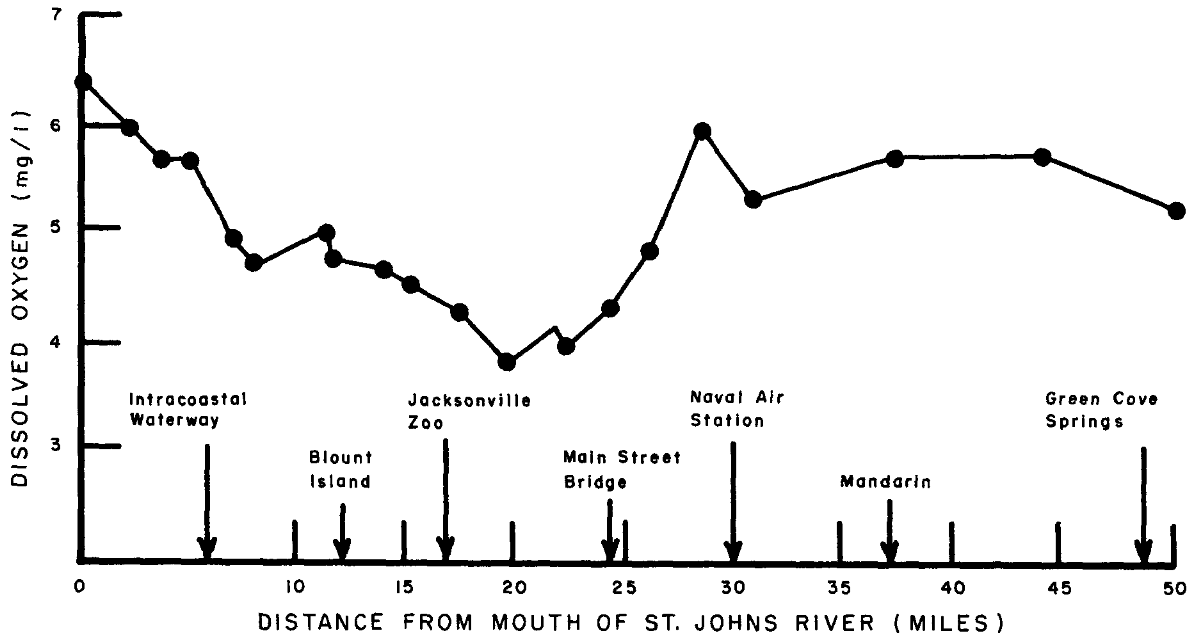


Figure 19

Dissolved Oxygen Profile

Lower St. Johns River (1972)

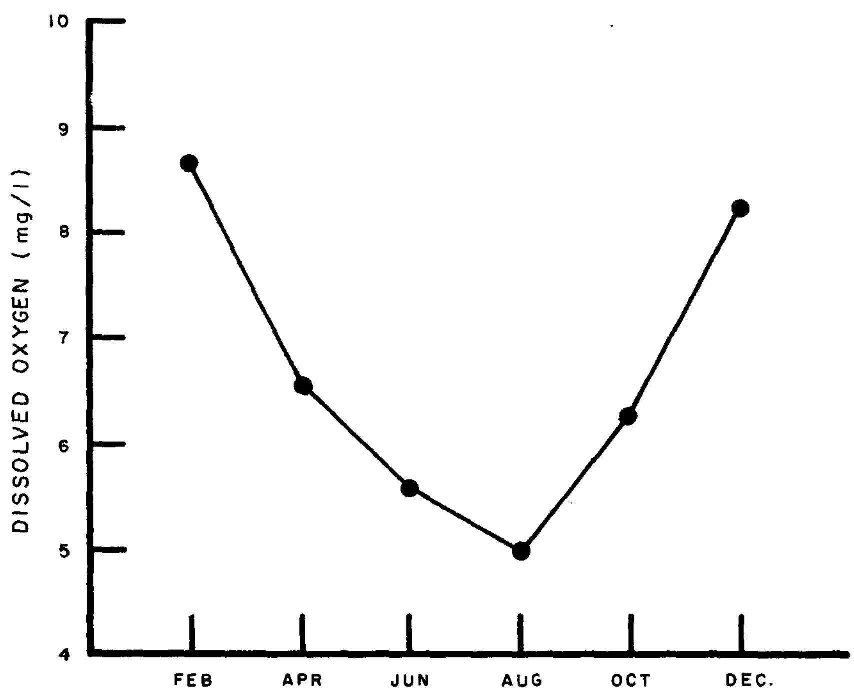


Figure 2-20

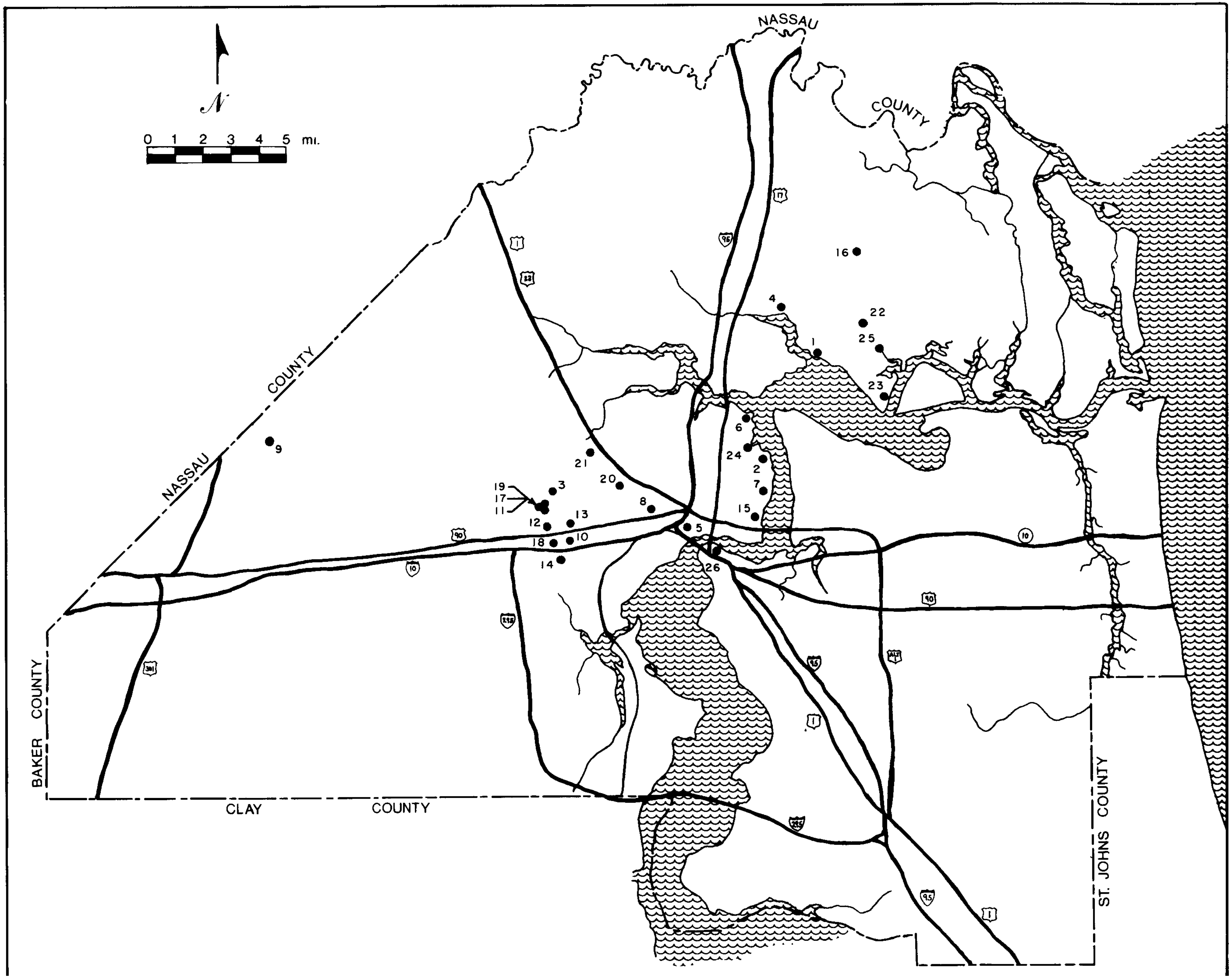
Seasonal Trends of Average Dissolved Oxygen Concentrations

in the St. Johns River at Jacksonville (1959-68)

Approximately 64 major industries within the county now dispose of their waste via private industrial outfalls. In some instances, pre-treatment is performed at the plant prior to discharge. Many industries will be picked up by the Core District sewering program scheduled for completion by 1990. Figure 2-21 shows the location of principal industrial outfalls in Duval County and Table 2-14 summarizes their estimated flows.

Several less obvious sources of water pollution exist in the Jacksonville area which have not received the relative emphasis afforded the treatment of domestic and industrial wastes. One of these is stormwater runoff -- the precipitation striking a surface during a storm which exceeds the absorption or holding capacity of that surface. The characteristics of this runoff can be a significant factor in causing undesirable effects in waterways draining individual watersheds. The effect of a major storm in Jacksonville is to dump more BOD into the St. Johns River than can be generated by all the secondary treatment facilities in Duval County in one day. This loading does not occur as frequently as the continuous point source loadings. However, a nitrogenous oxygen demand generated by storm runoff takes several weeks to die out and may extend to the next storm event. Based on conditions in other cities, the monthly contribution of stormwater runoff to the receiving waters of Duval County is estimated to be about 16 percent of the total BOD loading. Urban creeks are the most visibly damaged receiving bodies and, due to the impact of urban runoff, it is doubtful that water quality standards could be met in many of these creeks receiving large quantities of runoff even if present sewer discharges were removed.

A second less obvious source of water pollution in Duval County is septic tank effluent. Over 171,900 people, or about 34 percent of the county's population, were estimated to discharge their sanitary sewage to some type of septic tank system in 1970. At that time, over 50 percent of the total dwelling units in the North, Arlington, Mandarin, and East Districts were connected to septic tanks. The major septic tank problem area within the county is, ironically, situated within the 80 percent sewered Core District. Other major acute problem areas are located within the Southwest District. Septic tank areas, including chronic problem areas from a public health and water pollution standpoint, are shown in Figure 2-22.

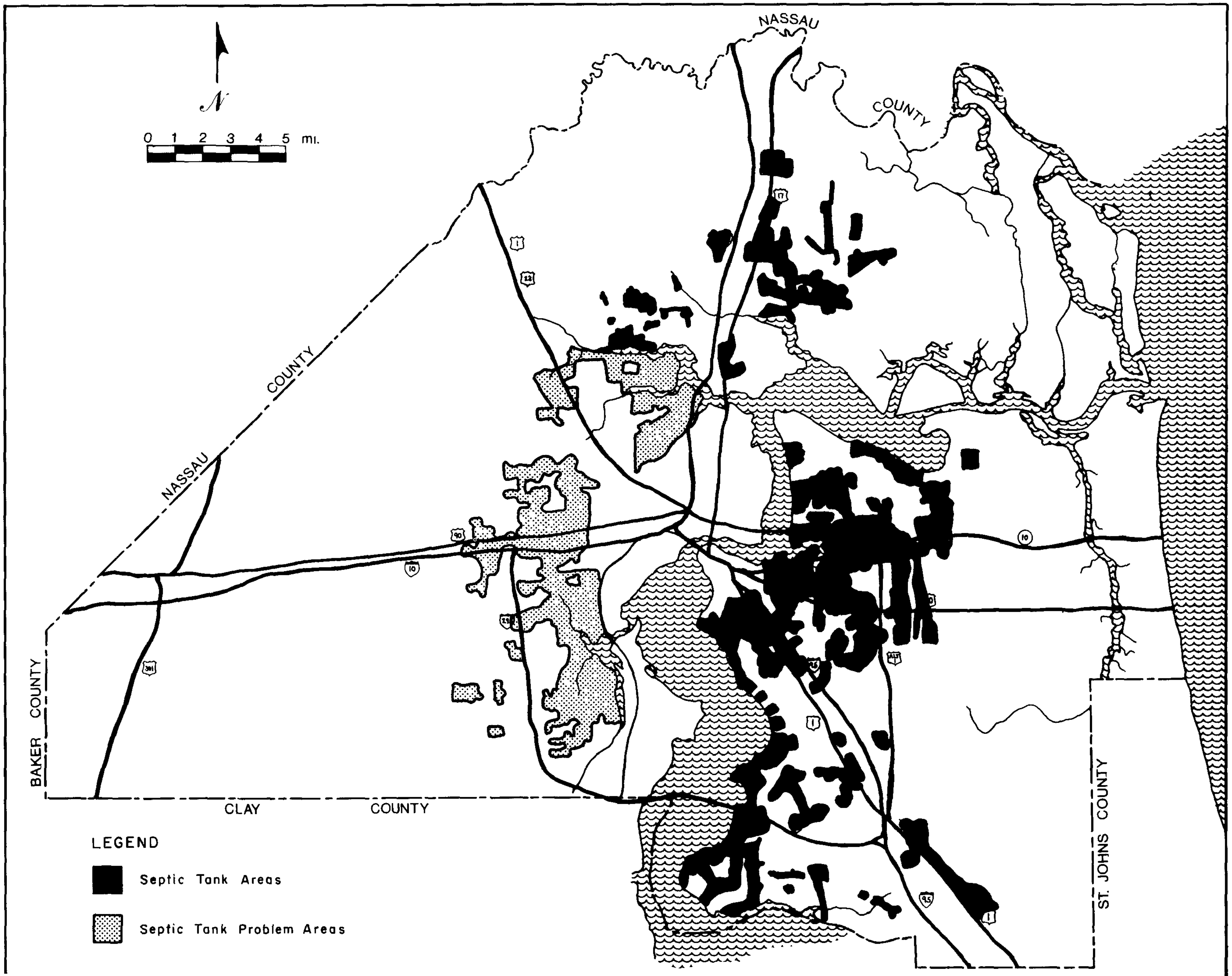


NASSAU
COUNTY
0 1 2 3 4 5 mi.
BAKER COUNTY
CLAY COUNTY
ST. JOHNS COUNTY

Table 2-14

ESTIMATED FLOWS OF PRINCIPLE INDUSTRIAL DISCHARGES IN DUVAL COUNTY

NAME OF INDUSTRY	MAP OUTFALL CODE	PROCESS WASTEWATER (MGD)	SANITARY SEWAGE (MGD)	COOLING WATER (MGD)	RECEIVING WATER
St. Regis Paper Co.	1	16.677	0.023	72.000	St. Johns River
Alton Box Board Co. - Kraft	2	5.300	0.013	14.000	St. Johns River
Union-Camp Corp.	3	0.298	0.002	3.870	Six-Mile Creek
Simplex Industries	4	0.326	0.003	1.380	Broward River
Florida Publishing	5	0.138	0.030	.020	St. Johns River
U. S. Gypsum	6	0.700	0.010	0.200	St. Johns River
Kerr-McGee Chemical	7	0.380	0.015	0.400	St. Johns River
Anchor Hocking	8	0.473	0.016	0.190	McCoys Creek
Southern Wood Piedmont	9	0.010	0.002	0.020	Baldwin Bay
Pepsi-Cola Bottling	10	0.138	0.005	0.003	Cedar Creek
Container Wire	11	0.098	0.002	-----	Cedar River
Reichhold Chemicals	12	0.083	0.002	0.570	Cedar Creek
Painters Poultry	13	0.794	0.014	0.030	Cedar River
Roux Laboratores	14	0.028	0.002	0.000	Cedar River
Asphalt Contracting	15	0.050	0.0003	0.016	Deer Creek
Sheffield Dairy	16	0.039	0.0006	0.000	Rushing Branch
Florida Wire and Cable	17	0.233	0.006	0.010	Cedar Creek
Buffalo Tank	18	0.019	0.002	-----	Cedar Creek
Cleaners Hangers	19	0.042	0.001	0.010	Cedar River
Union Carbide	20	0.016	0.001	0.020	McCoys Creek
Wooton Fibre	21	0.013	0.002	0.000	Ribault River
Mid-States Steel	22	0.021	0.004	0.300	San Carlos Creek
Kaiser Gypsum	23	0.088	0.002	0.010	St. Johns River
Jax. Elec. Authority-Kennedy	24	0.000	-----	248.000	St. Johns River
J.E.A. - Northside	25	0.000	-----	388.000	St. Johns River
J.E.A. - Southside	26	0.000	-----	358.000	St. Johns River
TOTALS		26.182	0.159	1086.150	



NASSAU
COUNTY
NASSAU
COUNTY
BAKER COUNTY
CLAY COUNTY
ST. JOHNS COUNTY
N
0 1 2 3 4 5 mi.
LEGEND
Septic Tank Areas
Septic Tank Problem Areas

Septic tank problem areas in Jacksonville are due largely to the shallow water table and flooding during periods of heavy rain. System failure is caused by temporary inundation. Under these conditions, the normally unsaturated soil zone is no longer available for removal of bacteria, viruses, and organic material. Effluent from the septic tank is then able to contaminate contiguous surface ditches and waterways which interact with the shallow water aquifer. Large areas of the urban city west of the St. Johns River have a chronic high groundwater problem. This, coupled with small lot sizes, renders thousands of septic tank drain fields inoperative. Effluent from the tanks either flows to the surface or seeps from the ground into the nearest drainage ditch or waterway. These receiving ditches are invariably septic and are a source of noxious odors and contaminated water as well as being aesthetically disagreeable.

From the layman's viewpoint, the worst pollution of the St. Johns River is probably the visual impact of floatables. Since they are generally insoluble in water, a quantitive floatable determination is very difficult. A nonmeasurable clutter of cans, paper, plastics, and grease mars the shoreline of downtown Jacksonville. However, the major floatable problem on the lower St. Johns has for years been the mobile rafts of water hyacinths which float down from above. In the past, these plants have been observed to cover the river from bank to bank at the Main Street Bridge. They are a hazard to small craft and an aesthetic irritant in addition to representing a potential threat to the remaining dissolved oxygen in the river as they die and decay in the brackish/salt water of the lower river. The United States Army Corps of Engineers is responsible for keeping the navigable waters from the ocean to Lake Harney free of these plants. This is accomplished by chemical spraying upstream in the winter and early spring and by mechanical means to control the plants that do float downstream. Responsibility for controlling the hyacinths in the upper St. Johns basin and in the upper reaches of tributaries within Duval County is given to the Florida Game and Freshwater Fish Commission and Duval County authorities, respectively. The severity of the problem varies from year to year; in 1975 the plants had not been a problem in Duval County at least through the month of August.

Oil pollution at one time constituted a major threat to the water resources of the St. Johns River. Recent legislation providing for more stringent containment and enforcement procedures has combined with better personnel training to reduce the amount of oil spilled. Total incidents have not decreased, however, but the majority are now smaller spills coming from private sources. The U. S. Coast Guard estimates that 4,000 gallons of petroleum products were spilled in the navigable waters of Duval County in 1974. For the period January through August 1975, gallons spilled totaled about 5,000. This is somewhat misleading, however, as it includes a spill of some 4,000 gallons from a single incident.

Another recently improved source of pollution to the lower St. Johns River is waste from watercraft. In 1972, commercial, military, and pleasure craft contributed an estimated average .1 mgd of raw sanitary waste to the river. Under authority of the Federal Water Quality Improvement Act of 1970, the U. S. Environmental Protection Agency issued standards in June 1972 for halting discharge of sewage from vessels into navigable waters of the United States. Coast Guard regulations subsequently issued govern the design, construction, installation, and operation of marine sanitation devices such as holding tanks, macerators, incinerators, and self-contained recirculation devices.

From a public health standpoint, the most pressing water quality problem of the river is its high level of bacteriological contamination. Coliform bacteria levels are exceeding State bacteriological standards for Class III waters in virtually all parts of the river from the Ortega River to Blount Island. From this point to the ocean, levels are relatively low due to increased mixing with ocean water. Figure 2-18 shows the approximate distribution of these concentrations. The Jacksonville Bio-Environmental Services Division monitors total and fecal coliform on a monthly basis at four points in the main channel of the St. Johns River and also in the lower reaches of several of the major tributary systems in Duval County. Results of these analyses for the period, October 1973 through August 1975, are summarized in Tables 2-15 and 2-16. Main stem and tributary data are grouped together since water quality of the lower tributary reaches is heavily influenced by that of the St. Johns River due to tidal mixing. Total and fecal coliform data are presented separately because, although fecal coliform concentrations may be seen to be undesirably high, sampling frequencies dictate that only the total coliform data may be compared with applicable State of

Florida Class III standards (no more than 2,400 most probable number (MPN) or membrane filter (MF) • per 100 milliliters (ml) in any one sample). A comparison of fecal counts with the State standard of no more than 900 on any one day in those waters normally used for body contact recreation, however, illustrates their relatively high concentrations throughout the downtown reach of the St. Johns River.

Table 2-15

TOTAL COLIFORM COUNTS IN THE ST. JOHNS RIVER AND ITS TRIBUTARIES, DUVAL COUNTY

OCTOBER 1973 THROUGH AUGUST 1975 (MPN or MF per 100 ml)

Location	Highest Count	Lowest Count	Average Count	Geometric Mean	Total No. Samples	Total No. Samples State Standard
St. Johns River, Mid-stream at Main St. Bridge	49,000	3,100	12,391	11,000	19	19
St. Johns River, Mid-stream at Talleyrand Docks	61,000	1,300	11,098	5,750	20	16
St. Johns River, Mid-stream between Broward R. & Dunn Cr.	110,000	490	9,164	2,000	20	8
St. Johns River, Mid-stream at Fulton Point	7,000	120	1,405	540	18	4
Ortega River at Timuquana Road	9,300	200	2,384	1,700	19	8
Cedar River at Blanding Blvd.	130,000	1,100	28,829	13,000	20	19
Arlington River at University Blvd. Bridge	34,000	1,300	6,166	4,900	20	16
Trout River at U.S. 17 Bridge	70,000	330	10,771	4,900	21	15

Table 2-16

FECAL COLIFORM COUNTS IN THE ST. JOHNS RIVER AND ITS TRIBUTARIES, DUVAL COUNTY

OCTOBER 1973 THROUGH AUGUST 1975 (MPN or MF per 100 ml)

Location	Highest Count	Lowest Count	Average Count	Geometric Mean	Total No. Samples
St. Johns River, Mid-stream at Main St. Bridge	15,000	700	3,516	2,300	19
St. Johns River, Mid-stream at Talleyrand Docks	33,000	100	4,679	1,975	20
St. Johns River, Mid-stream between Broward R. & Dunn Cr.	92,000	90	5,684	445	20
St. Johns River, Mid-stream at Fulton Point	4,900	50	776	215	18
Ortega River at Timuquana Road	1,300	2	314	310	19
Cedar River at Blanding Blvd.	130,000	150	11,313	4,700	20
Arlington River at University Blvd. Bridge	4,900	50	1,844	1,500	18
Trout River at U.S. 17 Bridge	35,000	20	4,844	1,100	21

Due to their smaller surface area, shallower depths, poor tidal flushing and small freshwater flow, the tributary streams of Duval County have a much smaller waste assimilation capacity than does the St. Johns River. During low flow conditions occurring during dry weather periods, very little fresh water flow is available for dilution. Brackish water, originating from the St. Johns, is often the only dilution water present in the lower reaches of most of the area's waterways. The background dissolved oxygen of this water as it flows in from the river ranges from about 4 to 6.5 mg/l. Further, the flushing capacity of the water in these lower reaches cannot be compared to the main stem of the St. Johns River. These characteristics notwithstanding, most of the county's 470-odd sewage treatment plants empty into the nearest tributary.

Of the 34 sewage treatment plants operated by the Public Works Department, only three discharge directly into the St. Johns River. In the Arlington-East Service District, there are six Public Works treatment plants all discharging to the tributaries. These are shown in Table 2-17; all but Laurina Village and Sandalwood will be phased out to the proposed Arlington plant.

There are 34 private utility sewage treatment plants located in the county with seven discharging directly to the St. Johns. Thirteen of these private utility plants are located within the service district with eight discharging to tributaries. These are shown in Table 2-18. There are currently no plans for the connection of any of these plants to the Arlington Sewage Treatment Plant; most approaching design capacity are slated for expansion and those unable to meet State standards will be abandoned.

The BOD5 removal efficiency rates of the public works sewage treatment plants in the Service District is relatively good and ranges from about 78 to 98 percent. The same is generally true for the private utility plants with removal rates usually in the 85 to 99 percent range. However, assimilative capacity analyses have in many cases shown the necessity for removal efficiencies of 98 or 99 percent for discharges to the tributaries, particularly in view of the State requirement for a 5 mg/l minimum dissolved oxygen level.

Table 2-17

PUBLIC WORKS DEPARTMENT SEWAGE TREATMENT PLANTS LOCATED IN THE ARLINGTON-EAST SERVICE DISTRICT

Plant Name	Design Capacity (MGD)	Current Flow (MGD)	Receiving Waterway
*Arlingwood	0.210	0.198	Strawberry Creek
*Center Park	0.750	0.750	Cedar Swamp
Grove Park	1.000	0.700	Pottsburg Creek
Laurina Village	0.040	0.040	Silversmith Creek
*Oakwood Villa	0.160	0.160	Strawberry Creek
Sandalwood	0.245	0.200	Pablo Creek

*Connection Planned to Arlington STP.

Table 2-18

PRIVATE UTILITY SEWAGE TREATMENT PLANTS LOCATED IN THE ARLINGTON-EAST SERVICE DISTRICT

Plant Name	Design Capacity (MGD)	Current Flow (MGD)	Receiving Waterway
*Beacon Hills & Harbor	0.310	0.095	St. Johns River
***Brookview (South-side Estates)	0.385	0.300	Jones Creek
**Ft. Caroline Club Estates	0.500	0.450	St. Johns River
**Holiday Harbor	0.250	0.110	Hogpen Creek
*Holly Oaks	1.000	0.020	Mill Cove
**Lake Lucina	0.600	0.441	New Castle Creek
*Monterey	4.500	2.480	St. Johns River
*Oak Harbor	0.110	0.120	Pablo Creek
***Regency Lakes Apartments	0.080	0.063	Jones Creek
**Regency Square	0.100	0.085	Jones Creek
**Royal Lakes	0.300	0.291	Swamp to Pottsburg Creek
*University Park	0.750	0.380	St. Johns River
*Woodmere (Reddi-Point)	0.500	0.035	St. Johns River

*NO PLANS (STATUS QUO)

**PLANNED EXPANSION

***PLANNED ABANDONMENT OR TIE-IN WITH OTHER PRIVATE PLANT

The problem is further compounded by the approximately 400 package treatment plants currently in operation in Duval County, most of which discharge to the tributaries. The average flow of these plants ranges from 0.006 to 0.012 mgd with an optimal BOD5 removal efficiency of more than 90 percent. This rate, unfortunately, is rarely achieved in practice; actual removal rates are estimated to be 75 to 85 percent.

Over 100 of these package plants exist in the Arlington and San Jose service districts. Those in Arlington have nearly 2,000 residential connections and probably can continue to discharge to the tributaries provided that many are upgraded. In most instances, a conventional secondary package plant fails to remove sufficient BOD to protect the minimum 5 mg/l dissolved oxygen requirement. There are no raw sewage outfalls within the Arlington-East Service District although there are some 15,000 septic tank systems. However, these are, for the most part, operating satisfactorily.

Nutrient enrichment problems in the county are almost exclusively limited to waterways draining to the St. Johns River. Much evidence exists from sampling and visual monitoring that these streams are over enriched and contain high concentrations of nitrogen and phosphorous. In addition, bacteria levels exceed the State bacteriological standards for water contact sports in most parts of the tributary system and commercial shellfishing is prohibited throughout the county except for one isolated area in the northeast.

Dissolved oxygen deficiencies are prevalent in both winter and summer in many of the tributaries. Certain waterways, such as the Trout River, reach zero dissolved oxygen levels during the summer months and gross violations of dissolved oxygen standards have been observed on several other major tributary systems including the Arlington River. In the Arlington-East Service District, the Jacksonville Bio-Environmental Services Division has measured the dissolved oxygen levels in the major tributary systems on a year-round basis. Twelve to fifteen samples were measured at each station each year. Results of these analyses for the period June 1973 through mid-summer 1975 are summarized in Table 2-19.

Table 2-19

SUMMARY OF DISSOLVED OXYGEN LEVELS IN TRIBUTARY STREAMS LOCATED IN THE ARLINGTON-EAST SERVICE DISTRICT (JUNE 1973 - MID-SUMMER 1975)

Stream	No. Stations Sampled	High Level (mg/l)	Low Level (mg/l)	Average Level (mg/l)
Arlington River	1	9.8	4.4	6.8
Strawberry Creek & Tribs.	14	8.6	0.4	3.7
Silversmith Creek	2	7.2	1.8	5.5
Pottsburg Creek & Tribs.	22	11.0	0.0	4.0
Little Potts-burg Creek	15	11.0	0.0	4.2
Oldfield Branch	2	7.0	4.8	5.8
New Castle Creek	2	5.6	1.6	3.7
Jones Creek	4	6.2	0.2	3.4
Ginhouse Creek	4	7.8	0.4	3.1
Cowhead Creek	2	8.5	3.2	5.9
Intracoastal Waterway	19	10.2	0.8	5.2
Hogpen Creek	1	3.2	1.5	2.4
Sherman Creek	5	6.4	0.0	3.9

b) Groundwater

Water of the shallow aquifer system is generally of good quality and within U. S. Public Health' Service standards for drinking water. It is generally suitable for domestic use and for most industrial uses. In most places, water of the shallow Aquifer system has less mineral content than water from the Floridan aquifer. In eastern Duval and Nassau Counties, however, the water in both aquifer systems is similar due to mineralization of the shallower aquifers by mixing with bodies of brackish surface water or sea water. Water of the shallow aquifer system does not generally require treatment although water from wells in certain areas of the county, primarily the northeast and southwest, regularly contains iron in excess of the .3 mg/l Public Health Service drinking water standards. Water from at least two wells in the southeast portion of the Arlington-East Service District regularly contains iron in concentrations greater than 1.0 mg/l. Such concentrations may impart a bad taste as well as stain household equipment (particularly porcelain) and clothes. Aeration or chlorination followed by filtration has been used with some success to remove this iron.

A few shallow aquifer wells, deeper than 60 feet, yield water having a moderate to strong hydrogen sulfide odor. Hydrogen sulfide is undesirable in drinking water due to its objectionable odor and corrosivity to pipes and fixtures. However, since it is a gas, it is easily removed by aeration.

Except in a few deep wells in Fernandina Beach, water from the Floridan Aquifer system in Duval and Nassau Counties is suitable for domestic and most industrial uses. In general, it contains more dissolved minerals and less iron than that of the shallow aquifer system. Locally, one or more of the U. S. Public Health Service standards for drinking water, notably chlorides and dissolved solids, may be exceeded. The sulfur odor indicative of hydrogen sulfide is usually present in the water from wells in the Floridan Aquifer system in the area and hardness is nearly always classed as hard to very hard (more than 100 parts per million calcium carbonate). An analysis of water from five department of public works artesian wells in downtown Jacksonville appears as Table 2-20.

Table 2-20

ANALYSIS OF WATER FROM FIVE DEPARTMENT OF PUBLIC WORKS ARTESIAN WELLS
In Downtown Jacksonville JULY 1973 (Parts per Million)

Parameter	High	Low	Average
Turbidity	3	3	3
Color	5	5	5
Chloride	20	12	15.4
Hardness ($CaCo_3$)	280	172	238
Iron	.01	.01	.01
Manganese	.00	.00	.00
Copper	.00	.00	.00
Aluminum	.00	.00	.00
Silica (SiO_2)	15	4	11
Calcium	72	32	58
Magnesium	24	20	22
Bicarbonate (HCO_3)	171	119	148
Sulfate	150	68	106
Fluoride	.20	.20	.20
Sodium & Potassium (Na)	12.6	1.0	7.1
p^H	8.2	7.7	7.9
Total Dissolved Solids	447	276	369
Specific Conductance @ 25° C	566	374	487

The major water quality problem facing users of the Floridan aquifer system in the Jacksonville area is increase in chloride content from salt water intrusion. During the period 1940 to 1962, chloride content in most artesian wells in the area increased from 2 to 14 parts per million. This increase generally correlates with the decline in artesian pressure and indicates that salt water is gradually moving into these zones of reduced pressure. However, the relatively low chloride content of water samples from most wells in the area indicates that serious contamination is presently restricted to the deeper wells at Fernandina Beach where, in many cases, chloride levels increased about 20 to 1,320 parts per million between 1955 and 1962. Chloride content in artesian wells generally decreases toward the recharge area to the southwest. Proceeding from Fernandina Beach, where the potentiometric surface is lowest, levels decrease to less than 10 parts per million in southwestern Duval County where the potentiometric surface is highest. Further salt water intrusion can be retarded and even prevented if future artesian wells are properly spaced and their discharges controlled to prevent excessive lowering of pressure.

b. Biota

There is no question that an estuary is an intregral component of the aquatic domain. Jacksonville harbor, near the mouth of the St. Johns River, is at the lowest reach of the estuary. As such, it is the vital link between fresh and marine habitats. A large number of invertebrates and vertebrates utilize this reach in their migratory movements. Anadromous and catadromous fish alike could not exist if this area of the St. Johns becomes impassable. Following larval stages, many invertebrates will complete the remainder of their life history in this estuarine zone. Regardless of phylogenetic position, nearly every group from microbiota to fish and aquatic mammals are dependent on the estuary.

Estuaries are quite resilient to natural phenomena such as storms and associated tidal flooding. However, the St. Johns River has received a considerable amount of man-made alterations. Because this estuary must continue to function biologically concurrently with its industrial use, the impacts on remaining biologically sensitive areas need to receive continual public concern.

Biologically, the St. Johns River is functioning as a prime resource even though it is in a degraded state. The commercial and sport fishing activities continue, however, trends indicate an increasing eutrophic condition. Near Blount Island, 56 fish species were collected in August 1972 by the Frederick Tone survey, indicating the great importance of the area as a fishery. The value of all fishery products harvested in the St. Johns commercially in 1971 was approximately $1.5 million. However, rough fish and game fish production is decreasing as shown in Table 2-21. While the value of the commercial fishery is increasing, each year the estuary is being more intensively fished. This means that the fisheries catch realized by each fisherman is decreasing for equal time spent.

TABLE 2-21

TRENDS IN ROUGH FISH AND GAME FISH PRODUCTION

Species	Mean Pounds	Percent
	1948-1953	
Freshwater Gamefishes (Grouped)	937	100
Gizzard shad and Garfish (Grouped)	650	100
	1967-1969	
Freshwater Gamefishes (Grouped)	464	50% decrease
Gizzard shad and Garfish (Grouped)	3,672	465% increase

Source: Water Quaity Management Plan

Little Pottsburg Creek suffers from excessive run-off as does Big Pottsburg Creek. Barrow pits created during expressway construction exist close to the headwaters of this creek. Earthen dikes have given way during heavy rain causing the barrow pits to drain anoxic water into the creek. This has caused minor kills of mostly menhaden fish.

Big Pottsburg Creek is subject to a sewage discharge from the Grove Park Sewage Treatment Plant. The creek is sluggish in its upper reaches increasing the wastewater retention time, thus degrading water quality. The creeks effectiveness as a nursery for aquatic juveniles could be suffering. However, at certain times of the year sport fish frequent the lower creek as evidenced by increased fishing activity.

1) Plants

Phytoplanton - The primary producers in the aquatic food web are the phytoplankton. High estuarine productivity is dependent on a beneficial level; but large concentrations indicate a state of excessive eutrophication. Commonly called blooms, high concentrations can severely limit dissolved oxygen during periods of low photosynthetic activity. The most sensitive animal life will be the first casualties with more resistent forms dying later as microbial activity further lessens available oxygen levels.

Dinoflagellates, a motile order of phytoplankters, have been known to reach "bloom" proportions in smaller tributaries of the St. Johns where water movement is minimal. The result has been depressed dissolved oxygen concentrations. However, no large fish kills have been linked to this group in the area.

A plankton survey of the lower St. Johns River by Environmental Science and Engineering, Inc., in March 1973, showed diatoms (Bacillariophyceae) composed 96 percent of the population. Typical marine littoral inhabitants, Skeletonema, Cocinodiscus, and Cyclotella were the dominant genera. Table 2-22 shows this data for four selected stations, two at the ship channel (Dames Point) and two in Mill Cove. A diversity index was applied to this data. Both sample sites are quite healthy based on this index.

Submerged Vascular Vegetation - Grassbeds, which remain submerged during low tides, are a prime habitat for numerous invertebrates and juvenile fish. Grass types which might be present in the zone immediately below the littoral zone are *Halodule wrightii*, *Thalassia testudinum*, or *Ruppia maritima*. Grassbeds are unique habitats which should be considered sensitive areas due to their short supply in the lower St. Johns. At present, no submerged grassbeds are known to be inside Mill Cove.

Floating Plants - Another group of plants present in the waters surrounding the service district are the floating aquatic plants. In Duval County, these plants are considered nuisance types due to their rapid proliferation beyond quantities utilized by wildlife. Moderate growths of the water hyacinth are beneficial to wildlife. They absorb excess nutrients in the water preventing algal blooms, which result in depressed oxygen levels. They provide cover for fish especially during hot sunny periods.

Table 2-22 Phytoplankton from the St. Johns River and tributaries near the proposed route of the Southside Boulevard Extension, Jacksonville, Florida, March 21-22, 1973.

Station	Dunn Creek 1	Dunn Creek 2	Dame Point 3	Dame Point 4	Mill Cove 5	Mill Cove 6
BACILLARIOPHYCEAE						
Achnanthes						
exigua var. heterovalve Krasske	7.9	7.9	---	---	---	---
lanceolata (Breb.) Grun.	3.2	---	---	1.6	6.3	---
Actinoptychus sp.	---	1.6	---	---	---	1.6
Anorthoneis hyalina Hust.	---	---	---	---	1.6	---
Amphora ovalis Kutz.	1.6	---	6.3	9.4	3.2	4.7
Asterionella japonica Cl.	---	---	---	1.6	15.8	12.6
Attheyea sp.	---	---	---	1.6	---	---
Biddulphia						
alternans (Bail.) V.H.	---	---	1.6	3.2	3.2	12.6
dubia (Brightw.) Cl.	---	---	---	1.6	---	---
laevis Ehr.	---	---	---	1.6	---	---
Cocconeis sp.	---	7.9	9.3	4.7	12.6	17.3
Coscinodiscus						
lacustris Grun	---	---	---	3.2	---	---
lineatus Ehr.	---	---	---	3.2	---	---
rothii (Ehr.) Grun.	---	3.2	79.0	75.8	120.0	120.0
Cyclotella sp.	---	71.0	94.8	77.4	91.2	79.0
Diploneis						
didyma (Ehr.) Cl.	---	---	4.7	4.7	1.6	7.9
smithii (Breb.) Cl.	---	6.3	3.2	9.5	---	1.6
Epithemia sp.						
Eunotogramma sp.	---	---	---	---	---	1.6
Fragilaria leptostauron (Ehr.) Hust.	---	---	---	3.2	---	---
Gyrosigma	---	1.6	---	1.6	1.6	---
balticum (Ehr.) Rabh.						
fasciola (Ehr.) Griff & Henfr.	---	---	4.7	1.6	1.6	3.2
Melosira	---	---	---	6.3	7.9	9.5
granulata (Ehr.) Ralfs						
italica (Ehr.) Kutz.	---	---	---	7.9	---	1.6
moniformis (Mull.).	---	3.2	---	22.1	15.8	20.5
Navicula	---	1.6	---	---	---	---
capitata var. hungarica (Grun) Ross	3.2	1.6	12.6	6.3	9.5	1.6
meniscoides Hust.	17.4	12.6	25.3	---	---	---
mutica var. undulata (Hilse) Grun.	---	---	---	1.6	1.6	---
normalis Hust.	4.7	3.2	4.7	---	---	---
peregrina (Ehr.) Kutz.	---	---	1.6	---	1.6	3.2
pupula Kutz.	11.0	---	1.6	---	---	---
Unidentified Naviculoides	3.2	4.7	4.7	53.7	25.3	31.6
Nitzschia						
cf. angustata (W.Sm.) Grun.	1.6	---	7.9	3.2	15.8	1.6
closterium W. Sm.	1.6	11.1	---	---	---	---
hybridaeformis Hust.	---	12.6	7.9	1.6	3.2	---
navicularis (Breb.) Grun.	---	---	---	3.2	3.2	---
paradoxa (Gmel.) Grun.	7.4	18.9	6.3	3.2	3.2	6.3
parvula Levis	13.7	15.8	7.9	9.5	---	---
punctata (W.Sm.) Grun.	---	---	15.8	9.5	9.5	3.2
tryblionella Hantz.	---	18.9	6.3	4.7	14.2	4.7
Unidentified Nitzschia	---	23.7	17.4	6.3	9.5	7.9
Pleurosigma sp.	---	---	6.3	4.7	6.3	3.2
Pinnularia termitina (Ehr.) Pat.	1.6	---	1.6	---	---	---
Rhaphoneis amphiceros Ehr.	---	---	4.7	1.6	7.9	1.6
Skeletonema costatum (Grev.) Cl.	---	---	79.0	167.0	120.0	94.8
Synedra						
fasciculata (Ag.) Kutz.	---	---	---	7.9	1.6	7.9
pucnella Ralf ex Kutz.	---	---	---	---	1.6	---
Surirella sp.	---	3.2	---	1.6	1.6	1.6

Table 2-22 (Cont'd) Phytoplankton from the St. Johns River and tributaries near the proposed route of the Southside Boulevard Extension, Jacksonville, Florida, March 21-22, 1973.

Station	Dunn Creek 1	2	Dame Point 3	4	Mill Cove 5	6
CHLOROPHYCEAE						
Closteridium sp.	---	---	---	6.3	---	---
Scenedesmus sp.	---	1.6	---	---	---	---
Tetraedron sp.	---	---	---	1.6	---	---
Tetrastrum heterocanthum (Nordst.) Chod.	---	3.2	---	1.6	---	---
DINOPHYCEAE						
Glenodinium sp.	40.1	455.0	25.3	---	---	1.6
Exuviaella compressa Ostenf.	---	30.0	---	---	---	---
CRYPTOPHYCEAE						
Cyanomonas americana	160.0	297.0	73.0	---	---	---
Cryptomonas sp. 1	40.1	23.7	15.0	4.7	3.2	7.9
Rhodomonas sp.1	120.0	94.8	120.0	6.3	14.2	3.2
CYANOPHYCEAE						
Anacystis marina	23,355.5	---	---	---	---	---
Oscillatoria cf. *limnetica* Lemm.	24,760.2	---	---	---	---	---
Microcoleus sp.	40.1	---	---	---	---	---
Unidentified Green Cells	94.8	120.0	25.3	---	---	---
TOTAL NUMBER OF CELLS PER MILLILITER	48,889.1	1255.9	672.4	535.3	533.8	463.3
SHANNON-WEAVER SPECIES DIVERSITY INDICES TO THE BASE 2.	1.153	2.994	3.867	3.593	3.577	3.428

Aquatic plant species present in Duval County include:

<u>Eichornia crassipes</u>	Water hyacinth
<u>Altermanthera philoxeroides</u>	Alligatorweed
<u>Pistia stratioties</u>	Water lettuce
<u>Hydrilla verticulata</u>	Hydrilla plant

All these tend to generate profuse growth by the presence of excessive nutrients in the water. They are freshwater plants that usually reproduce vegetatively. They can be either rooted or free floating and all, except <u>Hydrilla</u>, protrude above the water surface. Hyacinth, alligatorweed, and water lettuce are capable of surviving long drought. Hydrilla, however, is strictly a submersed plant and cannot withstand drying.

Any of these aquatic plants could be periodically present in the waters near the service area because they quite commonly become detached from aggregations upstream and these "floating islands" are transported downstream. Nearby small creeks have some of these species in their headwaters.

2) <u>Aquatic Fauna</u>

Most background aquatic faunal data on estuarine waters was obtained by Frederick Tone in 1972 for the Blount Island EIS. Figure 2-23 shows the sampling locations.

<u>Zooplankton</u> - Zooplankters, one of the lowest forms of consumers, are free living microscopic animals whose locomotion is almost completely under tidal influence in the lower St. Johns River. Populations in this group are quite naturally very irratic. Copepods tend to dominate the planktonic animal life. They consume the largest quantity of phytoplankton. Unlike the copepods, many other invertebrates spend only a fraction of their lives as planktonic larval forms. These would also be present in varying degrees in the St. Johns River.

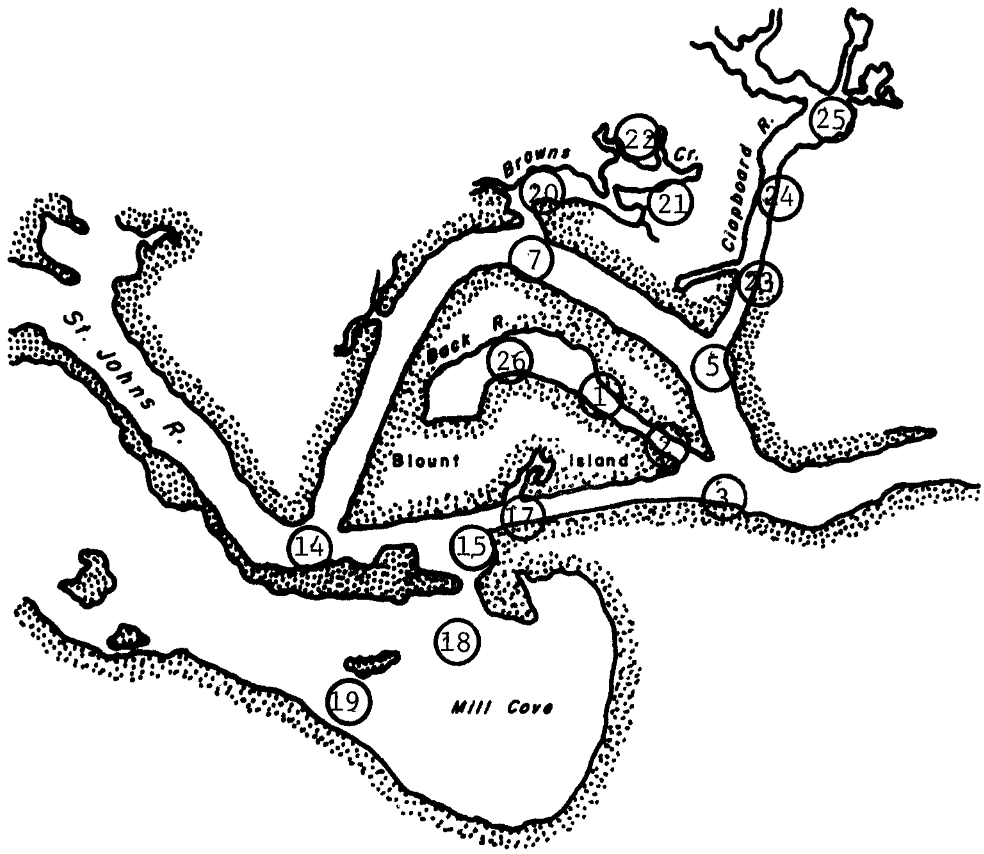


Figure 2-23

Aquatic faunal stations sampled

by Frederick Tone, August 1972.

Mill Cove sampling yielded higher populations than Brown's or Clapboard Creeks in the Tone survey, 1972. A mid-depth sample in the St. Johns had the highest population sampled anywhere. This indicates that the lower St. Johns can be highly productive. Diversity of Mill Cove did not differ much from other sampling sites. That survey did not yield larvae of the commercially harvestable blue crabs and white shrimp at any sampling site. However, it is known that these species would be found here at certain times of the year.

Nekton - A group which consists of the shrimp, swimming crabs, and fish is called the nekton. Their life histories include larval planktonic stages which develop into larger forms capable of self-locomotion. They are the major consumers in the upper aquatic trophic levels.

Shrimp are abundant and commercially harvestable in the St. Johns estuary. Brown, white and some pink shrimp all utilize the St. Johns estuary.

Shrimp use the estuary much the same way as other estuarine species. They spawn offshore and the post-larvae enter the estuary to mature. Young shrimp seek shallow brackish areas preferring submerged grassbeds for protection and food sources. As they mature, they seek deeper more saline waters, eventually entering the ocean. Studies by the Florida Dept. of Natural Resources found that the St. Johns River is probably the most important asset to the entire shrimp fishery along the Northeast Florida Coast.

Shrimping within the estuary generally produces smaller shrimp; as such, these catches are part of the bait fishing industry. Substantial catches do occur. A peak run recorded 50,000 pounds per day at Buckman Bridge, valued at $40,000 in 1971.

Frederick Tone sampled the Nekton with trawl nets in 1972. Five sites were sampled; results are shown in Table 2-23. This data is quite applicable because it compares Mill Cove with the main St. Johns River and three other sites of varying environmental conditions. Results showed Mill Cove and the St. Johns Station #5 to be highest in biomass. Mill Cove was one of the two sites having the highest diversity. Gill net sampling for nekton was also performed at two nearshore stations in four feet of water.

These data, Table 2-24, show the great diversity and biomass of fish collected in Mill Cove.

Table 2-23

Nekton Trawls Performed by Tone; August, 1972

STATIONS	BACK RIVER 2			ST. JOHNS RIVER 5			MILL COVE 18			BROWN'S CREEK 22			CLAPBOARD CREEK 25		
FISH SPECIES	No.	A.T.L. mm	T.W. lbs.	No.	A.T.L. mm	T.W. lbs.	No.	A.T.L. mm	T.W. lbs.	No.	A.T.L. mm	T.W. lbs.	No.	A.T.L. mm	T.W. lbs.
Dasyatis centroura							1	480	.25						
Elops saurus	1	245													
Brevoortia smithi	13	216	3.25				26	158	3.50						
Dorosoma cepedianum	1	240	.50				14	282	7.50						
Anchoa hepsetus	4	55					10	54					1	50	
Ictalurus melas	270	80	3.00	6	235	1.50	125	180	12.00	14	183	2.00	83	169	7.00
Bagre marinus							9	165	1.25				1	175	
Opsanus tau													1	80	
Cyprinodon variegatus													1	280	1.25
Pomatomus saltatrix													2	245	.80
Eucinostomus lefroyi										2	77				
Haemulon parrai													4	197	1.50
Cynoscion nebulosus															
Cynoscion regalis				10	311	7.50	1	250	.50	1	272	.75	1	290	
Leiostomus xanthurus	1	165		4	135	.75	16	196	4.00	5	165	1.00	12	182	2.75
Micropogon undulatus	11	133	.75	280	155	22.50	62	141	5.00	1	290	1.00	1	240	
Pogonius chromis							3	185	1.50	10	291	9.00	1	290	1.25
Sciaenops ocellata							3	279	2.00	4	350	3.50			
Trichiurus lepturus				2	850		1	183							
Scomberomorous cavalla	1	170													
Etropus crossotus	4	93		31	96	1.00	26	104	1.00	4	113	.25	5	72	
Paralichthys dentatus				1	185		3	192	2.00				1	190	
Paralichthys oblongus				1	198					1	192	.50	4	215	1.00
Trinectes maculatus				2	72		1	121							
Symphurus plagiusa				1	108										
TOTALS	306		7.50	338		33.25	301		40.50	42		18.00	118		15.55
INVERTEBRATE SPECIES															
Callinectes sapidus	8			18						5			4		
Panaeus fluviatilis	1			12		.25	49		2.00						

Key: No. - number
A.T.L. - average total length
T.W. - total weight

Table 2-24

Gill Netting Performed by Tone; August, 1972

STATIONS	MILL COVE 18			BROWN'S CREEK 21		
FISH SPECIES	No.	A.T.L. mm	T.W. Lbs.	No.	A.T.L. mm	T.W. Lbs.
Brevoortia patronus	8	309	6.00			
Brevoortia smithi	52	219	13.00	18	248	9.00
Brevoortia tyrannus	29	256	13.00	1	273	1.00
Dorosoma cepedianum	3	357	4.00	1	275	1.00
Ictalurus melas	10	262	6.25			
Bagre marinus	3	318	3.00			
Strongylura marine	1	540	.75			
Pomatomus saltatrix	2	189	.25			
Caranx hippos	4	284	3.50			
Trachinotus carolinus	1	198	.25			
Cynoscion nebulosus				4	318	3.00
Cynoscion regalis	1	290	.50			
Leiostomus xanthurus	32	183	8.00			
Micropogon undulatus	23	192	5.25			
Sciaenops ocellata	1	330	1.00	1	290	1.00
Mugil sp.	6	264	3.25			
Scomberomorous cavalla	2	207	.25			
Peprilus triacanthus	2	185				
TOTAL	180		68.25	25		15.00
INVERTEBRATE SPECIES						
Callinectes sapidus	5					
Panaeus fluviatilis				13		.50

Key: No. - number
A.T.L. - average total length
T.W. - total weight

The Florida manatee (Trichechus manatus latirostris) has been declared an endangered species. The species is often observed in the lower estuary specifically in the Jacksonville Mill Cove area. It commonly moves from the Palatka area all the way to the lower estuary being attracted to warmer waters here in winter. It feeds on various submerged freshwater and brackish vegetation and readily substitutes floating aquatic types for food.

Benthos - Benthic infauna, an important constituent in the food web, has been widely used as an indicator group of its habitat. Background data exists from the Frederick Tone survey in 1972 and the Corps of Engineers in cooperation with the Fish and Wildlife Service in 1974-75.

Tone sampled the silty sediments of Mill Cove and found no benthic invertebrates. A deep water sand sediment station in the St. Johns above Blount Island had 357 individuals distributed amongst five species. Five different areas in the lower estuary were sampled in the Tone survey and the overall trend was an increase in diversity and individuals with increasing sediment particle size.

The Corps has completed four samplings at several stations in Mill Cove. This is part of their monitoring program in connection with spoil sites located on Quarantine Island. Seasonal sampling of the benthos from January 1974 through January 1975 is presented in Tables 2-25 (a), (b), (c), and (d). Location of stations is shown in Figure 2-24. Twenty-two samplings were in Mill Cove below mean low water and not in the marsh. These stations averaged seven species or taxa and 2144 individuals at each station for the one-year sampling program. This monitoring although not exhaustive, indicates a good population of benthic invertebrates exists in Mill Cove sediments. An abnormally high rate of siltation is occurring and an alteration of the benthic community will result. Differences between the earlier Tone survey and the COE work might reflect environmental changes from 1972 to 1975.

TABLE 2-25 (a)

Benthic Macro-Invertebrate Populations collected on 24 January 1974
at Quarantine Island, Jacksonville, Florida

	Transect 1						Transect 2						Transect 3							
Station	1a		1b		1c		2a		2b		2c		3a		3b		3c		3d	
Location	150 yds from shore		50 yds from shore		Adjacent to Spartina		150 yds from shore		50 yds from shore		in Spartina		125 yds from shore		50 yds from shore		15 yds from shore		In emerging Spartina	
Substrate	silt and shell		sand, silt, shell		sand, silt, plant material		silt, fine sand		silt, fine sand		silt and plant material		silt		silt		sand, silt		silt and plant material	
Depth in feet	5		7		2-1/2		5		5		3		5		3		1		1/2	
Tide	Flooding		Flooding		Slack High		Slack High		Slack High		Ebbing		Ebbing		Ebbing		Ebbing		3/4 Ebbed	
No grabs	1		1		1		1		1		1		1		1		1		2	
TAXA	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%
Nematoda																			656	4.4
Polychaeta																				
Nereidea	57	3.7	38	2.1			19	3.4			228	4.4	19	1.5			38	1.0	219	1.4
Nephthydidae																			10	0.06
Oweniidae					95	8.0					475	9.2							3230	21.9
Spionidae	855	56.2	1178	65.9	247	20.9	513	93.1	1102	95.0	4085	79.9	1197	98.4	1330	97.2	3249	88.6	209	1.4
Copepoda																				
Cyclopoida																			10	0.06
Calanoida																			29	0.19
Mysidacea																				
Neomysis americana	57	3.7													19	1.3				
Cumacea																				
Cyclaspis sp.	19	1.2	57	3.1																
Tanaidacea																				
Leptocephalia rapax					665	60.8					133	2.6							9871	66.9
Isopoda																				
Cyathura polita	76	5.0	19	1.0	38	3.2					38	0.74					38	1.0	10	0.06
Chiridotea caeca											19	0.37								
Cassidisca lunifrons					19	1.6													38	0.25
Amphipoda																				
Gammaridea	152	10.0																	57	0.38
Decapoda																				
Macrura																				
Palaemonidae																				
Palaemonetes pugio																			29	0.19
Brachyura																				
Ocypodidae																			10	0.06
Mollusca																				
Gastropoda																				
Small unidentified species					19	1.6														
Bivalvia																				
Rangia cuneata	19	1.2					19	3.4	19	1.6					19	1.3				
Tagelus gibbus	19	1.2															342	9.3		
Modiolus tulipa																			19	0.12
Small unidentified species	266	17.5	494	27.6	76	6.4					133	2.6							152	1.0
Insecta																				
Diptera																				
Chironomidae																				
Dicrotendipes sp.																			209	1.4
Polypedilum sp.					19	1.6			38	3.2										
Total Number of Taxa	9		5		8		3		3		7		2		3		4		16	
Total Density	1520		1786		1178		551		1159		5111		1216		1368		3667		14,758	

TABLE 2-25 (b)

Benthic Macro-Invertebrate Populations collected 18-19 April 1974 at Quarantine Island, Jacksonville, Florida

	Transect 1				Transect 2				Transect 3				Transect 4					
Station	1a and 1b		1c		2a and 2b		2c		3a anc 3b		3d		4a		4b and 4c		4d	
Substrate	silt and shell		sand, silt, and plant material		silt and shell		sand, silt, and plant material		silt acc shell		sand, silt, and plant material		sand, shell, and rock		sand, silt shell, oily material		sand	
Depth in feet	4		1/2-1		3-4		1/2		2-4		1/2		1/2		2-3		1/2	
Tide	slacklow		slacklow		ebbing		ebbing		flooding		flooding		slacklow		slacklow		slacklow	
Number of grabs	2		2		2		2		2		2		2		2		2	
TAXA	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%
Nematoda			903	9.5			257	3.1			390	1.7			86	0.6		
Polychaeta	7,277	97.4	5,415	57.4	1,615	88.9	580	7.0	1,587	90.1	789	3.6	827	65.8	10,403	78.5	865	47.5
Copepoda																		
Calanoida							19	0.2	10	0.5	1,805	8.2	10	0.8	95	0.7	10	0.5
Cirripedia																		
Balanus sp.	10	0.1									114	0.5						
Cumacea																		
Cyclaspis sp.	114	1.5	19	0.2	76	4.1			67	3.8	10	0.04	76	6.0	1,311	9.9	19	1.0
Oxyurostylis smithi													29	2.3	38	0.3		
Tanaidacea																		
Leptochelia rapax	29	0.3	1,882	19.9	38	0.2	5,729	69.4			18,449	84.2	95	7.6	19	0.1	352	19.3
Isopoda																		
Cyathura polita			48	0.5	10	0.1	38	0.4	19	1.0	57	0.3	29	2.3			10	0.5
Cnirodotea caeca																	10	0.5
Cassidisca lunifrons			29	0.3			19	0.2			57	0.3	10	0.8				
Amphipoda																		
Ganamaridae	10	0.1	1,036	10.9	19	1.0	1,520	18.4	10	0.5	171	0.8	57	4.5	342	2.6	181	9.9
Haustoriidae													38	3.0	10	0.05		
Caprellidea																		
Caprella sp.															10	0.05		
Mysidacea																		
Neomysis americana	10	0.1	19	0.2	19	1.0			10	0.5	10	0.04			105	0.8	10	0.5
Decapoda																		
Penacidea																		
Lucifer faxoni															10	0.05		
Brachyura larvae	10	0.1	10	0.1											57	0.4	48	2.6
Mollusca																		
Bivalvia																		
Rangia cuneata	10	0.1			19	1.0			10	0.5								
Tazelus plebeius (gibbus)			48	0.5	19	1.0	67	0.8					48	3.8	542	4.1	219	12.0
Type B			19	0.2					19	1.0	19	0.08	19	1.6	133	1.0		
Type C									19	1.0					86	0.6	10	0.5
Type D																	86	4.7
Insecta																		
Diptera																		
Chironomidae																		
Dicrotendipes sp.							10	0.1			29	0.12						
Chaetognatha							10	0.1			10	0.04	19	1.6	10	0.05		
hemichorda																		
Enteropneusta																		
Balanoglossus sp.									10	0.5								
Total Number of Taxa	8		11		8		10		10		13		12		16		12	
Total Density	7,470		9,428		1,815		8,249		1,761		21,910		1,257		13,257		1,820	

Table 2-25 (c)

Benthic Macro-Invertebrate Populations collected on 23 August 1974
at Quarantine Island, Jacksonville, Florida

	Transect 1				Transect 2				Transect 3				Transect 4					
Station	1a and 1b		1c		2a and 2b		2c		3a and 3b		3c		4a		4c		4d	
Substrate	silt		silt and sand		silt and shell		silt and sand		silt and shell		sand and silt plant debris		silt, sand, and rock		silt and shell		sand	
Depth in feet	5		1.5		4		2		5		1		3		6		1	
Tide	slackhigh		slackhigh		flooding		flooding		flooding		flooding		slackhigh		ebbing		ebbing	
Number of grabs	2		2		2		2		2		2		1		1		1	
TAXA	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%
Nemertea													19	.8				
Nematoda							1,131	6.1			1,150	4.8						
Polychaeta	637	95.5	570	84.3	352	94.6	13,310	72.4	931	91.3	2,642	11.2	1,995	84.0	760	90.9	171	20.4
Oligochaeta	10	1.4	38	5.6			228	1.2	10	.9			114	4.8			513	61.3
Hirudinea																	19	2.2
Ostracoda																		
Podocopa			10	1.4			171	.9			19	.08						
Copepoda																		
Calanoida							19	.1	29	2.8	10	.04			19	2.2		
Cirripedia											10	.04						
Tanaidacea																		
Leptochelia rapax			38	5.6			3,069	16.7			18,468	78.4	57	2.4			76	9.0
Isopoda																		
Cyathura polita							10	.05			19	.08						
Cassidinidea lunifrons							133	.7			418	1.7						
Chiridotea caeca			10	1.4									19	.8	38	4.5		
Amphipoda																		
Gammaridae							43	.2			67	.2						
Talitridae											29	.1						
Unidentified	10	1.4							19	1.8								
Mysidacea																		
Mysidopsis bigelowi									10	.9					19	2.2	19	2.2
Decapoda																		
Xanthidae							19	.1										
Penaeidae																		
Trachypeneus sp.							10	.05										
Brachyura larvae											19	.08						
Unidentified											19	.08						
Mollusca																		
Bivalvia																		
Rangia cuneata	10	1.4			10	2.6	10	.05	10	.9								
Tellina sp.									10	.9								
Modiolus sp.			10	1.4			38	.2			124	.5						
Unidentified							10	.05			10	.04	19	.8				
Gastropoda																		
Unidentified							19	.1			29	.1	19	.8			38	4.5
Insecta																		
Diptera																		
Chironomidae																		
Dicrotendipes sp.					10	2.6	152	.8			504	2.1	133	5.6				
Total Number of Taxa	4		6		3		16		7		16		8		4		6	
Total Density	667		676		372		18,377		1,019		23,537		2,375		836		836	

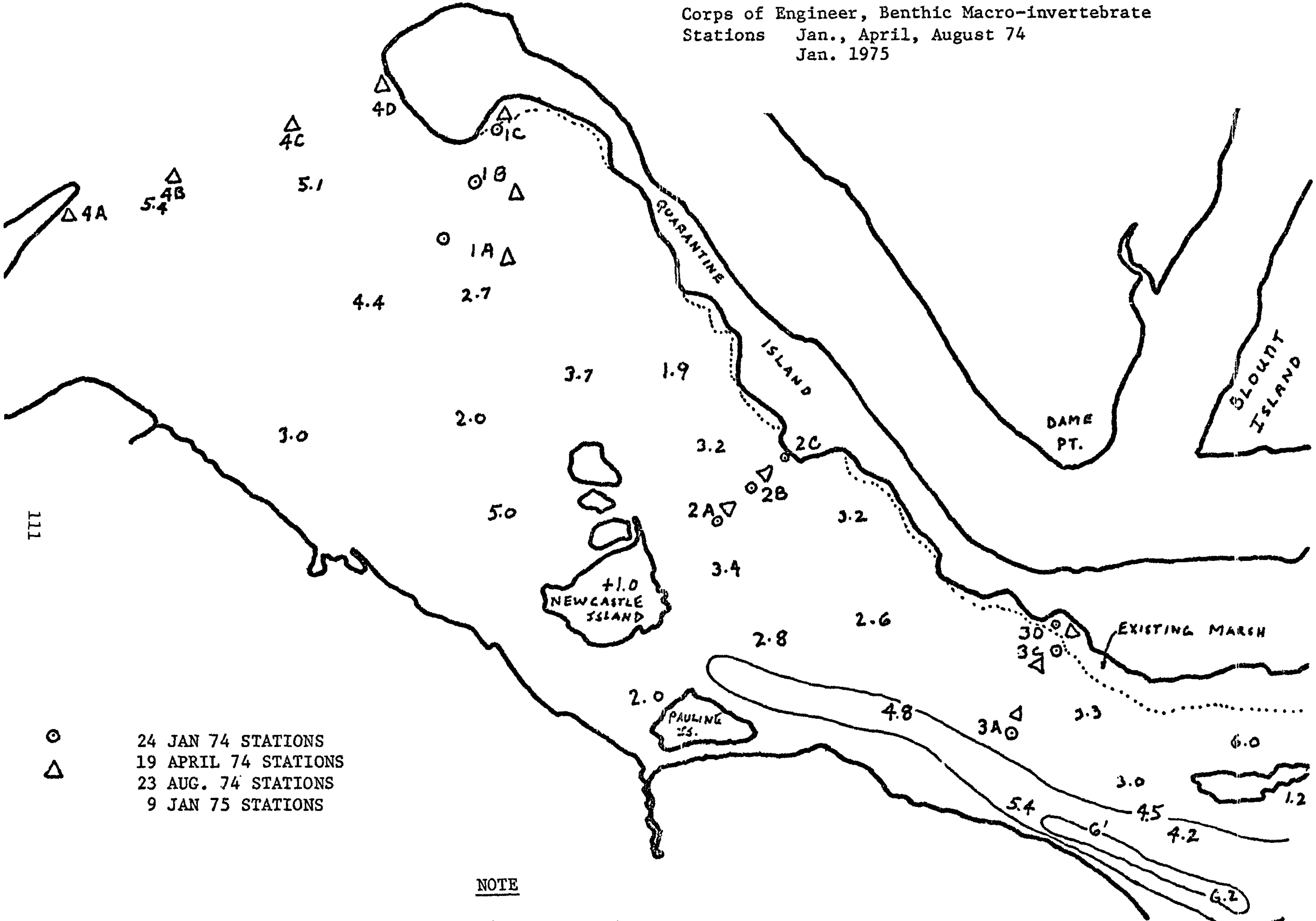
Table 2-25 (d)

Benthic Macro-Invertebrate Populations collected on 9 January 1975 at Quarantine Island, Jacksonville, Florida

Station	1a and 1b		1c		2a and 2b		2c		3a and 3b		3c	
Location	75-150 yards from shore		10 yards from Spartina		50-100 yards from shore		20 yards from shore		50-100 yards from shore		10' from shore near oysters	
Substrate	fresh silt from dredge		silt & sand		silt & shell		silt & fine sand		silt & shell		silt, shell, fine sand	
Depth	3 ft.		1 ft.		2 ft.		8 in.		3 ft.		6-8 in.	
Tide	slacklow		slacklow		slacklow		slacklow		slacklow		slacklow	
Number of grabs	2		1		2		1		2		2	
TAXA	No/m²	%	No/m²	%	No/m²	%	No/m²	%	No/m²	%	No/m²	%
Nemertea	19	5.8					19	.1	29	7.9	67	1.8
Nematoda												
Polychaeta	143	44.0	1,957	57.8	67	43.5	3,914	32.1	257	70.7	1,710	46.1
Oligochaeta	76	23.3	1,311	38.7	19	12.3	8,037	66.0	19	5.2	1,748	47.1
Copepoda												
Calanoida	19	5.8										
Cumacea												
Oxyurostylis smithi									10	2.7		
Tanaidacea												
Leptochelia rapax							19	.1			10	.2
Amphipoda												
Gammaridae					10	6.4						
Corophiidae			19	.5			19	.1				
Unidentified	29	8.9	38	1.1	19	12.3	57	.4	10	2.7	10	.2
Mysidacea												
Mysidopsis bigelowi											76	2.0
Decapoda												
Palaemonidae												
Palaemonetes sp.			19	.5								
Mollusca												
Bivalvia												
Tellina sp.	10	3.0					19	.1	38	10.4	10	.2
Rangia cuneata					29	18.8						
Donax sp.	10	3.0										
Unidentified sp. E	19	5.8			10	6.4	19	.1			29	.7
Gastropoda												
Pyramidella sp.							19	.1			29	.7
Capellinia sp.											10	.2
Insecta												
Diptera												
Chironomidae												
Polypedilum sp.			38	1.1			19	.1				
Chironomus sp.							19	.1			10	.2
Total Number of Taxa	8		6		6		11		6		11	
Total Density	325		3,382		154		12,160		363		3,709	

FIGURE 2-24

Corps of Engineer, Benthic Macro-invertebrate Stations Jan., April, August 74 Jan. 1975



NOTE

SOUNDINGS SHOWN ARE DEPTHS AT MEAN LOW WATER

B. Man-Made Environment

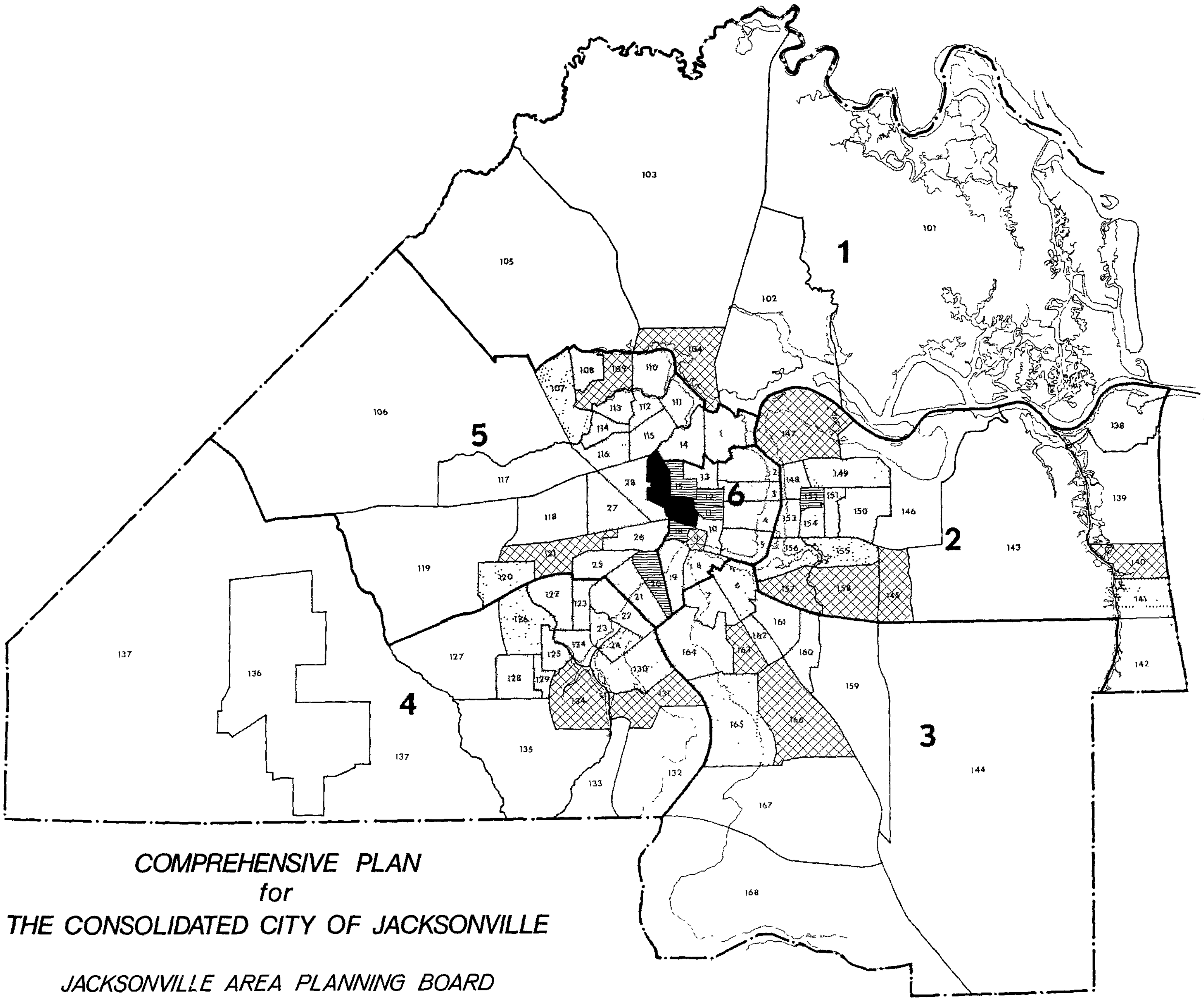
1. Demography and Economics

a. Current Population Data

The population of Duval County was 528,865 in 1970. This was an increase of 16 percent from the 1960 population of 455,308. Principal changes of population distribution during this period were a major decline of population in the core area and higher growth rates in the east and southeast portion of the county. The county-wide population density for 1970 is shown on Figure 2-25.

These population trends were reflected in the 60 percent growth rate of the Arlington service area. The 1960 population of 53,310 had increased to 85,384 by 1970. Three major factors appear to be responsible for the southeasterly shift of the population center. First, like most other Florida cities, Jacksonville is growing toward the ocean. Residence in the Arlington area provides for quick access to the principle recreational and aesthetic attractions of Duval County. The area also contains large tracts of vacant usable land for residential and commercial use. Relatively good access to Jacksonville's major downtown employment centers are provided by way of the Arlington Expressway and the Hart Bridge.

The balance between males and females in Duval County has remained almost constant since the 1960 census with a slight increase in the ratio for males. The average age has increased with substantial increases for age groups above 45 years and a significant decrease in the population of the under five age group. This decrease has been caused primarily by a decrease in the birth rate and average family size. The persons per household ratio dropped from 3.40 in 1960 to 3.14 in 1970. This ratio is expected to continue to decline because of the national trend of later marriages and fewer children. Future population is expected to be added at a ratio of 2.35 persons per household.



COMPREHENSIVE PLAN for THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

FIGURE 2-25

POPULATION DENSITY 1970

PERSONS PER ACRE GROSS LAND AREA

LEGEND

NUMBER OF PERSONS RANGE GROUPS·

(solid black)	17.57 & over
(horizontal lines)	11.36 to 17.56
(dotted)	5.15 to 11.35
(light dotted)	3.79 to 5.14
(cross-hatched)	1.93 to 3.78
(blank)	0 to 1.92

CITY AVERAGE 1.06

NOTE THE PURPOSE OF THIS ILLUSTRATION IS TO SHOW THE GENERALIZED RELATIONSHIP OF DATA BY CENSUS TRACT AND NOT THE LOCATION DENSITY THEREIN ON A NET BASIS

SOURCE JAPB

JUNE 1973

THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

b. Employment and Income

Table 2-26 shows employment by standard industrial classification for Duval County in 1970. The largest increases came in services and transportation and utilities which showed over 40 percent growth rates during the last decade. The labor force has increased at an average annual rate of 4,900 workers from 1950 to 1972.

TABLE 2-26

Employment Groups by Standard Industrial Classification*

Agriculture, Forestry and Fisheries	592
Mining	(D)
Contract Construction	13,219
Manufacturing	25,036
Transportation & Other Public Utilities	15,008
Wholesale Trade	19,081
Retail Trade	35,288
Finance, Insurance, and Real Estate	19,402
Services	31,575
Unclassified Establishments	(D)
	159,201

*Does not include government workers and self employed.

(D) - Figures withheld to avoid disclosure of operations of individual reporting units.

The Arlington service area is made up largely of residential land uses with relatively few employment centers. The two largest are the Boulevard Center Office Park and Regency Square. Smaller employment centers include Fields Plaza, Regency Plaza, Jacksonville University, Florida Junior College and the University of North Florida. New employment centers currently under development are Century 21 Office Park on Atlantic Boulevard and Corporate Square Office Park on Southside Boulevard. Most of the remaining employment in the area is located in the form of strip commercial development along Arlington Expressway, University Boulevard, Atlantic Boulevard, Beach Boulevard, Arlington Road and Southside Boulevard.

Manufacturing employment in the service area is minimal. Less than 600 out of the county's 25,000 manufacturing employees work here.

The percentage of families in Jacksonville with real personal incomes exceeding 10,000 dollars per year increased from 12.4 percent in 1959 to 41.1 percent in 1969. During the same period, families with incomes below the poverty level declined from 21.4 percent of total families to 14.1 percent. The average family income in Arlington in 1969 was almost 11,000 dollars per year. 58.9 percent of the 21,000 families in the service area had incomes of over 10,000 dollars. The unemployment rate in Jacksonville has been 40 to 50 percent below the national average during the past decade.

c. Economic Projections

The number of jobs in Jacksonville is expected to increase from the 1970 level of 196,000 to over 401,000 in 2002. Large increases in employment are forecast in several industrial classifications by the Jacksonville Area Planning Board. Projections for 1990 are as follows:

- Employment in services to increase from 31,575 to 71,000.

- Employment in retail trade to increase from 35,288 to 62,000

- Employment in wholesale trade is expected to increase from 19,402 to 33,100.

- Employment in transportation and utilities is expected to increase from 15,008 to 30,300.

- Manufacturing employment is expected to increase from 25,036 to 45,700.

- Contract construction employment will increase from 13,219 to 22,900.

- Financial insurance, and real estate employment will increase from 19,402 to 31,000.

- Government employment will increase from 34,200 to 57,000.

The largest single new employer will be the Westinghouse Company's Offshore Power Systems (OPS) project which is projected to employ up to 14,000 people in the mid 1980's. In addition, indirect employment created by the OPS project will exceed 20,000. OPS operational demands will create 7,750 of these new jobs and personal consumption expenditures. O.P.S. employees will create 12,265 new jobs.

The actual implementation of the project has been in some doubt over the last several months. Presently, however, plans are progressing for project development. Population projections and waste treatment facilities construction staging and sizing for the period beyond 1980 should be reviewed carefully if plans for OPS are not implemented.

Large increases in employment are not forecast for the Arlington area. Development is expected to continue as mainly residential. Some increases will be evident in the strip commercial and office park areas already discussed. In addition, a small industrial area will be developed south of Craig Field.

d. Population Projections

Figure 2-26 shows population trends for Duval County since 1950 with projections to 2002. The OBERS base-line projections are based on historical demographic data from 1940 to 1970 and represent an estimate of what will occur if present trends continue. These projections are meant to be used as a basis for evaluating locally developed projections.

The projections developed by the Jacksonville Area Planning Board (JAPB) deviate significantly from the OBERS base-line projections. These projections are based upon the assumption that economic activity will greatly increase in the future. Jacksonville's growth rate during the 1960's was 10 percent greater than the national rate. An economic study by Gladstone Associates forecasts a total civilian employment of almost 295,000 by 1980. This would constitute an increase of more than 77,000 since 1970. Employment projections made by the JAPB, discussed in the Economic Projections section of this chapter, also forecast large increases in employment.

The recent economic history of the Jacksonville area makes it a reasonable assumption that Jacksonville will grow at a rate exceeding the base-line projections. The expected operational level of the OPS project will make the JAPB projections for 1990 realistic even with the expected decrease in persons per household. Barring any additional projects of OPS magnitude, the rate of population growth should decrease somewhat after 1990. A projection of 929,000 for 2002 is a reasonable long range projection. This figure can be adjusted as intervening events warrant.

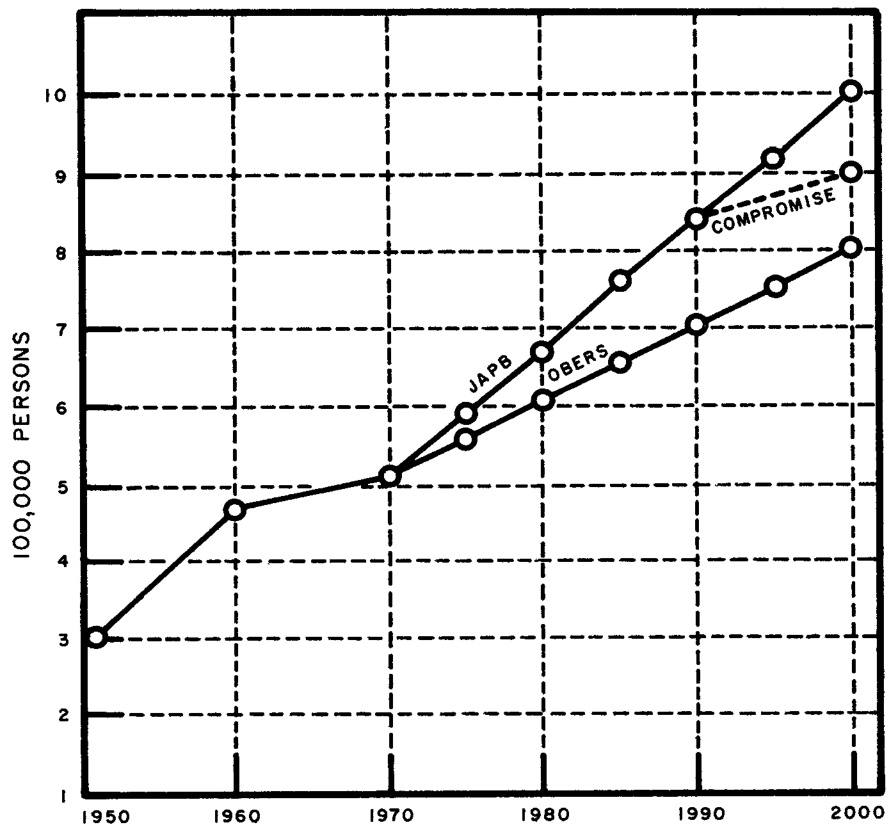


Figure 2-26

Population Projections for Duval County

The population of the Arlington service area should continue to grow at a faster rate than that of the city as a whole. The amount of attractive vacant land available and the nearness to the beach will continue to act as strong inducements to residential settlement in the Arlington area. Table 2-27 shows the projected population increases for the Arlington service area and their relations to the county-wide projections. Figure 2-27 shows how the expected 1990 population will be distributed throughout the service area.

TABLE 2-27

ARLINGTON POPULATION PROJECTIONS

Year	Area	Population	% of Total
1960	Arlington	53,310	11
1960	Duval County	455,308	
1970	Arlington	85,384	16
1970	Duval County	528,865	
1980	Arlington	119,442	18
1980	Duval County	660,000	
1990	Arlington	181,377	21
1990	Duval County	850,000	
2002	Arlington	219,850	23
2002	Duval County	925,000	

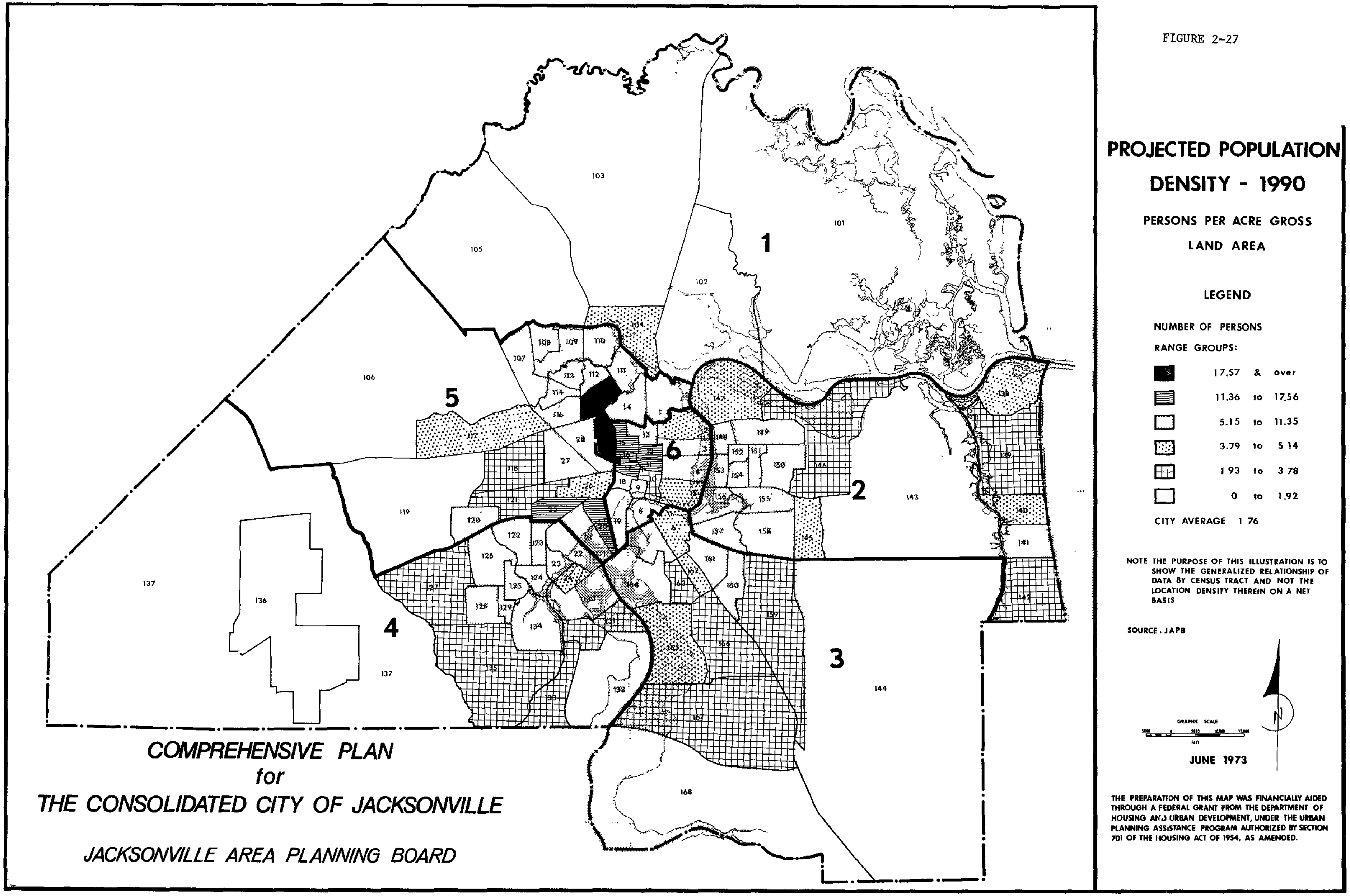

PROJECTED POPULATION DENSITY - 1990
PERSONS PER ACRE GROSS LAND AREA
LEGEND
NUMBER OF PERSONS RANGE GROUPS:
17.57 & over
11.36 to 17.56
5.15 to 11.35
3.79 to 5.14
1.93 to 3.78
0 to 1.92
CITY AVERAGE 1.76
NOTE THE PURPOSE OF THIS ILLUSTRATION IS TO SHOW THE GENERALIZED RELATIONSHIP OF DATA BY CENSUS TRACT AND NOT THE LOCATION DENSITY THEREIN ON A NET BASIS
SOURCE. JAPB
JUNE 1973
THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.
COMPREHENSIVE PLAN
for
THE CONSOLIDATED CITY OF JACKSONVILLE
JACKSONVILLE AREA PLANNING BOARD
1
2
3
4
5
6

FIGURE 2-27

Since the Arlington service area will act primarily as a residential community for people working elsewhere in Jacksonville, the population projections for this area are directly related to the city-wide employment forecasts and the availability of convenient transportation access. The long range projections beyond 1980 are particularly dependent upon the OPS project and the proposed Dames Point Bridge. The implementation of the OPS project will provide 14,000 jobs just across the St. Johns River to the north. The area adjacent to the OPS land on the north side of the St. Johns River is wetlands, which are recommended for preservation in the 1990 Development Plan of the JAPB. This makes the Arlington area the closest large area projected for residential development. The long range population forecasts for Arlington will need to be reassessed if either of these projects are not constructed.

2. Land Use

a. Existing Land Use

Approximately one-third of the 55,000 net dry acres of land in the Arlington service area are developed (see Figure 2-28). The developed portion of the service area is generally bounded by the St. Johns River to the north and west, the service area boundry to the south, and Craig Field to the east.

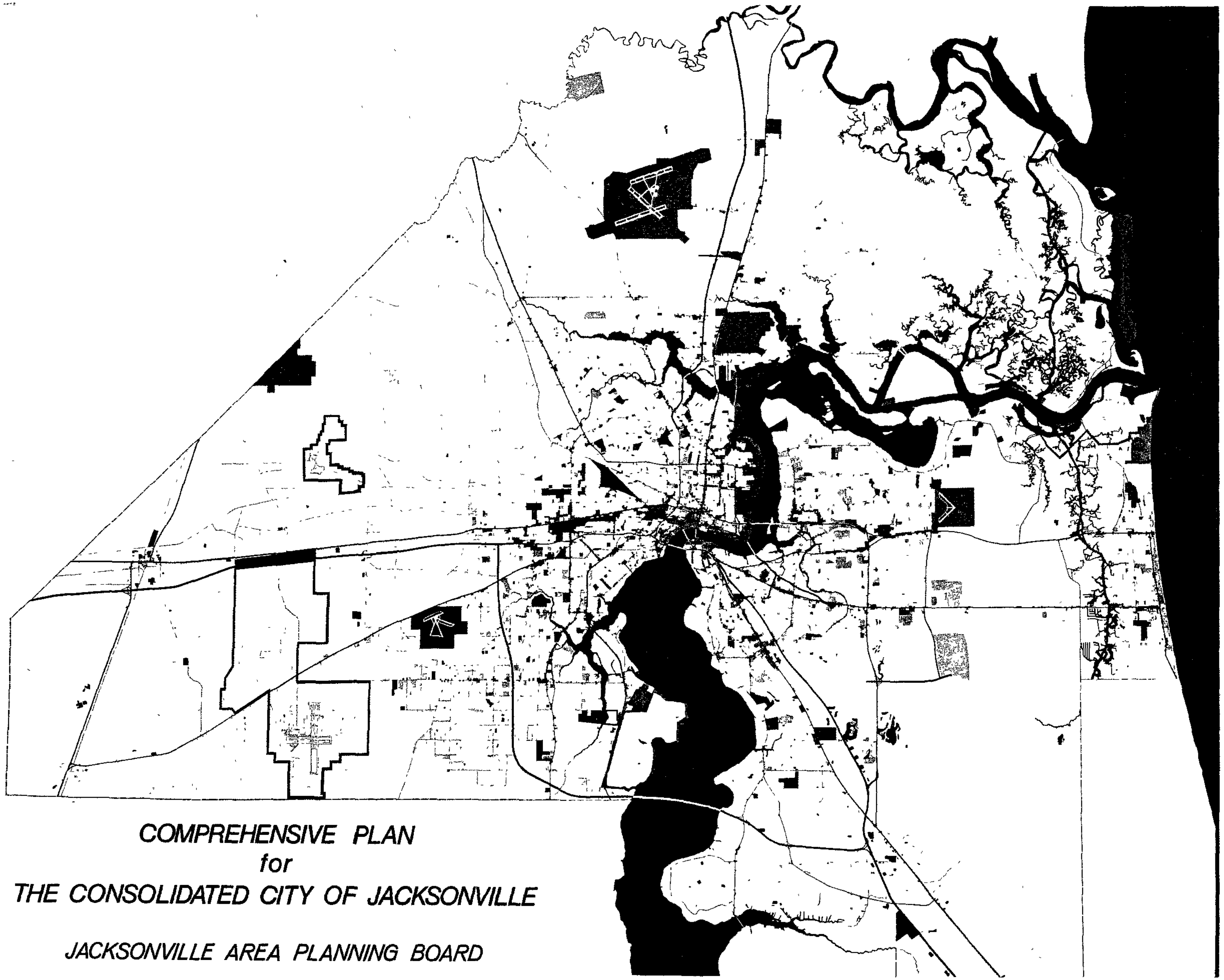
A little over half of this land is in residential development, about five percent in commercial use, and less than one percent in industrial use. All other uses such as streets and highways, Craig Airport, governmental facilities, and utilities, make up the remaining third of the developed land. Approximately 1,000 acres of the undeveloped land is part of an old titanium strip mining operation.

Over 70 percent of all land zoned for residential purposes is at a density of less than five dwelling units per acre. This land is generally spread throughout the developed portion of the service area, excluding land adjacent to the right-of-ways of the major transportation corridors such as Arlington Expressway, Atlantic Boulevard, and Beach Boulevard. Less than five percent of these units were built before 1940. Most of them were constructed between 1950 and 1965. One small area located between Atlantic Boulevard and the Arlington Expressway is undergoing neighborhood rehabilitation.

Since the mid-sixties, residential trends in the service area have changed to include more multi-family rental apartments. In the period, 1970-73, over 1,200 acres of land in the service area were zoned for residential development. Over 90 percent of it was for density over five dwelling units per acre. Most of these units are being located near the major transportation arteries such as Beach Boulevard, Atlantic Boulevard and the Arlington Expressway.

FIGURE 2-28

LAND USE-1972



LEGEND

- RESIDENTIAL
  - SINGLE FAMILY
  - MULTIPLE FAMILY
  - MOBILE HOME PARKS
- COMMERCIAL
- INDUSTRIAL
- CULTURAL & INSTITUTIONAL
- PARKS & RECREATION
- MILITARY

SOURCE JACKSONVILLE AREA PLANNING BOARD

GRAPHIC SCALE

FEET

JUNE 1973

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Most of the commercial activity in the service area is in the form of strip development along the major arterials. In addition, there are a number of major clustered developments including Boulevard Center Office Park, Regency Square Shopping Center, Town and Country Shopping Center, and Arlington Plaza Shopping Center. Major proposed shopping centers included locations at the intersection of J. Turner Butler Expressway and Southside Boulevard, and on Beach Boulevard north of the University of North Florida. A few small neighborhood shopping centers are also present throughout the service area.

Very little industry of any type is located in the service area. A small ship manufacturing facility, located along the Intracoastal Waterway at Atlantic Boulevard, is the only heavy industry. A few small light industrial establishments such as warehouses and auto repair shops are scattered through the area along the major arterials.

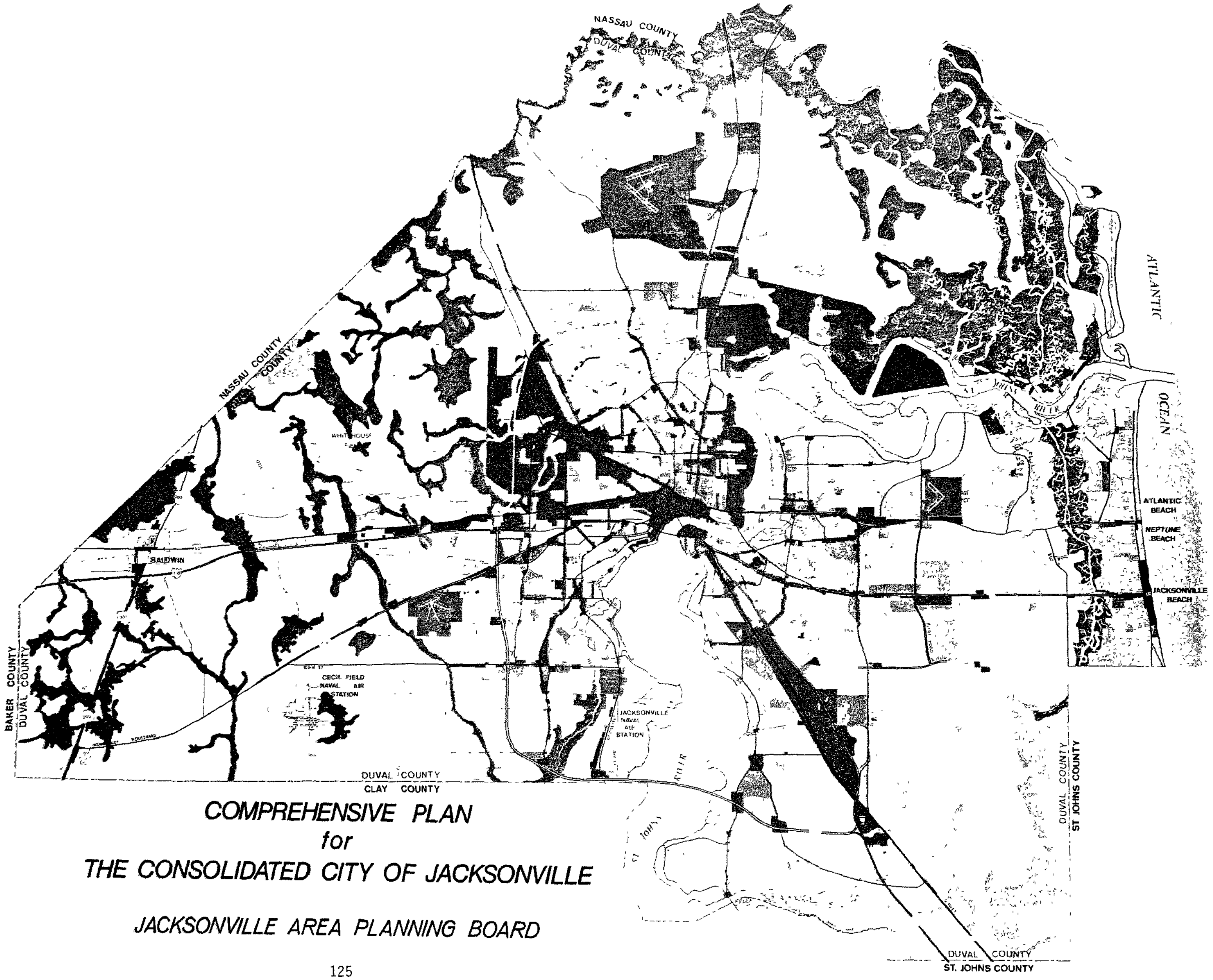
The remainder of the developed land in the service area is made up of various uses such as transportation facilities, governmental and community facilities, and utilities. These land uses act as support facilities for the residential, commercial and industrial uses already discussed, and as such, are scattered throughout the developed portion of the service area. The following governmental and community facilities are now present in the service area: 18 schools, two public parks and other outdoor recreational facilities (including mostly school playgrounds), eight private recreational facilities, five fire stations, seven health facilities, one library, three colleges, one sanitary landfill, and eight other public buildings.

b. Future Land Use

Most of the land in the service area is expected to be developed by 1990 (see Figure 2-29) at about the same ratio of land uses as is now present (residential over 50 percent, commerical about five percent, industrial less than one percent, governmental, transportation, utilities, etc., about one-third).

FIGURE 2-29

DEVELOPMENT PLAN - 1990



COMPREHENSIVE PLAN for THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

LEGEND

RESIDENTIAL

RANGE GROUP
DWELLING UNITS PER GROSS ACRE

0-1
1-5
5-10
10-15
15 & OVER

COMMERCIAL
INDUSTRIAL
AIRPORTS
CULTURAL & INSTITUTIONAL
PARKS & RECREATIONAL
MILITARY
PRESERVATION
CONSERVATION

SOURCE JAPB

Major factors leading to increased development in the area will continue to be the desirability of living near the beach and the availability of tracts of vacant land appropriate for development. Added impetus will be provided by an increase in employment opportunities through such projects as OPS, and the construction of the Dames Point Bridge. If the expected development of OPS and the Dames Point Bridge do not occur, development will proceed in the Arlington service area at a much slower rate than presently expected.

Residential development is projected to be present throughout the eastern section of the service area by 1990. The new development should provide a mix of densities with the higher ones (over five dwelling units per acre) being located adjacent to major transportation arteries and the universities. The existing low density character of the area adjacent to the right-of-way of the Dames Point Expressway north of Atlantic Boulevard will change to higher density following the completion of that project. This change could extensively affect the character of the surrounding low density neighborhood through increased traffic, visual impacts, etc.

Low density (less than five dwelling units per acre) development will occur only in areas away from the major arterials except near the Intracoastal Waterway where low density development is expected along Atlantic and Beach Boulevards. Areas east of Craig Field, near the St. Johns River and near the Intracoastal Waterway, which are the most environmentally sensitive, are proposed to be developed at densities not greater than one dwelling unit per acre.

Land devoted to commercial uses will gradually expand as the population demand warrants it. Most of this development should occur along the major arterials with the exception of a few small neighborhood shopping centers.

The service area will continue to have very little industrial development. One area of light industry is forecast adjacent to the southern edge of Craig Airport. No other areas of industrial development are forecast.

The remainder of the developed land in the service area will be made up of various uses such as transportation facilities, governmental and community facilities, and utilities. These land uses should be scattered throughout the service area as development warrants to avoid the overcrowding of existing facilities.

c. Land Use Planning and Controls

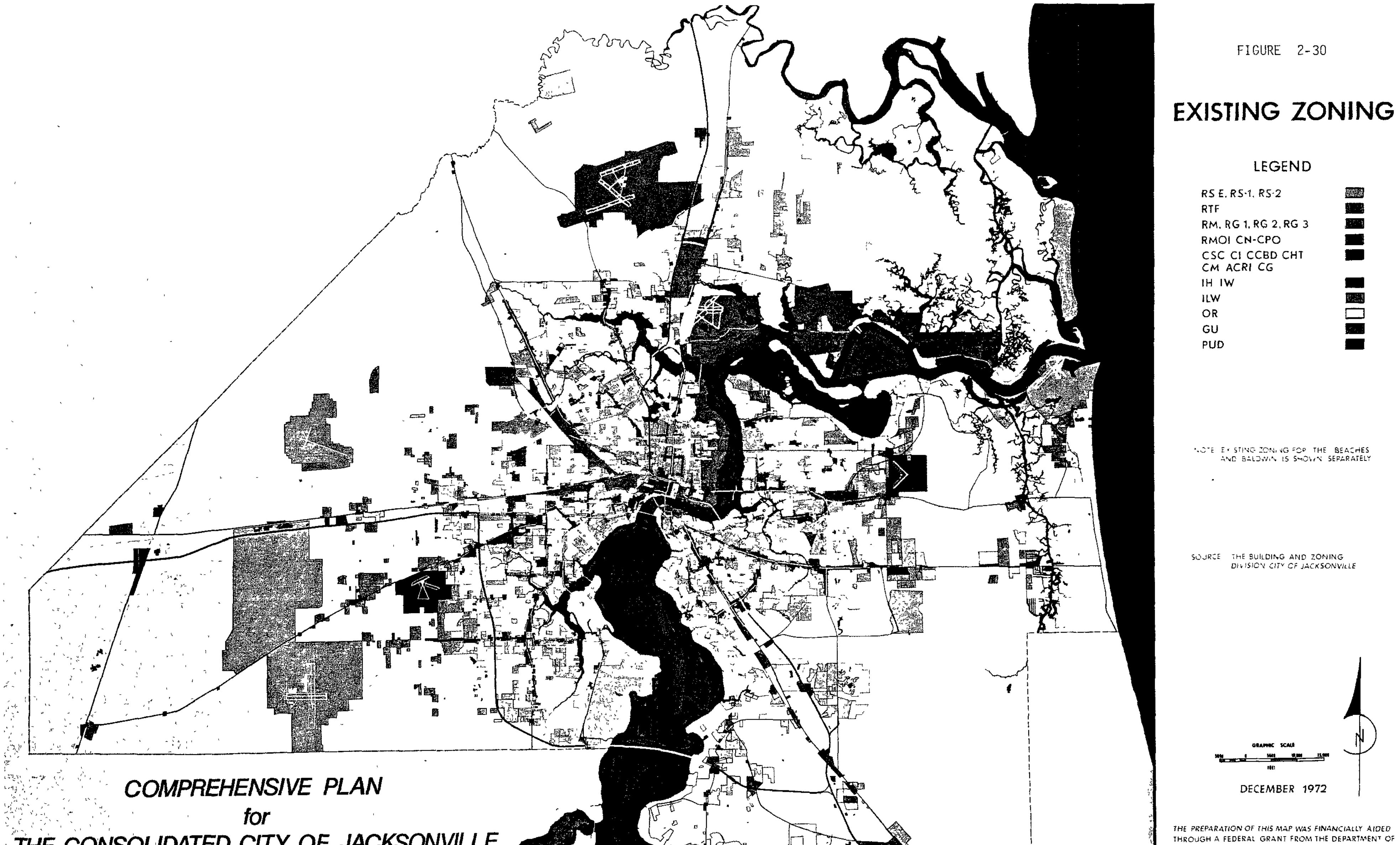
Extensive land use planning is now being accomplished in Jacksonville by the Jacksonville Area Planning Board. The JAPB has assembled a vast amount of information on the critical factors necessary for effective land use planning such as soil conditions, flood prone areas, water quality, air quality, community facilities loading, transportation, demographic data, and socio-economic conditions. This information has been used for preparing two principle planning documents; The 1990 Comprehensive Development Plan and The 1974-1979 Short Range Development Plan. These two plans provide a focus and direction for efficient land use development for the protection of environmentally sensitive areas, and for proper phasing of required community facilities.

The Consolidated City of Jacksonville currently has two major land use control ordinances that can be used to guide development to coincide with the JAPB plans. The first of these is a zoning ordinance. This ordinance (see Figure 2-30) controls how land can be used and what density. The proper use of this tool will be essential if a quickly growing area such as Arlington is to develop in an orderly manner, protect the character of its existing neighborhoods, and avoid disturbance to environmentally sensitive areas. If zoning decisions in the area are based largely on the JAPB planning documents, efficient land development with minimal damage to sensitive natural and man-made areas should result.

Subdivision regulations are also in effect in Jacksonville. This ordinance acts as a quality control on new development by governing the process of converting raw land into building sites. Aspects of development which are controlled include the safety and adequacy of the water supply and sewage disposal systems and the proper design and construction of new streets, utilities, and drainage systems.

FIGURE 2-30

EXISTING ZONING



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3. Archeological, Cultural, Historical and Recreational Resources

a. Historical and Cultural Properties

Duval County currently has ten sites which are included in the National Register of Historic Places (see Figure 2-31). These sites are as follows:

Jacksonville, Broward, Napoleon Bonaparte House,
9943 Heckshire Drive

Jacksonville, Catherine Street Fire Station,
14 Catherine Street

Jacksonville, Epping Forest, Christopher Point,
Off San Jose Boulevard

Jacksonville vicinity, Grand Site,
North of Jacksonville

Jacksonville, Kingsley Plantation,
Florida AIA

Jacksonville Old St. Lukes Hospital,
314 Palmetto

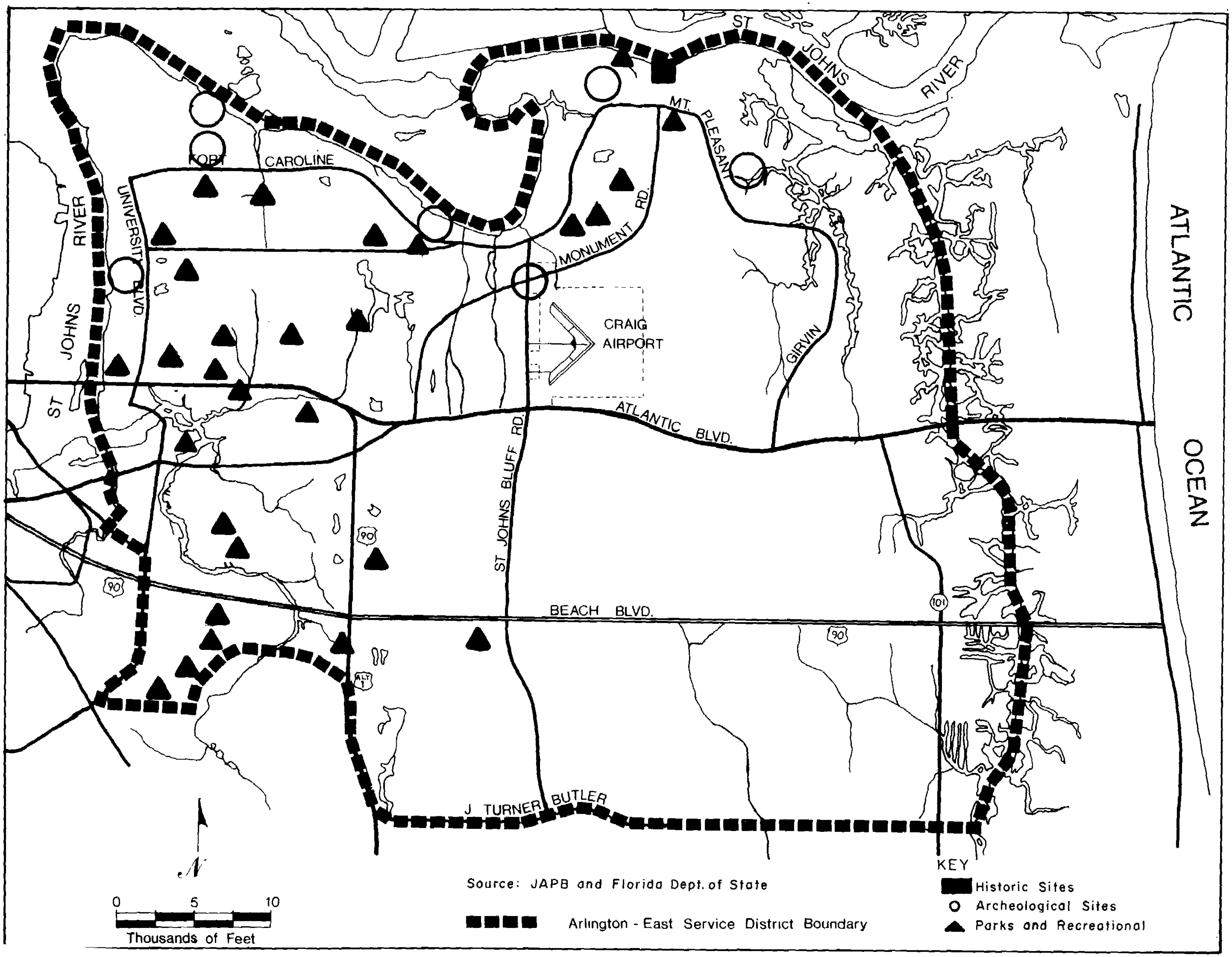
Jacksonville, Red Banks Plantation,
1230 Greenridge Road

Jacksonville, Riverside Baptist Church,
2650 Park Street

Jacksonville vicinity, Fort Caroline National Memorial,
10 Miles East of Jacksonville

Jacksonville vicinity, Yellow Bluff Fort,
South of Florida 105 on New Berlin Road

Only one of these sites, the Fort Caroline National Memorial is located within the project service area. This Fort is located along the south shore of the St. Jones River near St. Johns Bluff. It was originally settled in 1864 by French Huquenots.


ST JOHNS RIVER
ST JOHNS RIVER
ATLANTIC OCEAN
FORT CAROLINE
MT. PLEASANT
UNIVERSITY BLVD.
MONUMENT RD.
CRAIG AIRPORT
GIRVIN
ATLANTIC BLVD.
ST JOHNS BLUFF RD.
BEACH BLVD.
J TURNER BUTLER
90
101
ALT 1
N
0 5 10
Thousands of Feet
Source: JAPB and Florida Dept. of State
Arlington - East Service District Boundary
KEY
Historic Sites
Archeological Sites
Parks and Recreational

b. Archeological Sites

Seven archeological sites have been recorded within the project area by the Florida Bureau of Historic Sites and Properties of the Florida Department of State. All of these sites except one are prehistoric Indian burial mounds. Five of them were excavated, partially or wholly in the late 1800's by an early archeologist named Clarence B. Moore. The remaining site is a village site with evidences of both prehistoric and historic period occupations. The Bureau of Historic Sites and Properties asked that the locations of these properties not be circulated because the public availability of such information could lead to further destruction of the sites through the activities of amateur artifact hunters.

c. Recreational Facilities

The largest public park in the service area is the 5 acre Bruce Park located at the intersection of Arlington Road and Rogero Road. This park is now intensively used and is considered inadequate in size.

A ten-acre recreation area for retarded and handicapped children is also located within the service area. This is the Sunny Acres playground located on McCormick Road.

Most of the other recreational facilities in the area are located adjacent to public school sites. One public boat landing facility, on the St. Johns River at the end of Arlington Road, is located in the service area.

One Federal facility is also located within the area. This is the Fort Caroline National Memorial located near St. Johns Bluff. This facility has been included in the National Register of Historic Places.

According to national standards, the area is deficient by 700 acres in public recreational facilities. The Short Range Development Plan prepared by the JAPB proposes several new facilities to help remedy this situation. These are as follows:

Arlington Sports Plaza: Located south of Ft. Caroline Road, the 10-acre site is an old sanitary landfill facility, being converted into a public park. It is recommended that the completion of improvements here should be expedited.

Pottsburg Creek Park: This is a new community park recommended on a presently vacant piece of property located between Holiday Road and Pottsburg Creek. Approximately 40.0 acres in the area, the site has a sloping terrain and part of the land is in the flood-prone area. Surrounded by urban development and close to a principal arterial highway, the site is well suited for this purpose. Its location along a navigable water course makes it possible to incorporate water related recreation facilities in the park.

Memorial Park: About 11.75 acres in the area, this site is located on Lone Star Road. Presently lying vacant, the property is dedicated to the State (of Florida) for use as a cemetery. It is located next to "Tree Hill" and is in an area which is badly deficient in public open space and recreation facilities.

Fort Caroline Park: This is a 14-acre vacant tract of land located on Quitina Drive adjacent to Ft. Caroline Elementary and Ft. Caroline Junior High schools. With good accessibility, the site is proposed for a community park to serve the residential development around this area.

An additional 246 acres in recreational facilities are recommended to be scattered throughout the region to help bring the area up to recommended standards.

The Plan also recommends the preservation of several unique and sensitive natural areas as open space. One of these is a 50.4-acre tract located north of Ft. Caroline Road between Cowhead Creek and Jones Creek on Mill Cove. This area is primarily marshland located along the Intracoastal Waterway.

The Plan also recommends the preservation of a 46.3-acre area on Lone Star Road for preservation. This area, known as Tree Hill, is envisioned as a native site.

Other low-lying wetland areas along most of the creeks and Mill Cove are also recommended as open spaces. The exact location of these areas are depicted on the future land use map (Figure 2-29).

4. Transportation

a. Existing Transportation Facilities

The discussion of streets and highways in this section is based upon the nomenclature used in the Jacksonville Urban Area Transportation Study. The definitions of major facilities used in the study are as follows:

Freeways, Expressways, and Parkways. These limited access facilities are designed for high traffic service. They primarily serve longer trips which require relatively high operating speeds. Generally, freeways include those facilities with complete control of access through the use of grade separation and interchanges. An expressway is a major facility with full or partial control of access. Relatively few, if any, at-grade crossings or private driveway connections are permitted on expressways. A parkway is a route having full or partial access within a park-like development.

Arterial Streets. The arterial street system, together with limited access facilities, serves as the principal network for high volumes of traffic. Arterial streets provide some land service but should serve predominantly as traffic service facilities. Intersections with other streets are usually at grade; and, when traffic volumes through the intersections are large, traffic signals are employed.

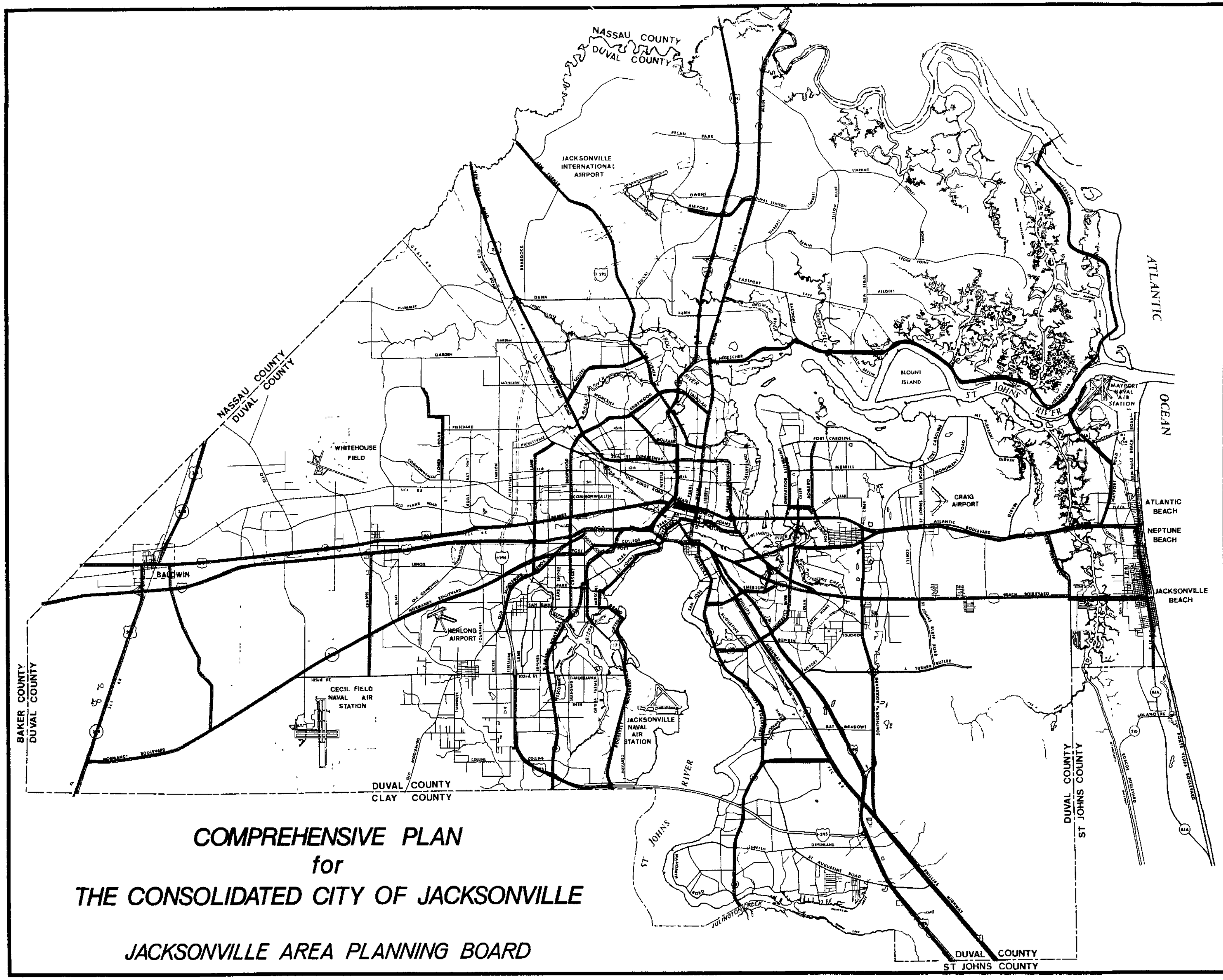
Collector Streets. The collector street system is designed primarily to collect and distribute traffic between local streets or areas and the arterial streets. Collector streets are used primarily for traffic movement into, from, and within residential, commercial, and industrial areas rather than through such areas. A high proportion of traffic on segments of collector streets indicates land service demand which, in turn, necessitates direct access to abutting properties.

Local Streets. The majority of streets within the community primarily serves adjacent land uses. These streets constitute the minor street network and need not be designed for high volumes of traffic. As a general rule, intersections of local streets with major streets should be minimized. Local traffic should be directed to collector streets and then to the major street network.

The major streets and highways in the service area are listed below by functional classification:

Name of Facility	Functional Classification
Commodore Point Freeway	Freeway
Arlington Expressway	Expressway
Southside Boulevard	Expressway
J. Turner Butler Expressway	Expressway
Beach Boulevard	Principal Arterial
Atlantic Boulevard	Principal Arterial
University Boulevard	Minor Arterial
St. Johns Bluff Road	Minor Arterial
Merrill Road	Minor Arterial
Fort Caroline Road	Major Collector
Rogero Road	Major Collector
Arlington Road	Major Collector
Lone Star Road	Major Collector
Cesary Boulevard	Major Collector
Townsend Boulevard	Major Collector

The major streets and highways and traffic volumes in the service area can be seen on Figure 2-32. Five major highways serve the area in an east-west direction. Atlantic and Beach Boulevards traverse the entire service area providing the only highway access between the beach and the rest of the County. The other major east-west highways, Arlington Expressway, Commodore Point Freeway, and J. Turner Butler Expressway serve only the urbanized part of the service area. North-south access is provided by St. Johns Bluff Road, Southside Boulevard, Arlington Road, Rogero Road, and University Boulevard.



COMPREHENSIVE PLAN
for
THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

FIGURE 2-32

TRAFFIC VOLUMES
1971

24 HOUR ANNUAL AVERAGE

DAILY TRAFFIC

LEGEND

24 HOUR ANNUAL VOLUME

—	0 - 19,999
—	20,000 - 39,999
—	40,000 - 59,999
—	60,000 - 79,999
—	80,000 & OVER

NOTE TRAFFIC VOLUMES DEPICTED ARE FOR EXISTING MAJOR HIGHWAYS, ARTERIALS, AND SOME MAJOR COLLECTOR STREETS

SOURCE FLORIDA DEPARTMENT OF TRANSPORTATION AND JACKSONVILLE TRAFFIC ENGINEER'S OFFICE

GRAPHIC SCALE

FEET

JUNE 1973

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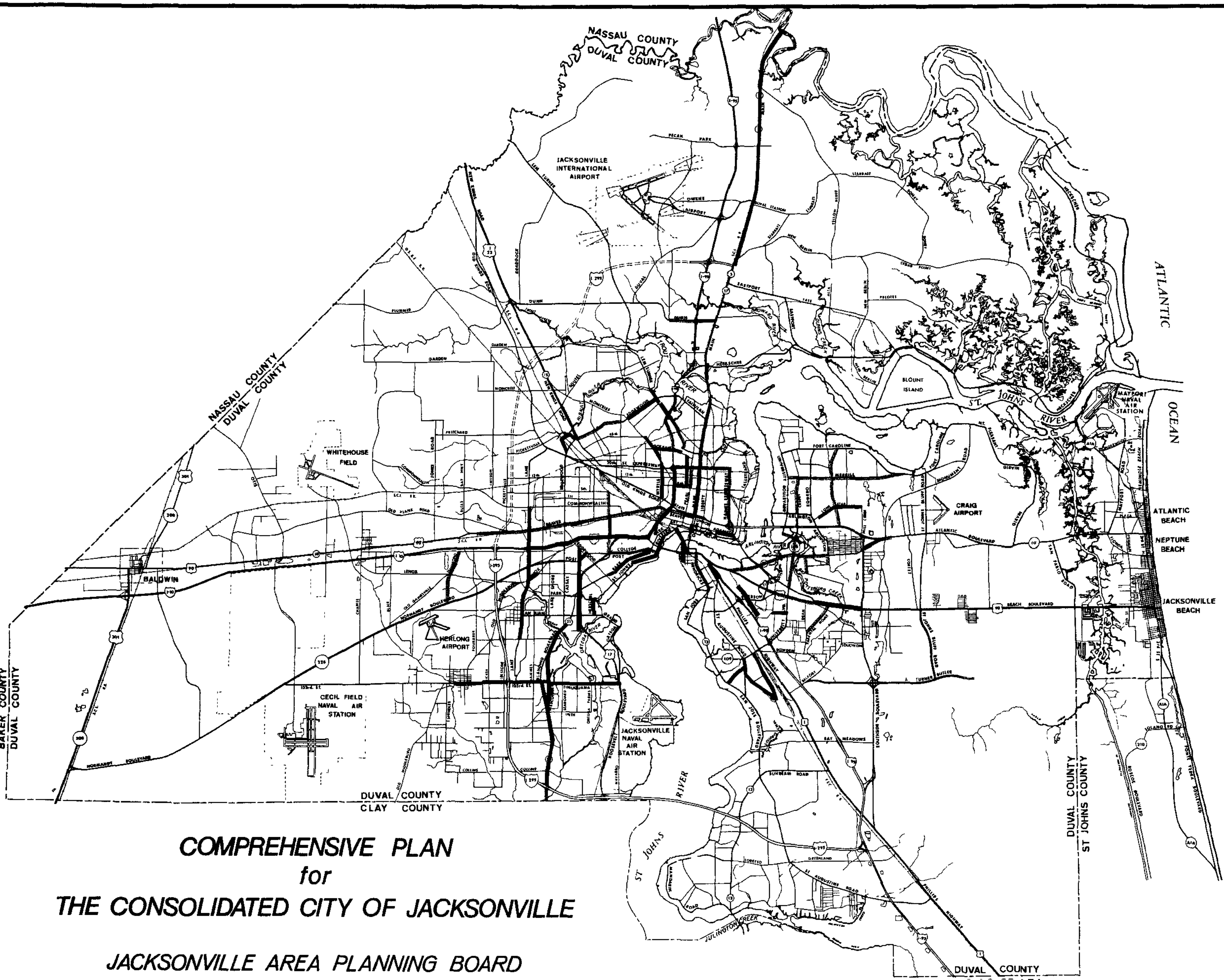
Many components of the major highway network are overloaded. (See Figure 2-33.) This is causing traffic congestion and accidents, particularly during peak hours. The two worst intersections in the service area are the intersection of Arlington Expressway, Atlantic Boulevard, and Southside Boulevard (Arlington Triangle) and the intersection between University Boulevard and Atlantic Boulevard. A major factor in the congestion problem is the limited access Arlington residents have with the rest of the County. Access to the west and north is blocked by the St. Johns River, while access to the east is limited by the Intracoastal Waterway.

The Mathews and the Hart Bridges provide the most direct access from the service area to the downtown area. Access to three other bridges crossing the St. Johns to the west is provided by Atlantic Boulevard and Beach Boulevard. All of these bridges except the Hart Bridge are carrying traffic greater than their design capacity.

Access from the service area across the Intracoastal Waterway to the beach communities is provided by Atlantic and Beach Boulevards. There is no direct connection between the service area and the north side of the St. Johns River.

This limited access is especially important because most of the people living in Arlington work outside the area. The Demography and Economics section of this chapter demonstrates the small percentage of jobs in Arlington. The largest employment center in the county is currently the downtown area. Work and home trips between Arlington and downtown travel on the Mathews and Hart Bridges. The average daily travel on these bridges in 1974 was 44,900 on the Mathews Bridge and 23,400 on the Hart Bridge. As the residential population of Arlington increases in the future, traffic on these bridges will increase as more commuting trips are made out of the service area. Completion of the Dames Point Bridge and the OPS project will lead to a large number of commuting trips between Arlington and the north side of the St. Johns River.



COMPREHENSIVE PLAN
for
THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

FIGURE 2-33

VOLUME TO CAPACITY RATIO - 1972

FOR THOROUGHFARE SEGMENTS

LEGEND

RATIO RANGE GROUPS FOR STREET SEGMENTS

0.90 to 1.00%

1.01 to 1.25%

1.25% & OVER

SOURCE JAPB, JUATS STUDY, AND FLORIDA D.O.T

JUNE 1973

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Mass transportation to the service area is provided by several bus routes operated by the Jacksonville Transportation Authority. This service is available only to the most populated portions of the service area and along the major routes to the beach.

Airport service is provided by Craig Airfield which is operated by the Jacksonville Port Authority. The airfield is used exclusively for general aviation (non-commerical) purposes. It is equiped with two 4,000 feet runways and a helicopter pad. The facility is currently servicing approximately 95,000 flights per year.

b. Proposed Transportation Facilities

Highway plans for Jacksonville were made in the Jacksonville Urban Area Transportation Study (JUATS), completed in 1972. Many major new facilities were planned for the Arlington area to serve the expected population increase and to ease existing congestion. Major elements of the plan were as follows:

1. Extend the Commodore Point Freeway to serve the east-west corridor between the Hart Bridge and the beaches.

2. Build Dames Point Freeway and Bridge to provide access from existing Southside Boulevard to I-95 on the north side of the St. Johns River. This facility will provide access from Arlington to the Blount Island industrial area.

3. The J. Turner Butler Expressway will be extended to connect University Boulevard with the south Jacksonville beach area.

4. The Fort Caroline Freeway is proposed to provide circumferential traffic service by connecting I-295 in the south and the Dames Point Freeway in northeast Arlington. It will also connect the service area to the western side of the St. Johns River at the 20th Street Expressway.

Since the completion of the JUATS study, local officials and citizens in Jacksonville have been questioning the need for the large number of new highway facilities recommended in the plan. For this reason, the plan has not been officially adopted by the City and a reevaluation of its recommendations is now underway.

The construction of the Dames Point and Fort Caroline projects would have a marked effect on the existing low density residential character of the area surrounding their proposed interchange. Development pressure from these projects is expected to lead to higher density residential development in the area made up largely of apartment complexes (See Figure 2-29). The planned four-laning of Merrill Road would also add to these development pressures. The surface streets in the surrounding neighborhoods can expect increased traffic volumes resulting from these expected increases in population density.

A long range mass transportation system study for Jacksonville has been completed. Major recommendations for the system in this service area are as follows:

1. A fixed guideway route along Beach Boulevard.

2. A fixed guideway route branching off from the above at University Boulevard where it turns north to Arlington Expressway and then east to St. Johns Bluff Road.

3. An express bus route, running east along Atlantic Boulevard from St. Johns Bluff Road to the beach and west from the beach along Beach Boulevard to Southside Boulevard.

4. An express bus route on the proposed Dames Point Freeway going north from Regency Square.

5. A network of feeder buses, running along major streets and connecting with the proposed fixed guideway and express bus systems.

Airport service will continue to be provided by Craig Field. In a 1972 study, a 20-year flight projection of 230,000 was made along with a recommendation for a new 3,700 foot runway. Because of the ensuing energy crisis, Port Authority officials are now reassessing this projection. A relocation of runway 1331, 2,000 feet to the southeast is also under consideration because of a noise problem in an adjacent residential area.

5. Resource Use

Electric use in the project service area is expected to require approximately 198 MVA in 1975. The Jacksonville Electric Authority (JEA) projects this need to increase to 358 MVA by 1984. Based upon the population projections presented earlier in this chapter, electric needs should increase to approximately 681 MVA by 2002.

Eight substations currently serve the area. One additional substation is projected to come on line in 1977. The planned capacities of the substations serving the area through 1984 are as follows:

2	Neptune	1975 - 67 MVA	1977 - 100 MVA	
3	St. Caroline	1975 - 67 MVA		
4	Merrill	1975 - 67 MVA		
5	Arlington	1975 - 67 MVA		
7	Hunter	1975 - 67 MVA		
8	San Souci	1975 -100 MVA		
9	Robinwood	1975 - 67 MVA		
12	University	1975 - 50 MVA	1980 -100 MVA	
98	Oakwood Villa	1975 - 0 MVA	1977 - 50 MVA	1978 -100 MVA

No formal planning has been done by JEA beyond 1984. Approximately 300 MVA in additional power will be needed in the service district between 1984 and 2002 if population projections are correct and power consumption per customer does not markedly change. This additional power demand would be met with a combination of additional transformers at existing substations and new substations. The ultimate size of substations usually ranged between 100 and 150 MVA. Each transformer generally supplies either 33 or 50 MVA of power. Each substation generally maintains enough reserve power to operate with no loan of service if one of its transformers is out of service.

If power use increases throughout Jacksonville at its expected rate, a new 400 to 500 megawatt generating station may be necessary in the early 1980's. This facility could probably supply the city's increased power needs until the mid 1990's.

The JEA does not feel that the addition of new transformers and substations will cause any increase in electric rates. It is felt that the increase in power consumed would pay for the new facilities. A new major generating station may, however, lead to a rate increase. The successful rate of bonds to pay for such a facility is dependent upon the JEA's financial condition. Higher rates may be deamed necessary to insure the redemption of the bonds.

The current rate structure of the JEA has been in effect for 10 years. The higher users of electric power are rewarded with lower rates along a sliding scale. Monthly residential rates are as follows:

4.55¢ per KWH for first 100 KWH
1.78¢ per KWH for next 250 KWH
1.50¢ per KWH for next 500 KWH
1.25¢ per KWH for next 650 KWH
1.10¢ per KWH for all over 1500 KWH

Although the rate structure has remained constant for 10 years, customers' bills have gone up significantly. This has been caused by a fuel adjustment charge which increases with the price of fuel. The JEA currently uses only oil fired boilers. A close approximation to the fuel oil adjustment is to add 1.8 mills/KWH to each bill for every $1.00 increase in fuel oil per barrel above $1.86/bbl. This charge is applied to all bills in this way with no sliding scale as the rate schedule employs.

There are currently no major resource users or major resources being extracted from the project area. Titanium was formally mined in the area using strip mining techniques. Stretches of white sandy soil remain where the mining activity took place. The area stretches southward along Southside Boulevard from Merrill Road to the southern edge of the service area.

6. Water Programs

a. Wastewater Systems

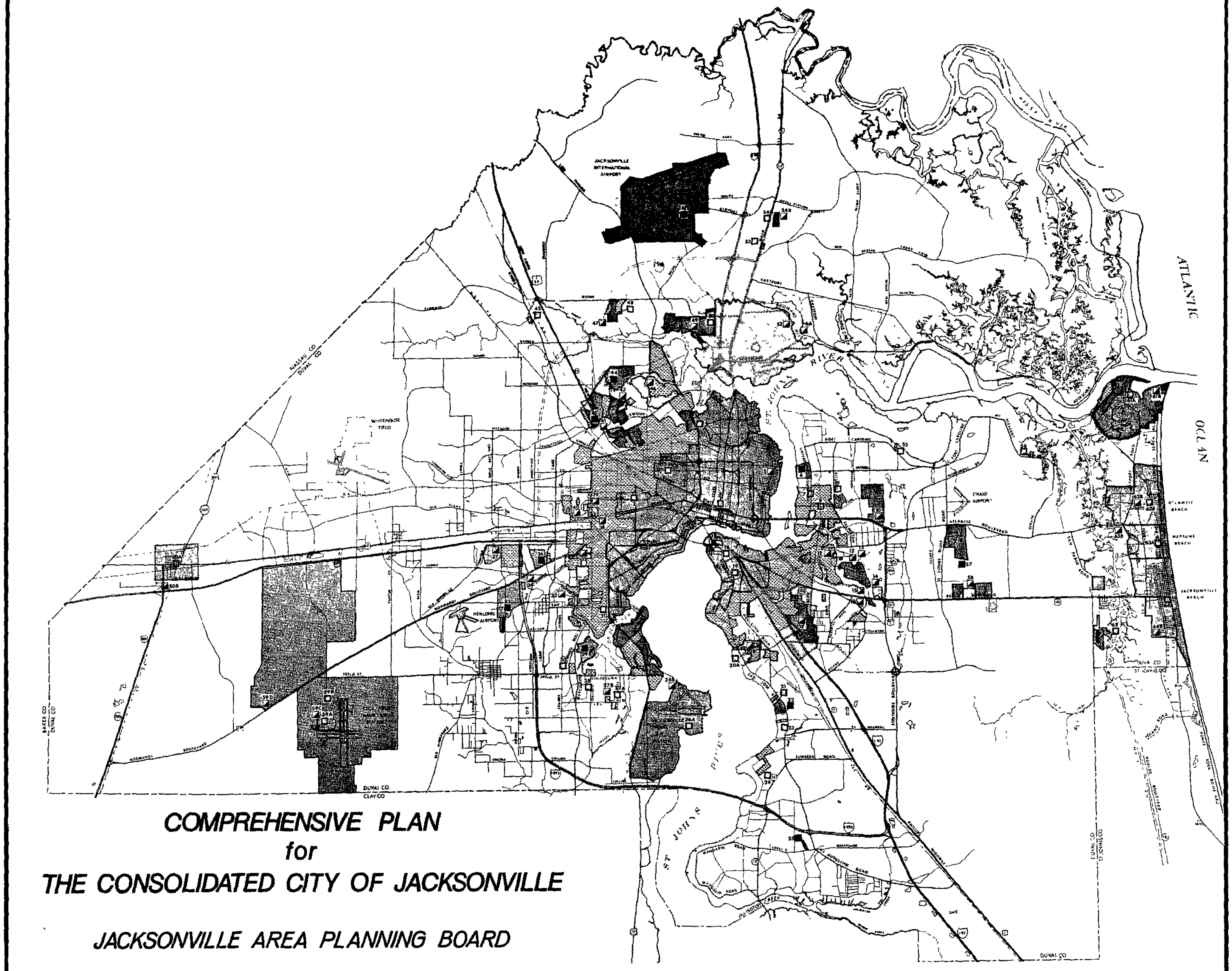
Wastewater collection and treatment is fragmented among several small private and public utility systems, package plants, and septic tanks. The private and public utility systems are shown on Figures 2-34 and 2-35. The septic tank service areas are shown on Figure 2-22.

The total average wastewater flow in the service area is now approximately 10 mgd. Just over 2 mgd is served by the existing city-owned treatment plants while about 5 mgd is served by private treatment plants. (See Tables 2-19 and 2-20.) The remainder of the flow is in the septic tank service areas. The study on infiltration and inflow prepared by the city has not yet been received by EPA. Conversations with the city's consultant indicate that an insignificant portion of this flow is caused by infiltration and inflow.

Peak flows to these facilities range between 2.5 and 4.0 times as great as the average flows. Generally, if a facility's average flow is greater than 1 mgd the peak is approximately 2.5 times as great, while an average flow of less than one usually means a peak flow approaching 4 times as great.

FIGURE 2-35

NON-PRIVATE WATER AND SEWER SERVICE AREAS

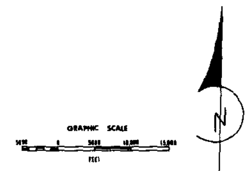


LEGEND

- 59 OR 59A — FACILITIES IDENTIFICATION NUMBER
- WATER PLANT
- SEWER PLANT
- WATER AND SEWER PLANTS
- WATER SERVICE AREA
- SEWER SERVICE AREA
- WATER AND SEWER SERVICE AREAS

NOTE SERVICE AREAS SHOWN ARE GENERALIZED AND ARE CONSIDERED TO BE PRELIMINARY IN NATURE TABULATIONAL FACILITIES BY FACILITY IDENTIFICATION NUMBERS ARE PRESENTED IN TEXT

SOURCE JACKSONVILLE DEPARTMENT OF PUBLIC WORKS



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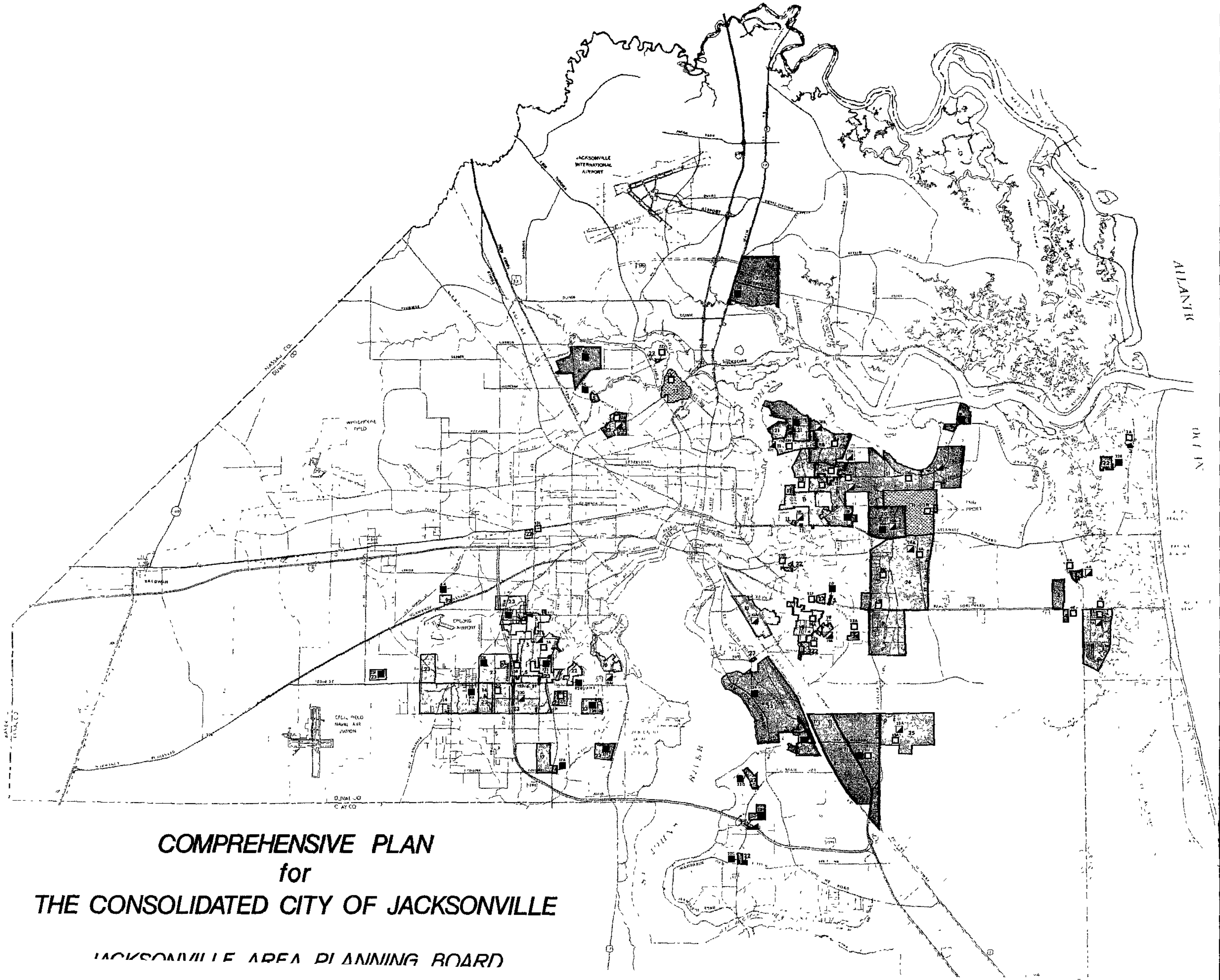


COMPREHENSIVE PLAN for THE CONSOLIDATED CITY OF JACKSONVILLE

JACKSONVILLE AREA PLANNING BOARD

FIGURE 2-34

PRIVATE WATER AND SEWER SERVICE AREAS

LEGEND

- 22 — SERVICE AREA IDENTIFICATION NUMBER
- 226 — FACILITIES IDENTIFICATION NUMBER
- WATER PLANT
- SEWER PLANT
- WATER AND SEWER PLANTS
- WATER SERVICE AREA
- SEWER SERVICE AREA
- WATER AND SEWER SERVICE AREAS

NOTES SERVICE AREAS SHOWN ARE GENERALIZED, AND ARE CONSIDERED TO BE PRELIMINARY IN NATURE TABULATIONAL FACILITIES BY FACILITY IDENTIFICATION NUMBERS ARE PRESENTED IN TEXT

SOURCE UTILITY REGULATORY BOARD

JUNE 1973

THE PREPARATION OF THIS MAP WAS FINANCIALLY AIDED THROUGH A FEDERAL GRANT FROM THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, UNDER THE URBAN PLANNING ASSISTANCE PROGRAM AUTHORIZED BY SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

Figure 3-1 shows the projected peak flows in the service area for the design year of 2002. The population forecasts discussed earlier in this chapter were used to develop these flow projections. The red lines denote the first priority for interceptor construction. These lines will connect the existing city-owned facilities with the proposed regional plant. This will improve water quality in the Arlington River system while allowing for continued commercial and residential development in that portion of the planning area. The existing privately owned systems, shown in green, will be added to the regional system as they are acquired by the city. Areas now being served with properly functioning septic tank systems will not be required to join the regional system.

No combined wastewater collection systems exist in the service area. The old residential neighborhoods in the northwestern section of the service area have the only extensive storm water collection systems.

b. Water Quality Planning and Regulations

In 1972, the Jacksonville Area Planning Board was awarded a grant by EPA to develop a Water Quality Management Plan (WQMP) for Jacksonville. The service area boundary for the Arlington East District was developed in the Plan. The WQMP was officially adopted by the Florida Pollution Control Board in October of 1974. At this time, the Florida Department of Pollution Control ruled that no new point source water pollution loads would be allowed to enter polluted streams. This order, in effect, banned the construction of new sewage treatment plants in the Arlington area unless effluent is retained on site or an outfall is constructed to the St. Johns River. The expansion of existing treatment plants is also prevented.

c. Potable Water Systems

All potable water in the Arlington area is supplied from groundwater either through private wells or public and semi-private water systems. These systems are shown on Figures 2-34 and 2-35 respectively. These service areas correspond closely with the currently urbanized portions of the service area.

In 1974, the water for the Jacksonville municipal system came from 92 wells in 11 well fields which produced an approximate average of 58 mgd. Four well fields with 13 wells now serve the Arlington area (See Table 2-28). The city also owns several smaller wells through the purchase of private systems in the area. An average of approximately 10 mgd of water is produced for use in the Arlington service area by the public and private systems.

TABLE 2-28

Major Municipal Well Fields
Located in the Arlington East Service Area

Name of Well Field	Number of Wells	Location of Field	Treatment
River Oaks	6	River Oaks Rd.	Chlorination and Aeration
Love Grove	2	Baker Street	Chlorination and Aeration
Arlington	3	Sprinkle Dr.	Chlorination and Aeration
Oak Ridge	2	Beachwood Blvd.	Chlorination and Aeration

Future plans call for the continued purchase of private water supply systems and the continued expansion of the municipal systems to serve newly developing areas. By 2002, virtually all of the Arlington East project area will be served by the municipal water systems. Water consumption will increase to approximately 27 mgd by the year 2002. The current well fields should be sufficient to supply this demand.

The city is currently in the process of revising its water rate structure. If it receives final approval from the Jacksonville City Council and EPA, the new rate structure as shown in Table 2-29 go into effect.

TABLE 2-29

Commodity Charge - For water used in excess of the minimum allowance		Rates per 100 cubic feet $
Monthly consumption		
First	300 cubic feet	Minimum Charge
Next	2,700 cubic feet	0.40
Next	47,000 cubic feet	0.36
Next	950,000 cubic feet	0.29
All over	1,000,000 cubic feet	0.22

Minimum Charge - For the first 300 cubic feet or less monthly

Meter Size inches	Monthly Charge
5/8	3.50
3/4	3.85
1	4.90
1-1/2	6.30
2	10.00
3	40.00
4	50.00
6	75.00
8	100.00
10	135.00
12	160.00
20	700.00

The existing rate structure is as shown in Table 2-30.

Monthly Consumption		Rates Per 100 Cu. Feet
First	800 cu. ft.	Minimum Charge
Next	4,200 cu. ft.	$0.25
Next	15,000 cu. ft.	0.22
Next	980,000 cu. ft.	0.18
All Over	1,000,000 cu. ft.	0.14

Minimum Charges
(For First 800 Cubic Feet or Less)

Meter Size Inches	Monthly Charge $	Meter Size Inches	Monthly Charge $
5/8	3.00	6	27.00
3/4	3.50	8	40.00
1	4.00	10	50.00
1-1/2	5.00	12	60.00
2	6.00	16	80.00
3	10.00	20	100.00
4	15.00		

7. Other Community Services and Facilities

a. Schools and Libraries

The service area now contains thirteen elementary schools, three junior high schools, and two senior high schools, on approximately 300 acres of land (see Figure 2-36). These schools have a capacity of about 8,700 elementary school students, 3,800 junior high school students, and 4,000 high school students.

Additional educational facilities include the Southside Campus of Florida Junior College, Jacksonville University and the University of North Florida.

There is now one branch of the public library in the service area. Located on Regency Square Boulevard, the facility occupies approximately one acre of land. This facility is now adequately servicing the area.

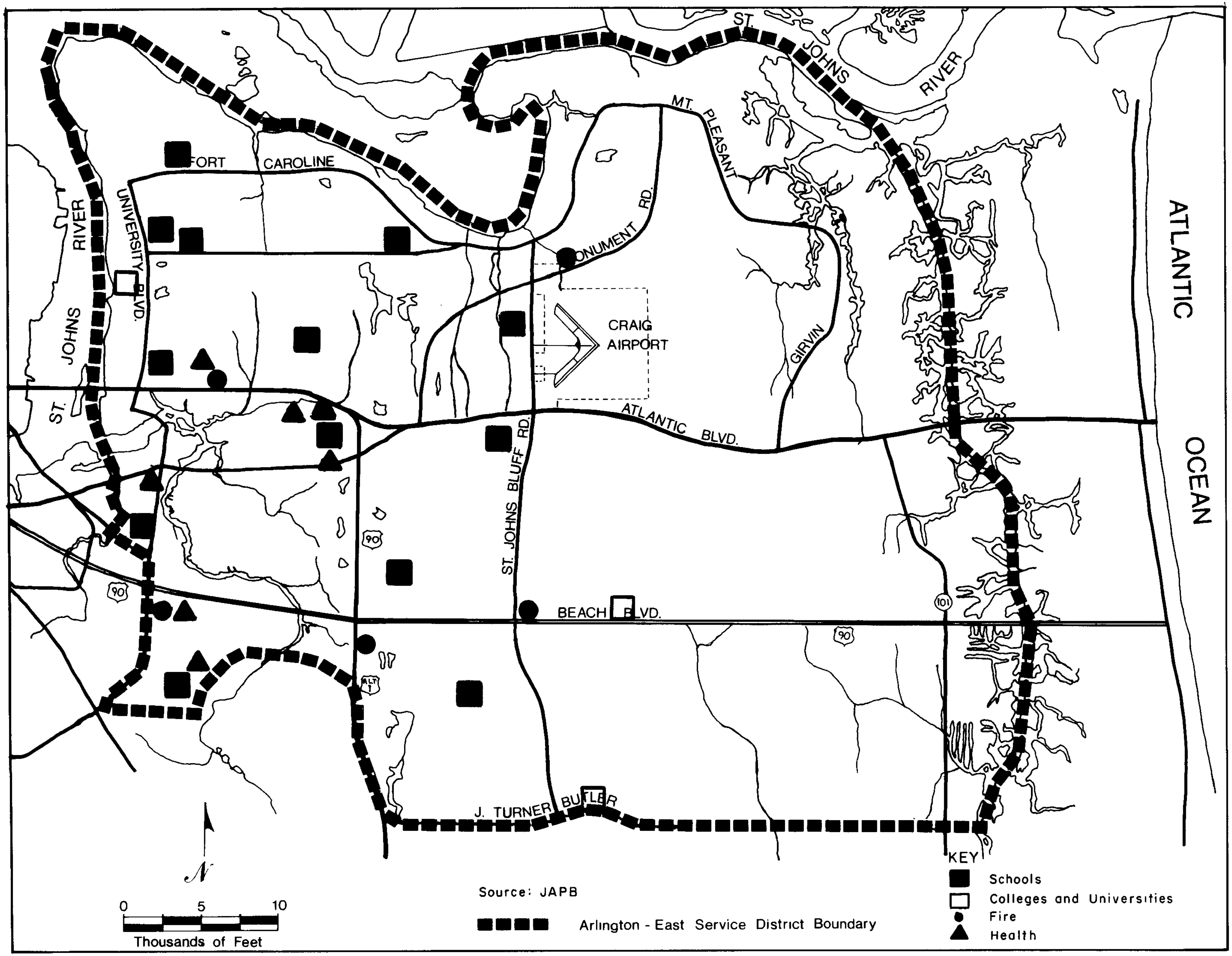


Figure 2-36 - Community Facilities in the Arlington - East Service District

b. Public Safety

Five fire stations are currently located in the service area. These are as follows:

Fire Station #	Location
19	Arlington Road
20	Beach at University Blvd
28	Southside Boulevard
29	St. Johns Bluff Road
27	Ft. Caroline Road

One additional station is currently needed to service the newly developed area around Regency Square.

Police services to the area are provided from the downtown police facility. There is no immediate need to provide any precinct stations in the service area.

c. Solid Waste

Solid waste in the service area has been disposed of at a sanitary landfill site south of Ft. Caroline Road. This site, however, is now full and another site, located between Girvin Road and Greenfield Creek, south of Singleton Road, has been selected by the Jacksonville Department of Public Works to service the area. The possibility of installing an incinerator to serve the area's long-term needs is also being investigated.

d. Health Facilities

Two public health clinics are currently operating in the service area. These are located on Arlington Road and on Jasper Avenue. Both of these facilities are currently overcrowded and need expansion. Three private health facilities are also present. These are Hope Haven Children's Hospital on Atlantic Boulevard, Southside Rest Home for the Aged on Atlantic Boulevard, and the Trowbridge Nursing Home on Jasper Avenue. The service area has two private hospitals. These are St. Johns River Hospital on

Beach Boulevard and Jacksonville Memorial Hospital on University Boulevard.

8. Taxes and Capital Budget

All of the community facilities and services discussed above are the basic responsibility of local government with the exception of state and Federal highways. The provision of these services and the collection of revenue to finance them are simplified in Jacksonville since the city and county governments have been consolidated. For this reason most locally provided services including water supply, wastewater treatment and disposal, public safety, public works, health and welfare, and libraries are provided by the single Consolidated City of Jacksonville. Only the schools are run by a totally independent agency, the Duval County School Board.

The Fiscal Year 1974-75 budget for Jacksonville totals $529.3 million. This money will be divided up among several funds. These funds are fiscal and accounting devices which are used to keep track of revenues and expenditures. The largest of these funds is the $88.6 million General Services District Fund. Expenditures for health and welfare, public safety, public works, recreational facilities and libraries, all come from this fund. The major sources of revenue for this fund are the following:

Ad Valorem Taxes	28.2%
Revenue Sharing	23.0%
Jacksonville Electric Authority	20.1%
Utility Service Tax (other than JEA)	17.5%
Charges for Services	6.0%
Gasoline Taxes	4.4%
Licenses and Permits	3.6%
Other Sources	12.0%
Interagency Transfers	- 14.8%
	100.0%

Money from three other funds is contributed to services which are discussed in this report. The Water Utility Fund contains 7.2 million dollars. The money from this fund comes from water charges and income on investments and goes to water service costs. The Sewer Utility Fund contains

6.2 million dollars. The money comes from sewer charges and goes to sewer service costs. The Sanitation Fund contains 8 million dollars. The money comes from disposal fees and contributions from other funds and provides solid waste collection and disposal.

The City's budget also contains 150 million dollars for the Duval County School Board. This money comes largely from ad valorem taxes, interagency transfers, and state and Federal funds.

Most of the state money coming into the City is used for education, welfare, and state roads. The major sources of money for the educational and welfare funds are the state sales tax and revenue from horse and greyhound racing and jai alai. State roads are paid for out of gasoline tax revenue, as are Federal roads. Other Federal money comes largely through the income tax. Most of this money is being spent as part of the general operating budget rather than being earmarked for specific projects.

9. Other Projects, Programs and Efforts

a. Federal

The Environmental Protection Agency (EPA, through the Federal Water Pollution Control Act Amendments of 1972, has authority to improve water quality by administering a program of grants for research, planning, engineering and construction of wastewater treatment facilities and their appurtenances. The Amendments also authorize EPA to establish the National Pollutant Discharge Elimination System, under which EPA establishes a permit system for the discharge of any pollutant into the waters of the United States.

Section 208 of the Amendments provides for the development of an areawide multifacet wastewater management plan in areas with complex point and non-point source wastewater problems. The 208 Plan will include controls for municipal and industrial point source waste systems, for pollution emanating from diffuse sources, for protection of the groundwater and for disposal of residual wastes. This program also includes the use of non-structural techniques, including the control of the use of land for water quality management. The initiation of a 208 planning program in the Jacksonville area is now under active consideration at both the local and Federal levels.

The EPA, through the mandate of the National Environmental Policy Act (NEPA) of 1969, is author of this environmental impact statement. NEPA provides that a detailed statement be prepared by the responsible official on major Federal actions significantly affecting the quality of the human environment. In the present context, the issuance of grant funds for construction of the proposed project is considered a significant Federal action.

Through section (300) of Public Law 86-660, EPA can provide fifty percent of the project monies for the preparation of Water Quality Management Plans (WQMP). The purpose of the plans is to foster the achievement and maintenance of water quality standards by developing the most cost effective Regional Water and Sewer Plan. In early 1972, the Jacksonville Area Planning Board was awarded a grant by EPA to develop a WQMP for Jacksonville. The service area boundary for the Arlington-East area was developed in the WQMP.

The Jacksonville District of the Corp of Engineers has permitting responsibility for any construction activity in the St. John's River pursuant to Section 10 of the River and Harbor Act of 1899 (33 U.S.C. 403) and Section 404(b) of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1344).

A COE permit based upon this authority will be required for the outfall line from the proposed waste treatment plant into the St. John's River.

Other COE activities related to this project are the continuing use of Quarantine Island for fill operations, the proposed channeling of Mill Cove, and the Blount Island Development project. It is necessary that the outfall from the proposed project be constructed so it will have no significant adverse impact upon these projects as well as safe navigation and proper flow in the St. John's River.

The COE is also now in the process of beginning an urban study in the Jacksonville area. This three-year study will involve analysis of hydrology, water supply, flood control, flood plain management, and urban runoff. The major objective of the study is to develop recommendations to improve drainage patterns in the area. The Arlington River drainage basin is one of six major water sheds which will receive significant attention in this study.

b. State

A reorganization of state environmental agencies was adopted by the 1975 session of the Florida State Legislature. Effective July 1, 1975, the legislation consolidated various state environmental responsibilities into two major agencies - the Department of Environmental Regulations (DER) and the Department of Natural Resources (DNR).

The Department of Environmental Regulations will be responsible for the enforcement of Florida's currently existing pollution control and environmental laws and regulations. All state environmental permitting authority, including that needed by the City of Jacksonville to construct this project, will be centered in this department.

The Department will be organized into three divisions. The Division of Environmental Permitting, including duties and programs relating to power plant certification, processing of permits, licenses, certificates and exemptions, enforcement and supervision of district operations. The Division of Environmental Programs includes administration and coordination responsibilities and supervision of programs relating to planning, grants, air quality, water quality and quantity, noise and solid waste management. The Division of Administrative Services include personnel, fiscal, purchasing, education and information activities.

Five environmental districts are being established by the DER. Processing of applications for most permits, licenses, certificates and exemptions will be accomplished at the district level centers as well as related field services and inspection activities.

Incorporated into the new agency will be the current responsibilities and duties of:

- Department of Pollution Control (except for regulation of open burning in connection with rural land clearing, agriculture and forestry operations which was transferred to the Department of Agriculture).

- Bureau of Sanitary Engineering of the Florida Department of Health and Rehabilitative Services (except for responsibilities relating to interstate common carrier water facilities, public swimming pools and bathing areas and the regulation of shellfish). Provisions were also made for interagency agreements with the Division of Health or County Health units for delegating permitting, monitoring, serveillance and enforcement, where applicable, with respect to public water supply and sewage treatment and disposal facilities.

- Board of Trustees of the Internal Improvement Trust Fund relating to the issuance of permits, certificates, licenses and exemptions, and enforcement activities.

- Bureau of Water Resources of the Department of Natural Resources as well as all DNR duties and activities relating to permits, licenses and exemptions under Chapter 253 F.S. and duties relating to water management under Chapter 373 F.S. (Water Management Districts) and Chapter 298 F.S. (Drainage and Water Management).

- Division of State Planning which relate to the development of data for the environmental quality portions of the State Comprehensive Plan.

The Division of Natural Resources will maintain most of its existing function except for its permitting authority. These include programs in land management, marine resources, and beaches and shores protection. Duties and responsibilities of the Board of Trustees of the Internal Improvement Trust Fund that were not assigned to DER were transferred to the Department of Natural Resources as were duties of the Coastal Coordinating Council and the sea resources section of the Bureau of Sanitary Engineers.

The DNR will also have the power to review and approve the Florida Game and Fresh Water Fish Commission (FGFWFC) budget, however, the FGFWFC will otherwise remain a separate entity.

c. Regional

The Jacksonville Area Planning Board is the regional planning authority for the project area. The Board also has responsibility in the area for the Coastal Zone Management Program. The Board has approved the proposed project as consistent with regional planning objectives. Further, if a 208 study is undertaken in Jacksonville, the Jacksonville Area Planning Board will be the designated planning agency for the project.

d. Local

In October 1973, the Bio-Environmental Services Division of the Jacksonville Department of Health, Welfare and Bio-Environmental Services was officialy designated to be a recognized local program by the Florida Department of Pollution Control. As such, the Water Pollution Control Activity Section of Bio-Environmental Services became the local agent for processing Construction and Operation Permits for water pollution sources.

Application to construct or operate a water pollution source or applications to construct sewage collection/transmission systems for projects in Duval County are now filed with the local program. If a thorough engineering review indicates proposed construction is acceptable, and if plants are meeting standards, permits are made and forwarded to the Northeast Regional Office of the Florida Department of Environmental Regulations (formerly the Florida Department of Pollution Control).

The local agency maintains a continuous update of loadings on all treatment plants, both from data obtained from monthly reports and from data provided by approved collection systems. No further connections are allowed to plants when they become loaded or when they are not meeting standards.

As part of the Water Quality Management Plan described under EPA programs, present waste loadings were calculated for all streams in Duval County and based upon a computer model, reduced allocations through improved treatment were figured for each source. When all sources meet new, reduced waste-loading allocations, the waterways of Duval County will meet water quality standards. No provision was made for adding new sources to streams since all future development was projected to be served by the regional system.

New waste-load allocations assigned to existing sources are now tied to the NPDES permit program. All sources are required to obtain their Federal permits and the permits will require sources to upgrade to the new wasteload allocations by 1977 or discharge into the Regional System.

In February of 1974, the Florida DPC and Bio-Environmental Services began requiring all proposed new water pollution sources to design for treatment levels required for existing sources in 1977. These new requirements increased BOD reduction beyond the 95% levels, and called for nitrification in order to reduce the ultimate oxygen demand on the receiving stream. An alternative to plant nitrification was allowed if plant effluent was retained on site for at least 20 days.

In October 1974, the Florida Pollution Control Board formally adopted the Jacksonville Area Water Quality Management Plan. Full water quality standards were implemented for Duval County and the Florida DPC indicated that no new point source water pollution loads would be allowed to enter polluted streams. Since virtually all of the streams in Duval are polluted, including those in the Arlington service area, no new sewage treatment plants can now be approved unless effluent is retained on site or an outfall is constructed to the St. John's River. These regulations also prevent expansion of existing sewage treatment plants.

Since most municipal and private utility treatment plants are at capacity and since construction of new or expanded plants is limited by water quality standards, many areas of Jacksonville, including the Arlington service area, are facing a virtual moratorium on building. Since private utilities cannot expand their plants and thereby increase their revenue base, they are reluctant to upgrade plants to meet 1977 NPDES permit conditions. Thus, the growth rate in some sections of the city may be significantly decreased until the regional treatment system is completed.

The Bio-Environmental Service Division is also the local agency responsible for air pollution activities (see Air Quality Section of Chapter II). The Air Pollution Control Activity Section was created to deal with air pollution problems in Jacksonville. The local agency is placing increased emphasis on the proper maintenance of control equipment. Since March 1973, fourteen notices to correct have been issued for the failure to maintain pollution control equipment. In late 1963, the local agency assumed responsibility for the administration of the state permit system. An engineering review of each permit application is made to check its compliance with all rules and regulations before a permit is issued. All new sources are also reviewed to insure compliance with EPA new source performance standards or the local best technology rule before a construction permit is granted.

The future emphasis of the agency will be to maintain the improved air quality obtained by the State Implementation Plan through enforcement of the maintenance of control equipment rule, and the implementation of the AQMA Plan.

Jacksonville's noise and odor control programs are also the responsibility of the Bio-Environmental Services Division. These programs are discussed in the Noise and Odor Sections of Chapter II.

C. Sensitive Areas

1. Sensitive Natural Areas

Areas within or adjacent to the service district known to perform a critical environmental function and which have been proven to be relatively intolerant to man's modification are considered to be sensitive natural areas (Figure 2-37).

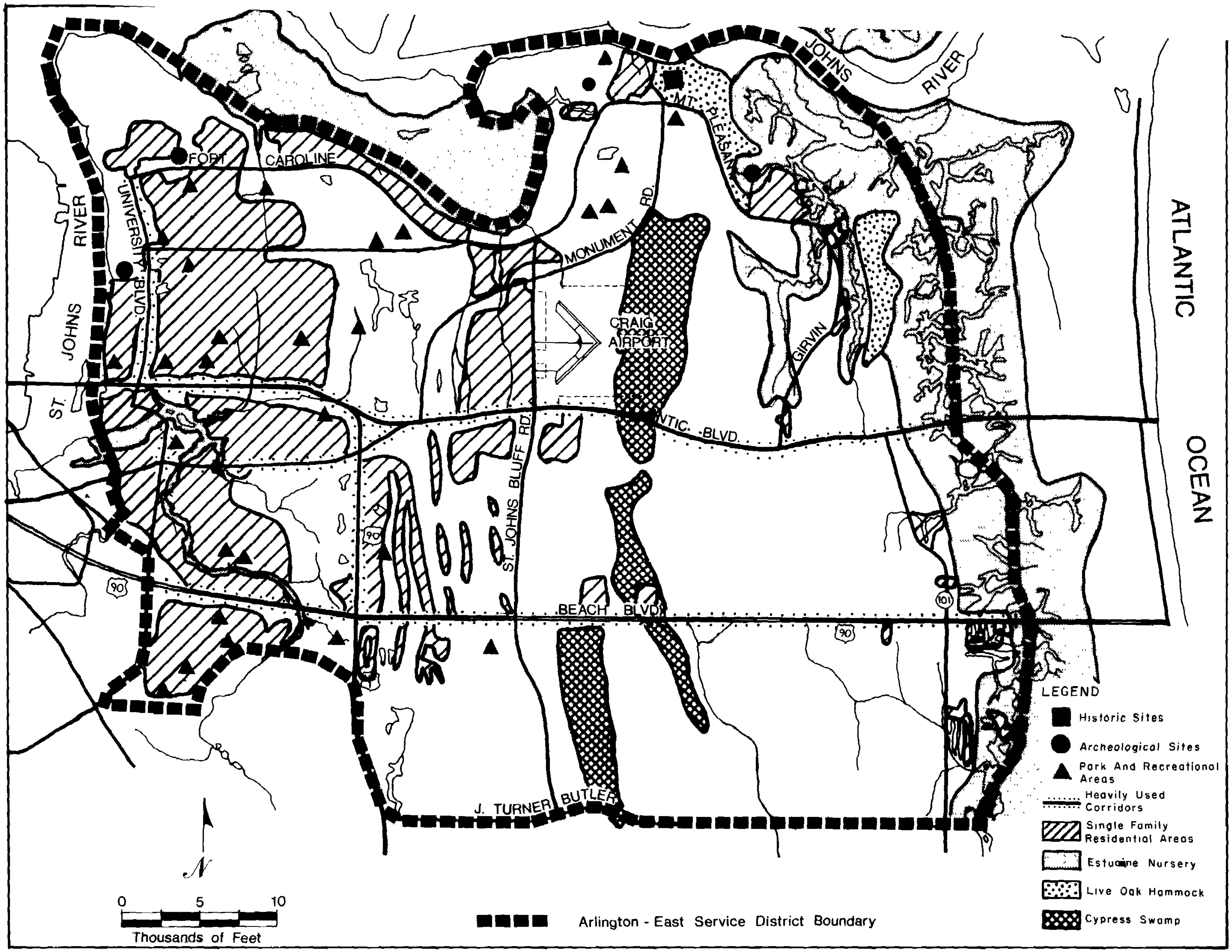


FIGURE 2-37
SENSITIVE AREAS

a. Cypress Swamp East of Craig Field, and similar freshwater hardwood swamp areas lying between the "finger ridges" east and south of Cedar Swamp. They drain higher flatwoods and retain nutrients and moisture.

b. Estuarine Salt Marsh Particularly those around Mill Cove, Chicopit Bay, and along both sides of the Intracoastal Waterway. Low marsh areas, type 18, usually vegetated by *Spartina alterniflora*, are extremely valuable. High marsh, type 17, where *Juncus roemerianus* dominates the vegetation, is similarly valuable to the estuary.

c. Hammock Areas Surrounding Fort Caroline Park The magnificant stands of old live oak trees and the 60-80 foot high bluffs overlooking the St. Johns River constitute a unique natural area within the service district.

d. Big and Little Pottsburg Creeks These tributaries are unable to assimilate the excessive amounts of waste they presently receive. Brackish creeks are sought by numerous juvenile marine species seeking food and cover.

2. Sensitive Man-made Areas

The sensitive man-made areas in the Arlington-East District are shown on Figure 2-37. These areas are as follows:

a. Historical and Archeological Sites

Once destroyed, historical and archeological resources cannot be renewed. If the limited sites still in existence are not protected, we are in danger of losing the unique scientific, aesthetic, and recreational benefits which they can provide.

b. Recreational Sites

In a rapidly urbanizing area such as Arlington, land which can be used by the general public for outdoor recreational activity becomes more limited every day. Thus, it is necessary to protect existing facilities as well as develop new ones if future generations are to enjoy the benefits of parklands and other outdoor recreational facilities.

c. Single-family Residential Communities

The attractiveness of single-family residential communities is largely dependent upon the degree of impact of many aspects of the urban environment such as traffic congestion, noise, odor, and crime. This attractiveness becomes more difficult to maintain as the urban environment expands to include existing residential communities. An effective, comprehensive planning process is needed to maintain existing community character while, at the same time, providing for the expanded needs of the region as a whole.

d. Heavily Used Traffic Corridors

The functioning of a modern urban community is dependent upon the proper operation of its transportation facilities for the movement of goods, services, and people. It is essential for the economic well-being of the community and for the expeditious movement of local citizens that suitable transportation facilities be constructed and maintained.

III Alternatives

A. General

This chapter on Alternatives contains a systematic development of all feasible alternatives for the attainment of the project objectives and a rational comparison of these alternatives leading to the selection of one over the others. Much general information included in this chapter of the EIS has been excerpted from The Water Quality Management Plan for Duval County, Florida and the Environmental Assessment Statement for the Arlington-East Service District. The development and evaluation of the alternative systems has been performed independently.

B. Development of Viable Subsystem Alternatives

The development of feasible alternative systems is divided into four major steps. First, major subsystems and possible subsystems alternatives have been identified. Secondly, the objectives of the project are examined and subsequent alternatives incapable of meeting the objectives have been eliminated. Thirdly, identified constraints to these alternatives have been applied to reduce the number of subsystems considered. Finally, the remaining subsystems' interactions have been evaluated to further limit feasible alternatives.

Possible subsystems to reach project objectives include both structural as well as non-structural measures. Structural measures include all facilities constructed.

Non-structural measures include all other efforts which can be taken to approach the project's objectives.

1. Non-Structural Alternatives

a) Waste Management Systems

The two basic types of waste management systems are regional and non-regional. A regional system brings all, or most of, the service area's wastes into one centralized location for treatment and disposal. A non-regional system decentralizes waste treatment and disposal among a variety of public and private facilities throughout the service area.

The construction of a regional system in the Arlington-East service area would obtain the project objective of removing all discharges from the polluted tributaries of the St. Johns River. This type of system would also provide maximum operational efficiency. Only a small number of trained plant operators would be required and monitoring of plant operations could be easily accomplished.

A non-regional system in Arlington East could not remove all discharges from the tributary streams. It would require many more plant operators, would be much harder to monitor, and would be hard-pressed to meet shock episodes. For these reasons, the development of a non-regional system would not successfully obtain the objectives of this project.

b) Land Use Development Controls and Management Practices

Land use and development controls are the tools through which a community's development policy is carried out. In Jacksonville, a zoning ordinance and a subdivision regulation ordinance are the major tools used to guide development into the form recommended in the Comprehensive Development Plan.

Since the first phase of the project is designed to serve existing needs, land use controls would not influence the attainment of project objectives. These tools could, however, affect future growth in the area, and accordingly affect future production of wastewater.

If the regional system is constructed, water quality will not act as a constraint to land use decisions made by the local government. These land use decisions cannot be dictated by this impact statement and can change as new officials are elected to office. For these reasons, land use controls are not considered as part of the solution to projected wastewater treatment needs assuming regionalization is implemented.

If the regional system is not constructed, water quality constraints will limit development in the area. State water quality regulations and local septic tank restrictions would limit potential growth in the area. In this case, land use controls must be used to allocate the use of the limited land which could be put into development. In this case, a limited growth policy in the Arlington area alone would simply channel this potential growth into developments in other areas of the city which might not be as appropriate for urban growth (e.g., areas north of the St. Johns River designated for conservation and preservation and areas in the southern and western ends of the city which are farther from employment centers).

The regional system as proposed is based upon the growth forecasts in the Comprehensive Development Plan for the Consolidated City of Jacksonville, 1990 with population projections extended from that report to the year 2002. The proposed regional system will obtain project objectives if development in the service area proceeds as this plan forecasts.

The continuance of a non-regional system would require an extensive reduction in the growth forecasts by the Comprehensive Plan to conform to water quality and septic tank restrictions. If this occurs, a much more extensive use of land use controls will be required to help limit and allocate growth.

c) Wastewater Generation Reductions

A household of four persons will use an average of 255 gallons per day (gpd) with toilet flushing being the major element at 100 gpd. A number of devices both for initial installation and/or for later modification are available to reduce domestic water use, with the greatest potential savings in the toilet flushing area. It is estimated that a savings of 10 gpd can be realized by a broad program of installing water saving devices.

While this savings would be significant, it would not negate the need for additional structural treatment facilities. The possible decrease of 1 mgd of flow with no decrease in BOD would still leave a significant need for additional treatment facilities. It is also important to note that these devices have not yet been technically perfected. In many cases, two flushes may be required which negates the water savings and may actually increase the total wastewater generated.

d) Water and Sewer Rate Structure Alterations

Numerous studies have revealed that people are more careful in their use of water when they know that they will have to pay by the amount used (metering as against flat rates). Studies also indicate that increases in rates for excess water use over what is considered essential use can lead to a proportional reduction in water consumption.

Jacksonville currently uses a metering system with a descending rate structure (i.e., as total use increases, the price per cubic foot of water used decreases). A proposed increase in water and sewer rates is currently under consideration. This proposal would maintain a descending rate structure. This increase should encourage people to conserve. A change to an increasing rate structure (i.e., as total use increases, the price per cubic foot increases) could lead to additional savings of water. This savings, however, would be largely felt in "non-essential" outdoor uses such as watering lawns and car washing, and, as such, would not be related to the waste water system. Therefore, this type of restructuring would not significantly help in obtaining project objectives.

e) Project Phasing

The project's phasing is the division of its construction schedule into different time periods based upon a study of current and projected needs. The first two phases of the Arlington-East project are the construction of a 10 mgd wastewater treatment plant and an interceptor system to serve areas now served by small city owned plants. These phases are scheduled for immediate construction to service existing needs. The next phases of the project consist of purchasing existing private systems, extending interceptors to nearby developing areas, and expanding the plant to 25 mgd. The need for plant expansion is based upon the population projections of the JAPB. These projections are based to a significant extent on the completion of the Dame Point Bridge and the development of Blount Island. If these development do not occur as expected, and population does not grow as projected, the latter phases of the project can be delayed or cancelled, giving flexibility to the proposed project.

2. Structural Subsystems

The structural subsystems to be evaluated include a) treated effluent disposal, b) plant locations and interceptor alignments, c) treatment processes, d) sludge treatment and disposal, and e) odor and f) noise control.

a) Treated Effluent Disposal

There are six major alternatives for disposing treated effluent. These include reuse, soil systems, well injection, ocean outfall, estuarine outfall, and river outfall.

1) Direct Reuse

The reuse of wastewater effluent has many advantages, including saving a valuable resource and solving the effluent disposal problem. In the Jacksonville area, wastewater could potentially be directly reused as public water supplies and for industrial process water, cooling water, and steam generation.

At present, neither the public nor EPA is encouraging the direct reuse of treated wastewater effluent for drinking water supplies. Major areas of concern regarding this alternative include failsafe control of viruses and inorganic solids (heavy metals, etc.) It is EPA's opinion that direct reuse of wastewater for drinking water supplies in the Jacksonville area at this time is not a viable alternative.

Reuse as an influent water for cooling purposes, process water, or steam generation is a desirable additional use of a resource where the saving of a more valuable resource may be realized for a reasonable cost. Certainly, each gallon of water that is used by an industry that otherwise would have to be pumped from the Floridan aquifer is one gallon available for an alternative use.

Excluding transportation costs, the cost of reclaiming wastewater for industrial reuse should be in the range of 25 to 30¢ per 1,000 gallons. This cost is approaching the cost for effluent treatment and disposal for certain facilities, particularly the major pulp and paper industries in Jacksonville. However, the Arlington-East service area is isolated from any major industrial water users, and the potential benefits from reuse in this area cannot be realized without excessive costs in transporting the wastewater to the facilities.

2) Soil Systems

Utilization of local soil systems is to be considered as an economical, environmentally sound, and mutually beneficial means of disposing of septic tank discharge and/or treated effluent. To be favorably considered in this regard, the soils to be utilized must possess proper physical, chemical, and drainage characteristics, as well as adequate areal distribution.

(a) Septic tanks

The most common septic tank system combines the tank itself with a soil leaching or absorption field which receives the overflowing liquid wastes from the tank after a period of detention. About half of the particulate solids in the sewage settle out and are retained in the septic tank. The liquid portion of the waste, plus non-settleable solids, overflow the tank into an underground perforated pipe network which distributes the wastes over a large soil area by allowing percolation into the soil and ultimate entry into the groundwater regime.

Under controlled circumstances, septic tank systems have a place in Jacksonville's wastewater disposal program. There are specific locations within the county where these systems have been functioning satisfactorily for years without a public health or water pollution problem. These areas are characterized by large lot sizes, sandy soils, and a water table deeper than three feet below ground surface. Figure 2-22 shows the largest concentration of these satisfactorily functioning areas to be located in the western half of the Arlington-East Service District. The remainder of the Service District is characterized by poorly drained soils including stream flood plains and extensive marshlands that cannot support septic tank systems (refer to Figure 2-10 and Table 2-9).

The soil and drainage constraints in the Arlington-East area preclude the choice of septic tank sewage disposal techniques as a viable alternative for some new residential construction. However, in the county as a whole, septic tank disposal systems will be used extensively to service at least a portion of new single family housing during the next 30 years. In the county, and in Arlington-East, new septic tank permits for residential and commercial installations should continue to be issued if technical and legal guidelines are satisfied and if connecting to a conventional sewage treatment system is not feasible.

(b) Land spreading

In Duval County, effluent disposal through land spreading has been evaluated for the purposes of groundwater recharge and crop irrigation.

Large quantities of secondary treated effluent are being used in other areas of the county for groundwater recharge. Moreover, long-term monitoring of water quality effects on the receiving groundwater aquifers has verified the safe public health aspects of these operations.

Wastewater spreading in shallow basins is usually carried out in an intermittent wetting and drying cycle; that is, a string of basins will be supplied with effluent for three to five days, then dried for fifteen to twenty days. At the start of the wetting cycle, the groundwater table should be at least 25 to 30 feet below the bottom of the spreading basins. Such a series of shallow basins could be constructed in much of the undeveloped land surrounding the urban centers of Duval County. However, since almost all of the county is underlain by a groundwater table less than five feet from the surface, operational problems would undoubtedly occur in a very short period of time and would probably result in stagnant ponds of sewage effluent. This is not to say that land treatment in Duval County is impossible. Studies have shown that if the effluent were piped to remote areas of the county and spread on extraordinarily large tracts of land, effective treatment could result. The costs for such a scheme are prohibitively high, however, and one of the prime purposes of the operation--that of groundwater recharge--cannot be effectively accomplished in Duval County by such means in any case since the shallow aquifer in this area does not recharge the Floridan aquifer. Large scale land spreading of effluent for the purpose of groundwater recharge has thus been shown not to be a feasible alternative in the county, and certainly, in the Arlington area.

Another variation of land spreading is crop irrigation through the use of sewage effluent. Common irrigation practices are used, but the land area required is invariably large due to necessarily large unit loadings. As in shallow basin spreading, the main process of wastewater renovation is the chemical, biological, and physical interactions with the soil.

The utilization of sewage effluent for crop irrigation requires that the system be located in a geographical area where year-round crops can be grown. If there is a dormant season, as in north Florida, the waste must be stored or disposed of elsewhere. Moreover, the land requirements necessary to make irrigation function in northern Florida's relatively wet climate are impractical since about 160 acres of irrigated land would be required for one million gallons per day of effluent. Further, the physical problems to be encountered are much the same as described for shallow basin effluent spreading.

These factors, combined with the fact that there are no irrigated agricultural lands under cultivation in Duval County (and, therefore, no need for irrigation waters), render land spreading for crop irrigation a non-viable alternative in Arlington and in the county as a whole.

3) Well Injection

(a) Deep Well Injection

Subsurface injection of partially treated wastes into saline aquifers is considered by many governmental agencies and private groups as an attractive alternative for final disposal. To ensure protection against pollution and other environmental damage, the EPA has established a policy on subsurface emplacement of fluids by well injection which, in general, provides for protection of the subsurface environment by proper design, testing, and monitoring of deep well injection systems and by plugging and abandoning such systems if they fail or when new or better techniques for fluid disposal are developed.

A prime consideration in subsurface waste disposal is to ensure that the injected waste will not pollute potable water supplies or damage other subsurface resources. This is largely a function of local geology; idealy, there should be a permeable zone containing saline water below the fresh water aquifer, and the two must be separated by relatively impermeable confining layers to prevent the upward movement of injected waste into the overlying fresh water supplies. Inspection of logs from three deep wells in the Jacksonville area indicates that geologic and hydrologic conditions may be favorable to deep well liquid injection systems. Here the Floridan aquifer extends to about 2,100 feet below mean sea level and is separated from 400 to 500 feet of probably permeable beds of limestone and dolomite by about 1,000 feet of relatively impermeable gypsum, anhydrite, and dolomite beds. Another permeable zone consisting of basal calcareous sandstone beds lies between 3,700 and 4,500 feet below mean sea level.

Determining the feasibility of a deep liquid waste disposal system in Duval County would involve drilling a test well into these deep zones and conducting injection quantity tests. Additional wells would then have to be drilled into the injection zone and into the overlying Floridan aquifer to monitor the movement of effluent.

Previous experience in Florida indicates that 5 to 10 mgd per well can be injected into limestone and dolomite strata. Emplacement of secondary treated wastewaters through wells into the limestone and dolomite strata below the Floridan aquifer must thus be considered a potential viable disposal alternative in Jacksonville. Three basic areas of concern, however, remain to be adequately addressed:

1) that such waste emplacement is physically possible on a long-term basis,
2) that it will not interfere with present or potential use of the Floridan aquifer, and
3) that it is the best waste disposal alternative in terms of overall environmental protection.

Based on the present available technology, lack of adequate knowledge of the local geohydrologic regime, and economic advantages of other wastewater effluent disposal methods, deep well injection is considered non-viable for immediate and large-scale applications in Duval County.

(b) Shallow Well Injection

The shallow water aquifer underlying Duval County consists of thin limestone, shell, and sand beds separated from the Floridan aquifer by the relatively impermeable Hawthorne Formation. Nowhere in the project area are these beds of sufficient thickness to allow consideration for large-scale shallow well injection of effluent. In addition, the morphology of the shallow water aquifer would undoubtedly allow injected wastewaters to move without benefit of adequate filtration. Thus, such wastewater could be withdrawn with little change in quality by domestic supply wells using the aquifer. Even if the local geology were favorable for shallow well injection, a higher level of treatment than is now proposed would be needed for the protection of the shallow aquifer as a potable water supply. For these reasons, shallow well injection of effluent is not considered viable for immediate or large scale applications in the project area.

4) Surface Water Outfalls

Two basic methods of disposal by dilution in surface waters have been examined in the Jacksonville area. These alternatives are ocean disposal and discharge to local estuarine waters.

(a) Ocean Disposal

Discharge of liquid wastes to the ocean is one of the most obvious means of disposal available to a coastal area. It is accomplished by submarine outfalls that consist of a section of pipe to transport the effluent some distance from the shore and a diffuser section to insure adequate dilution with seawater.

In the Jacksonville area, some of the disadvantages of waste disposal into inland waterways would be overcome by the use of ocean outfalls at the expense of the ocean environment. The primary environmental constraints to this alternative are the adverse impacts attendant to pipeline construction in estuarine and littoral waters. The overriding constraint, however, which eliminates ocean disposal from consideration for immediate local application is costs. For the Arlington-East plant, these costs remain prohibitive even when ocean disposal is considered in combination with other regional treatment plants.

(b) Disposal To Local Estuarine Waters

In Duval County there are two main classes of available receiving waters--the St. Johns River and the streams tributary to it.

Discharge to the Tributaries - For purposes of this discussion, the tributaries include all local surface waterways other than the main stream of the St. Johns River, including the Intracoastal Waterway. As noted in Chapter II, the drainage areas of these streams are small; fresh water inflow during dry weather is quite limited; gradients are flat; and tidal action is prevalent. Notwithstanding these constraints, it is not impossible to continue discharging wastewater effluent to the tributaries provided that many of the existing systems are expanded and upgraded.

Certainly the only method of tributary disposal in Arlington and in the county as a whole, which can be at all considered, would be that from a decentralized treatment plan. However, tributary disposal puts the effluent close to urban areas, hence the reliability of treatment must weigh heavily in the consideration of this alternative. An additional and very significant adverse effect of promoting a decentralized treatment scheme is the perpetration of a large number of separate point sources of waste disposal with attendant monitoring and enforcement hardships. Finally, such a system requires a heavy investment in treatment facilities and associated operation and maintenance costs. For these reasons, effluent discharge to the tributaries is considered a non-viable alternative in the project area.

Discharge to the St. Johns River - Effluent discharge to the St. Johns River is the only acceptable method of estuarine disposal available to regional treatment plants in Jacksonville. The river's flushing dynamics, as described in Chapter II, are extremely complex. In general, however, it may be said that:

(1) About 10 percent of the outflow of the St. Johns River is returned to the river system during successive tidal reversals.

(2) The dynamics of ebb and flood tidal periods could result in liquid wastes discharged to the river being delayed in their passage to the ocean. However, the tremendous dilution volumes available within the Duval County reach of the river act to suppress adverse dissolved oxygen reactions from organic loadings.

(3) The existing benthic demand in combination with periodic input of storm water pollutants creates an oxygen demand far in excess of the BOD of projected wastewater from secondary treatment.

Disposal of wastewater from the Arlington-East plant to the St. Johns River would result in a substantial improvement of the water quality in the tributaries of the Service District. In addition, the Water Quality Management Plan has demonstrated that organic waste loads surpassing those expected by the year 2002 can be assimilated by the St. Johns River without violation of current stream water quality standards and meeting prevailing effluent criteria. Moreover, secondary treatment and St. Johns River discharge has been determined to be by far the most cost-effective of all the fundamental treatment/disposal options evaluated by the WQMP. Consequently, this alternative is considered the most viable for immediate local application.

b. Plant Locations and Interceptor Alignments

Twelve alternative sites and interceptor systems have been identified in the Arlington-East Area as potential wastewater treatment plant sites. These sites and systems are shown individually on Figures 3-1 through 3-11 with the exception of Alternative 12 for which graphics are not available. Figure 3-12 shows the locations of all alternative plant sites collectively.

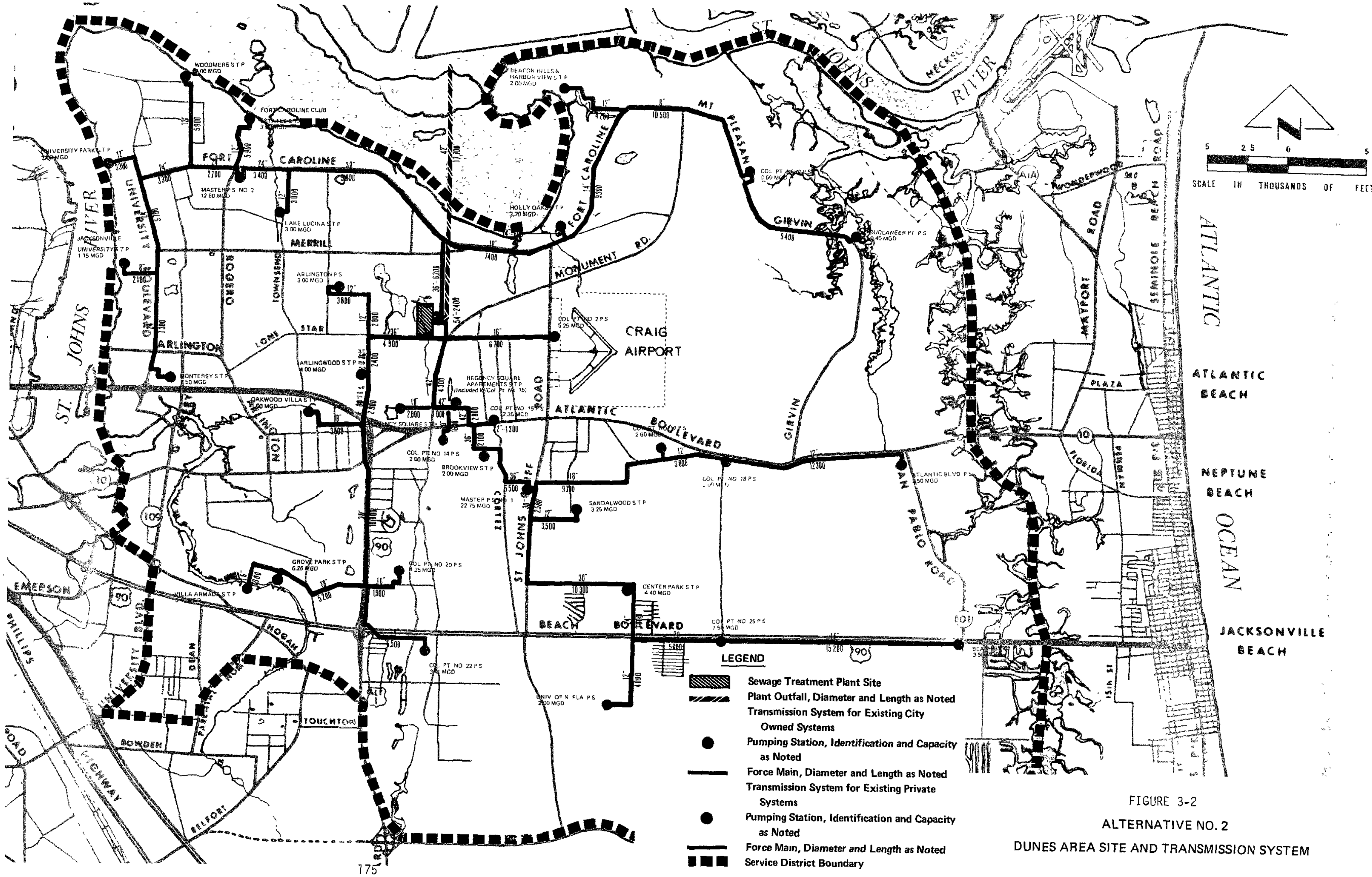


FIGURE 3-2

ALTERNATIVE NO. 2

DUNES AREA SITE AND TRANSMISSION SYSTEM

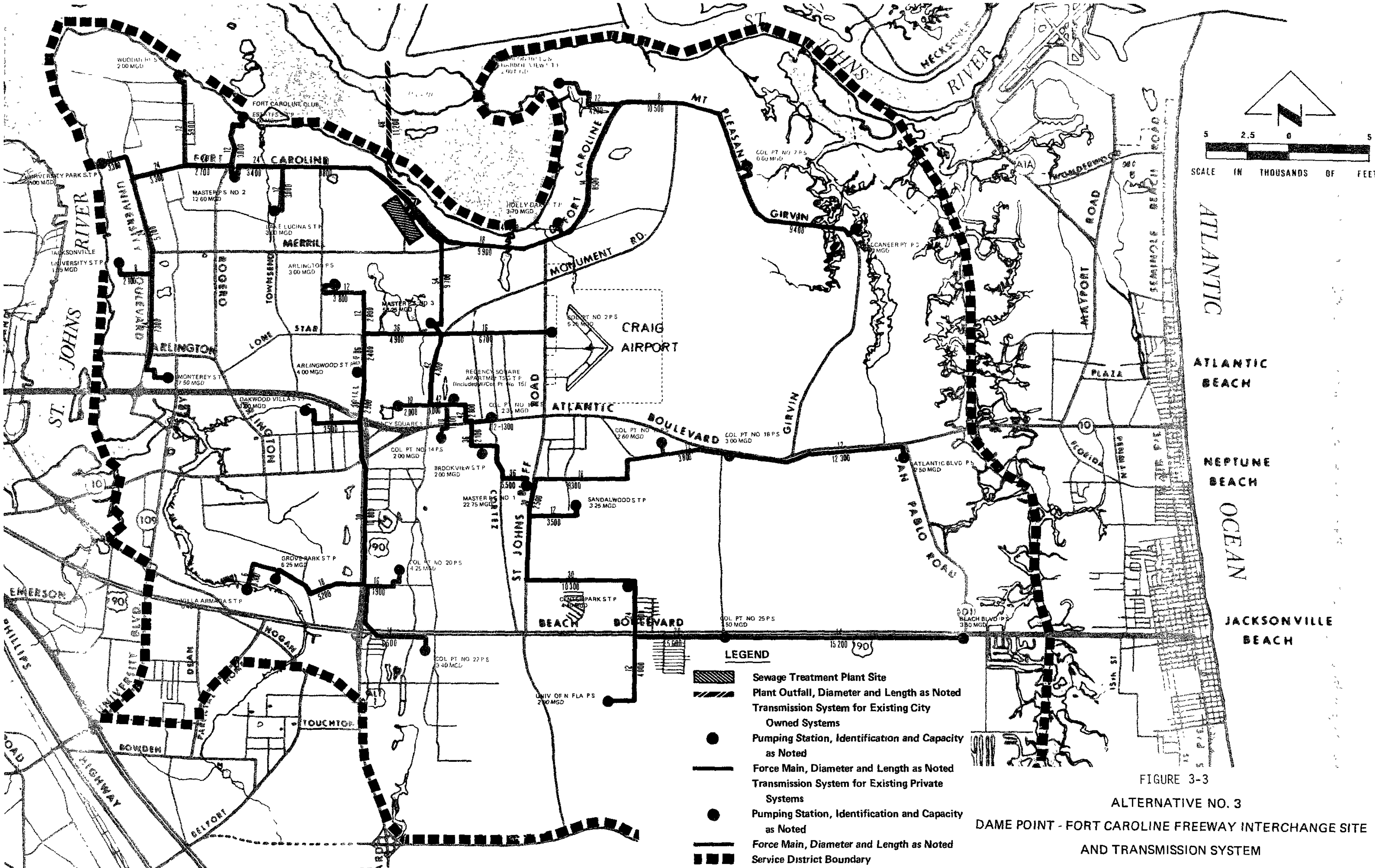


FIGURE 3-3

ALTERNATIVE NO. 3

DAME POINT - FORT CAROLINE FREEWAY INTERCHANGE SITE AND TRANSMISSION SYSTEM

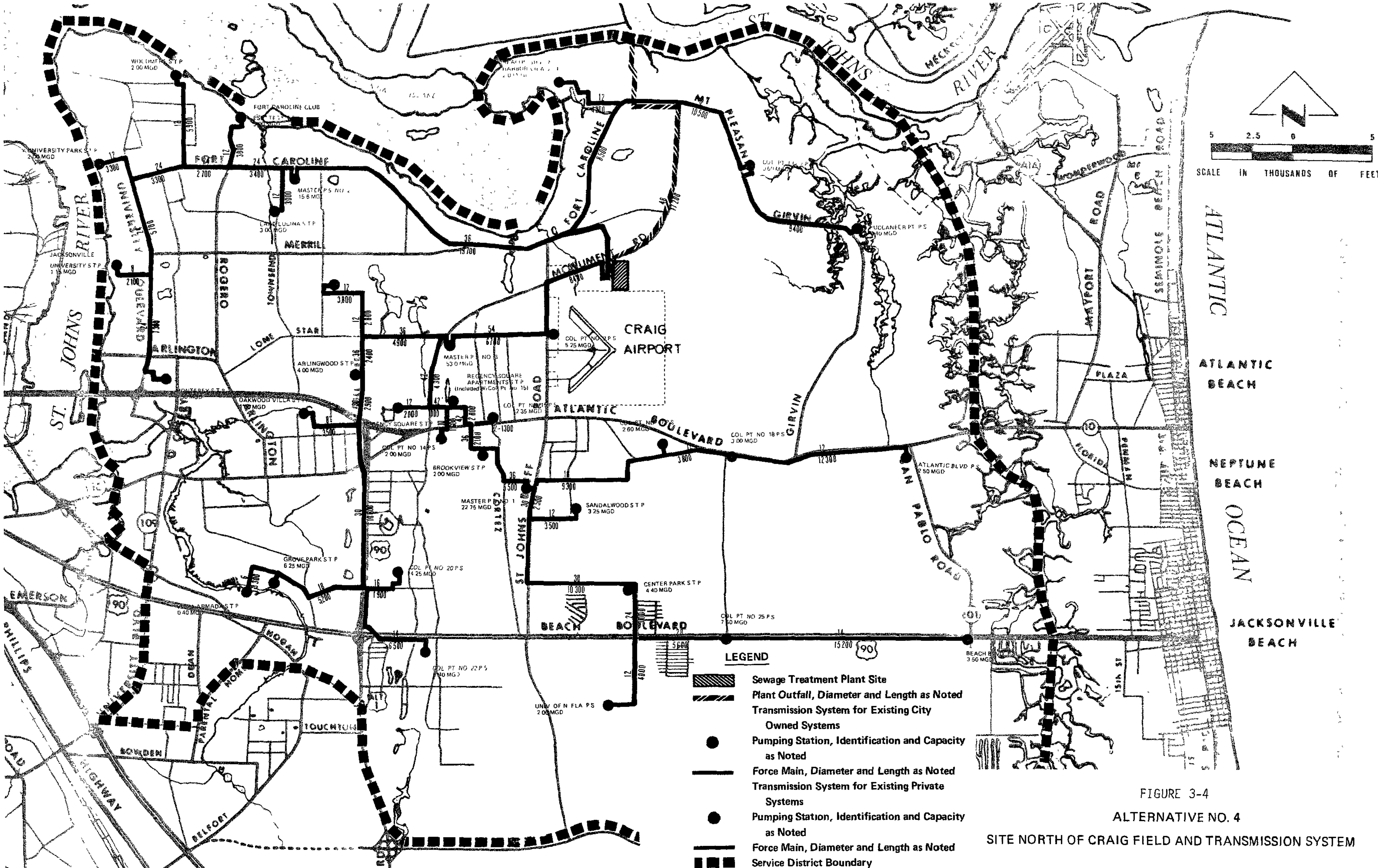


FIGURE 3-4

ALTERNATIVE NO. 4

SITE NORTH OF CRAIG FIELD AND TRANSMISSION SYSTEM

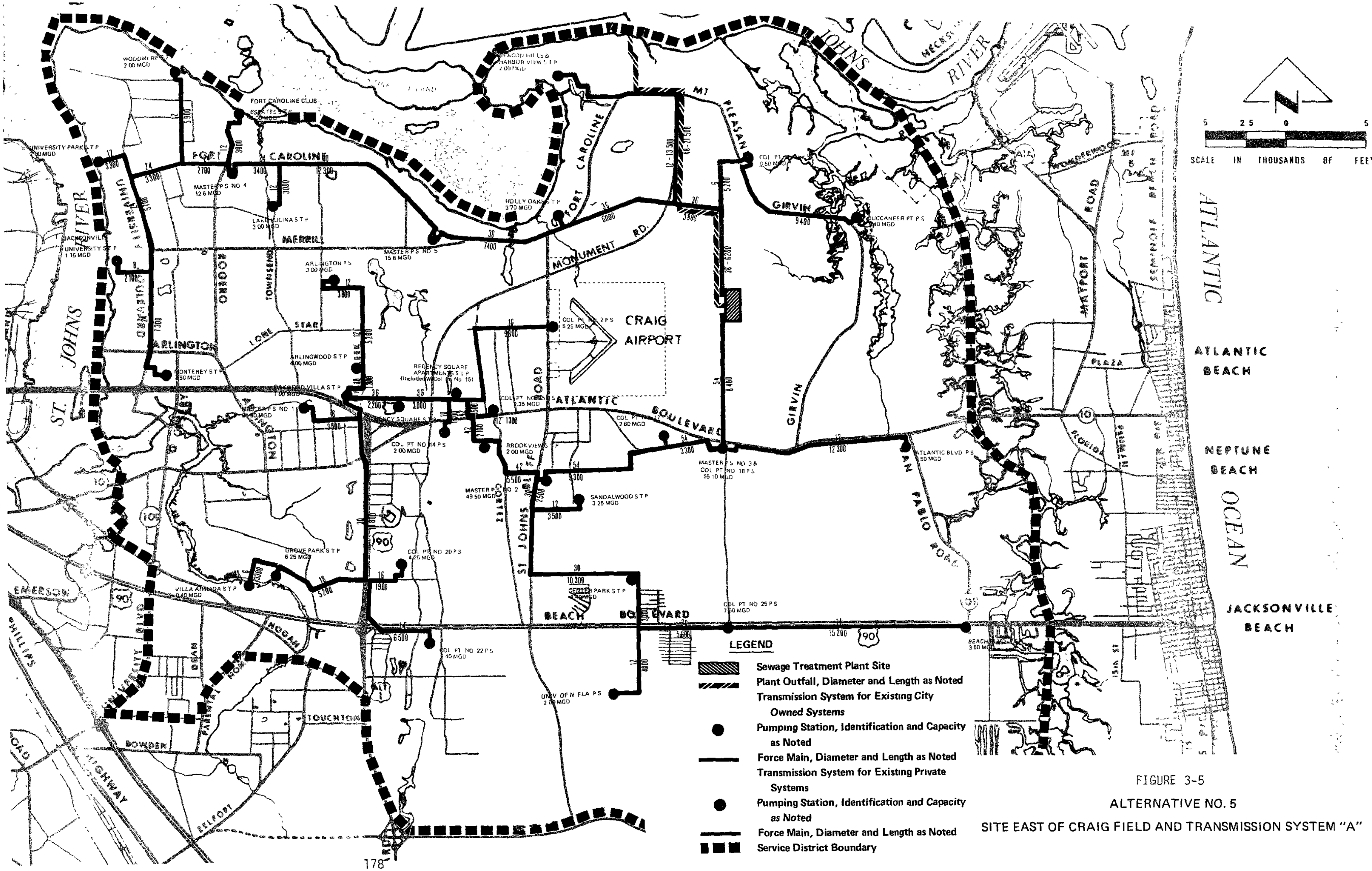


FIGURE 3-5

ALTERNATIVE NO. 5

SITE EAST OF CRAIG FIELD AND TRANSMISSION SYSTEM "A"

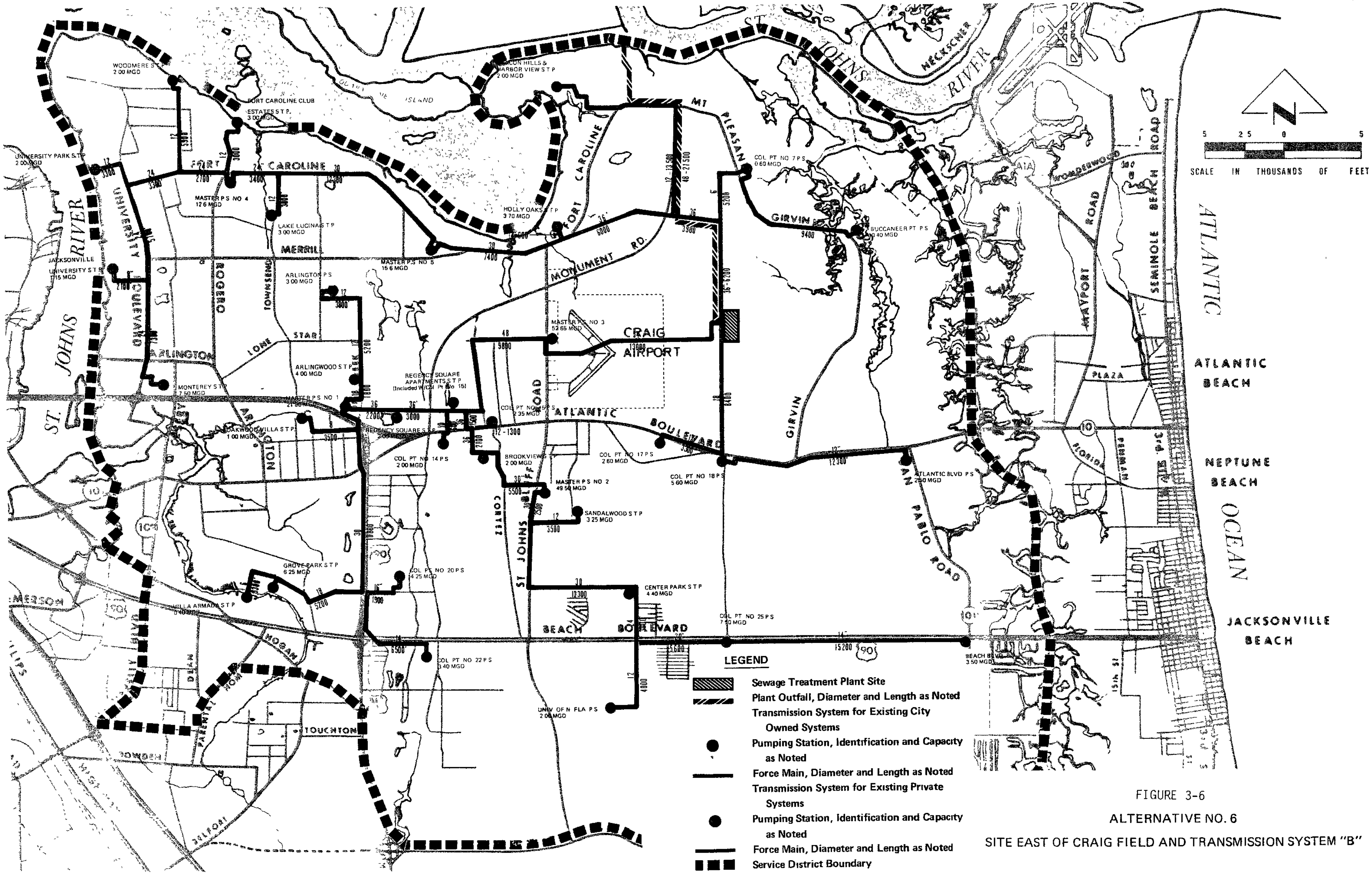


FIGURE 3-6

ALTERNATIVE NO. 6

SITE EAST OF CRAIG FIELD AND TRANSMISSION SYSTEM "B"

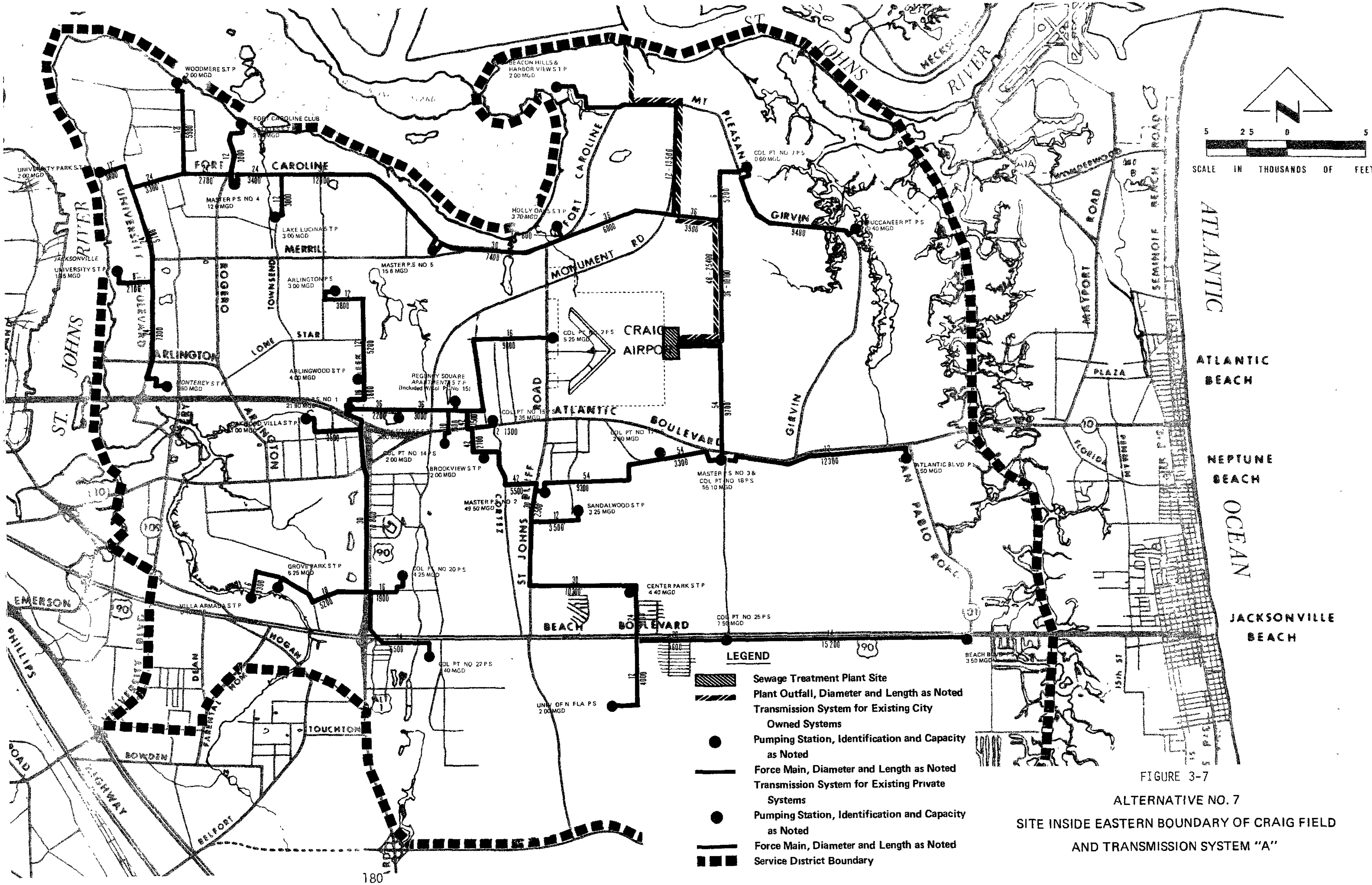


FIGURE 3-7

ALTERNATIVE NO. 7

SITE INSIDE EASTERN BOUNDARY OF CRAIG FIELD AND TRANSMISSION SYSTEM "A"

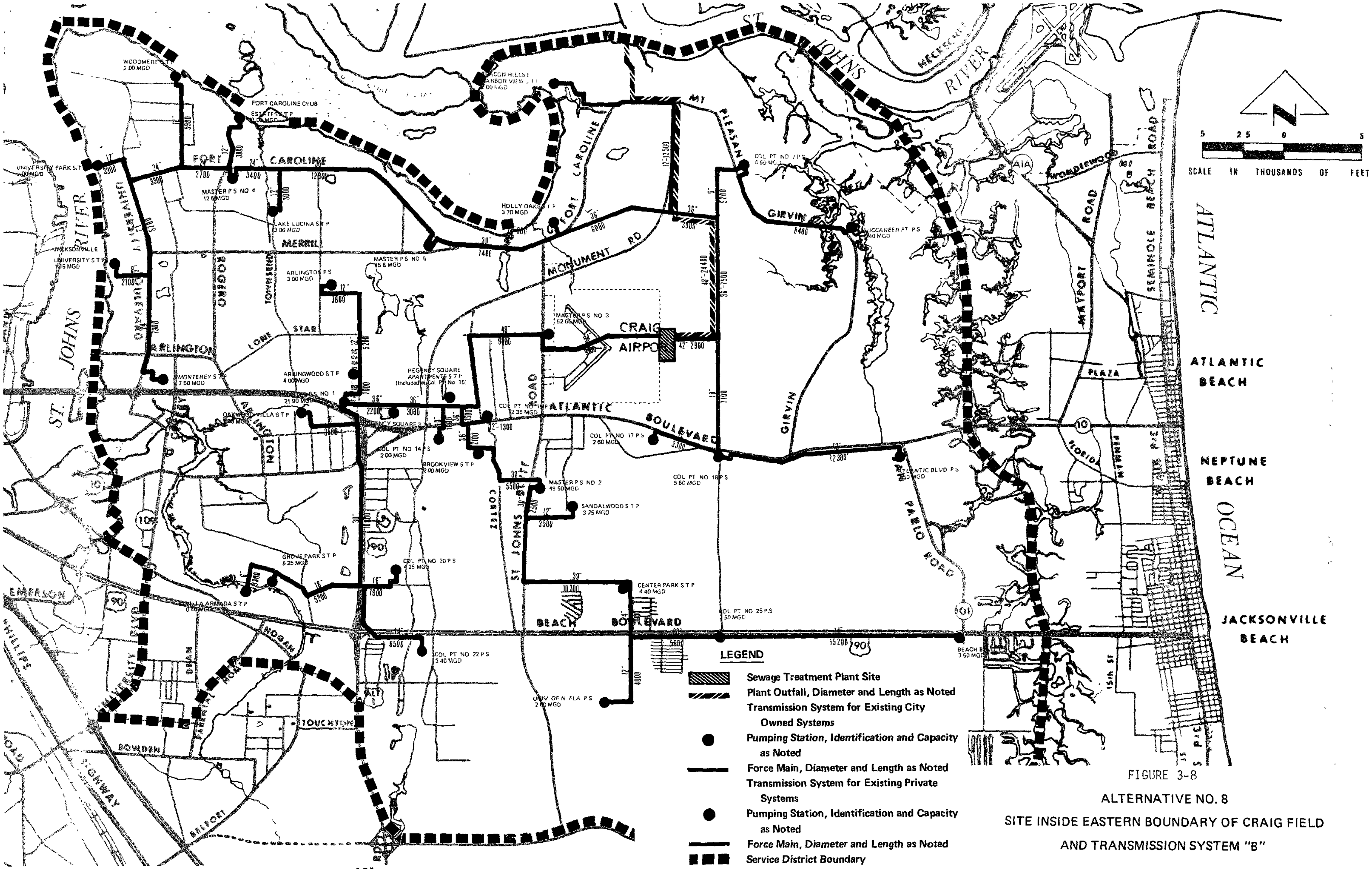


FIGURE 3-8

ALTERNATIVE NO. 8

SITE INSIDE EASTERN BOUNDARY OF CRAIG FIELD AND TRANSMISSION SYSTEM "B"

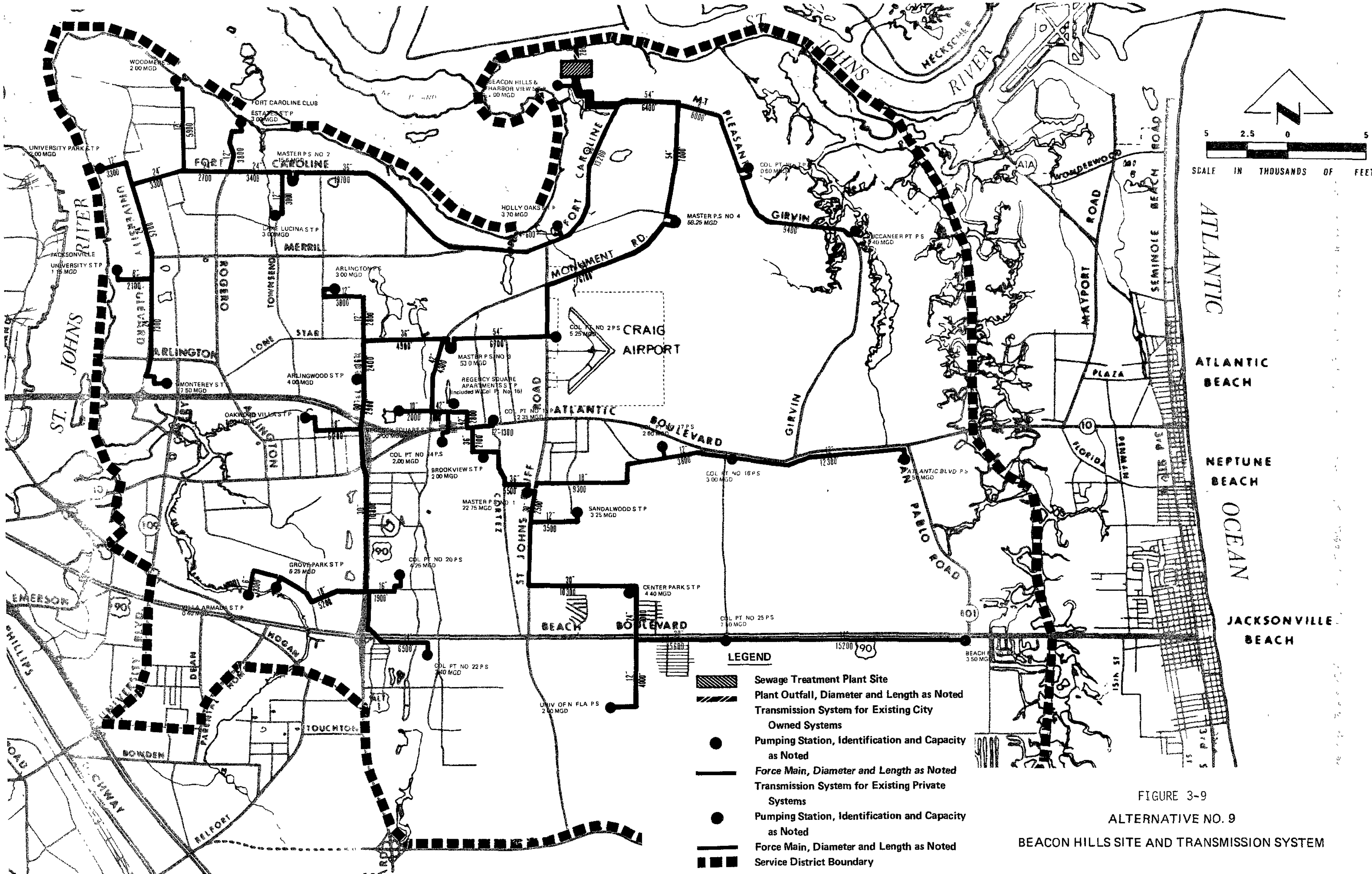
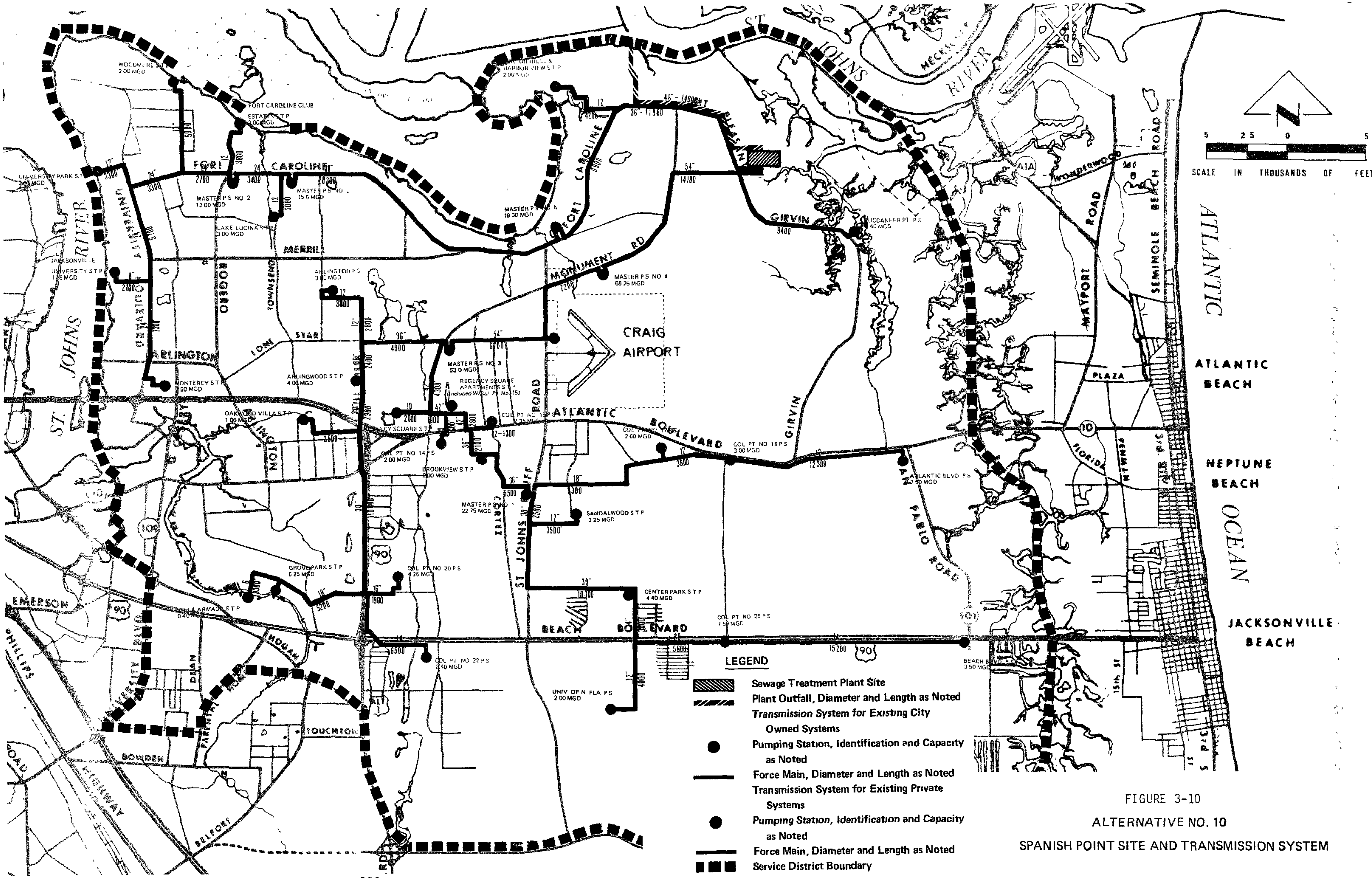


FIGURE 3-9

ALTERNATIVE NO. 9

BEACON HILLS SITE AND TRANSMISSION SYSTEM



LEGEND

- Sewage Treatment Plant Site
- Plant Outfall, Diameter and Length as Noted
- *Transmission System for Existing City Owned Systems*
- Pumping Station, Identification and Capacity as Noted
- Force Main, Diameter and Length as Noted
- *Transmission System for Existing Private Systems*
- *Pumping Station, Identification and Capacity as Noted*
- Force Main, Diameter and Length as Noted
- Service District Boundary

FIGURE 3-10

ALTERNATIVE NO. 10

SPANISH POINT SITE AND TRANSMISSION SYSTEM

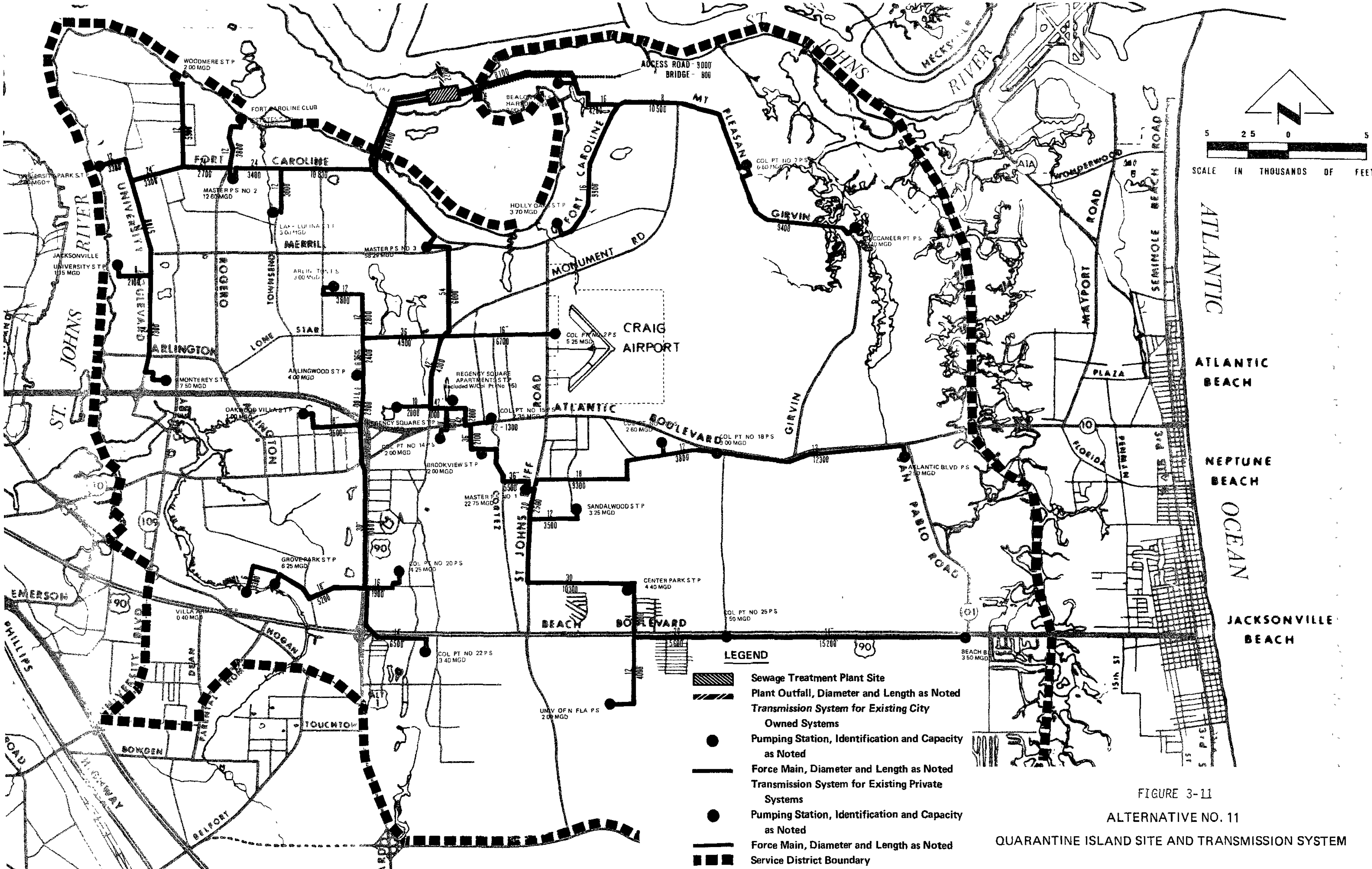


FIGURE 3-11

ALTERNATIVE NO. 11

QUARANTINE ISLAND SITE AND TRANSMISSION SYSTEM

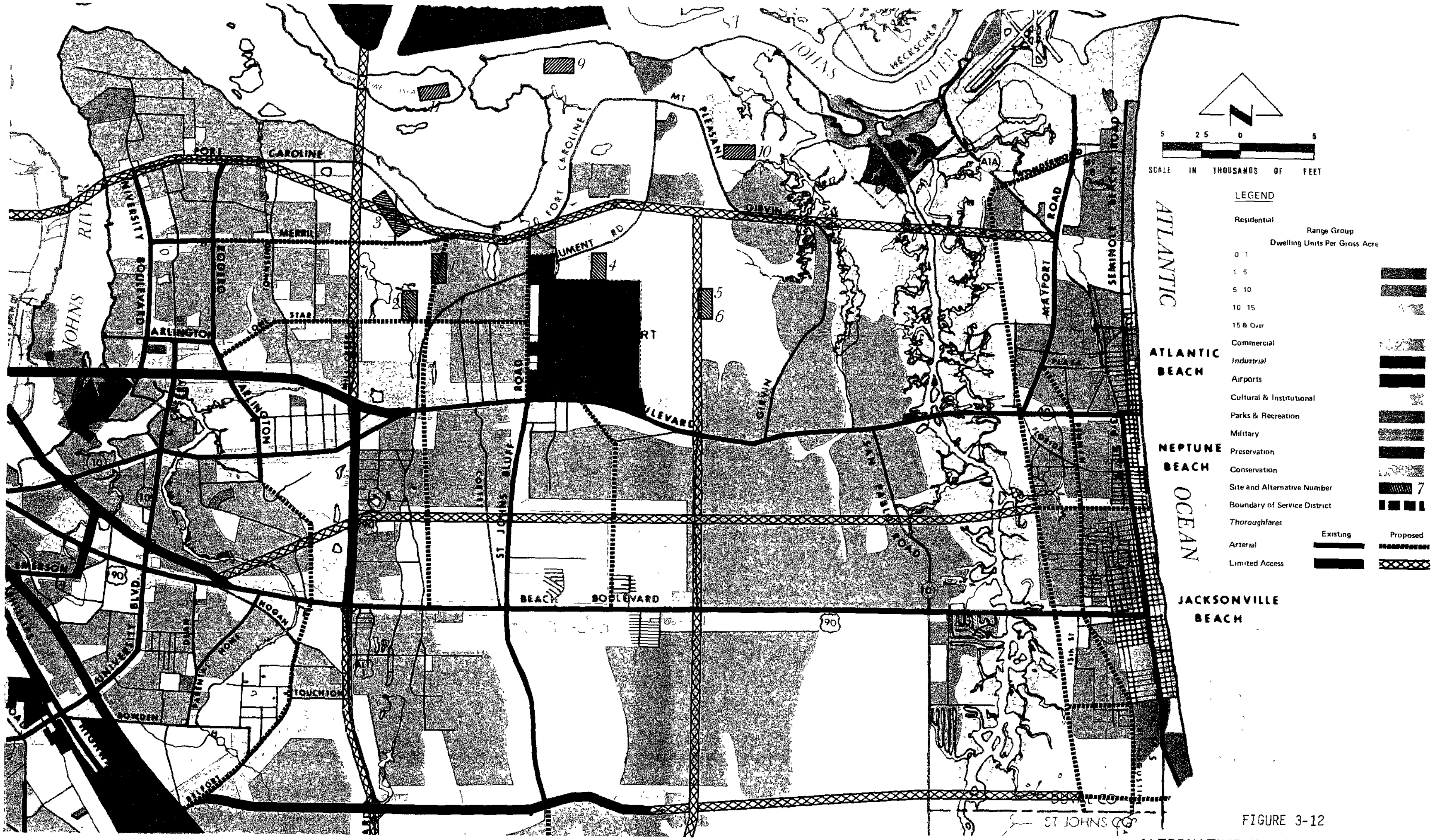


FIGURE 3-12
ALTERNATIVE TREATMENT PLANT SITES
ARLINGTON - EAST DISTRICT

The twelve alternative systems are identified as follows:

Alternative Number	Description	Figure Number
1q	Millcoe Road (System A)	3-1
1b	Millcoe Road (System B)	--
2q	Dunes Area Site (System A)	3-2
2b	Dunes Area Site (System B)	--
3	Dame Point-Fort Caroline Freeway Interchange	3-3
4	North of Craig Field	3-4
5	East of Craig Field (System A)	3-5
6	East of Craig Field (System B)	3-6
7	Inside Craig Field (System A)	3-7
8	Inside Craig Field (System B)	3-8
9	Beacon Hills	3-9
10	Spanish Point	3-10
11	Quarentine Island	3-11
12	Inside Southern Boundary of Craig Field	--

These alternatives were identified by the City, by the public, and by the EPA. The sites, except site No. 3, are assumed to be rectangular in shape, 1000 feet X 2000 feet, containing approximately 45.9 acres. Site Number 3, the Dame Point-Fort Caroline Freeway site, is assumed to require a larger site since it must accommodate highway interchange structures as well as the treatment facilities. For this alternative, a rectangular site, 1000 feet by 3000 feet, containing approximately 69 acres is assumed.

A brief description of each alternative is given below.

1) Alternative 1q - Millcoe Road System

(a) Plant Location

The Millcoe Road site is a 46.98 acre tract of land located between Merrill Road and Monument Road, on the east side of Millcoe Road right-of-way. The closest residential area, Holly Oaks, lies to the east of the plant site, at a distance of no less than one-quarter mile from the property line.

The site is located in a generally well-drained wooded area at an average elevation 40 feet± above mean sea level. There are some wet areas on the north edge of the plant site. A 200-foot wide buffer zone and screen would be retained on the east side and a 100-foot wide buffer zone on the north, west, and south sides. In addition, a 98-acre wooded area on the north and east side between the plant site and the Holly Oaks development, would be purchased by the City of Jacksonville and reserved as a park type recreational area.

Treated plant effluent would be discharged through 13,800 feet of 48-inch force main, including 7,500 feet of subaqueous line, north across Mill Cove and Quarantine Island to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system serving the Arlington-East District and tributary to this site would consist of 32 pumping stations, and 245,500 feet of force main ranging from 6-inch to 54-inch in diameter.

2) Alternative 1b - Millcoe Road (System B)

This alternative is the same as 1A, except that the outfall line is rerouted along Fort Caroline Road and discharges into the St. Johns River in the ship channel opposite the eastern end of Blount Island. This disposal location will require approximately 20,000 feet of 48-inch force main, including 200 feet of subaqueous line.

3) Alternative 2q - Dunes Area System

(a) Plant Location

The Dunes Area plant site is located on the northeast corner of the projected intersection of Lone Star and Gilmore Heights Roads.

Projection of the future Southside Boulevard extension (Dame Point Freeway) through this area must be considered. The northeast corner of the intersection was selected for study since it is further from existing residential areas than other locations. There is no natural screening in the strip mine areas, since the dunes area is almost completely devoid of vegetation. A plant in this location would be within a lake and marsh area, and groundwater is high. Sand in the dunes area has been so "mined" in the past that all minerals and organic materials have been removed, and the sand itself is of such "ball-bearing" nature as to be of poor quality foundation material.

Treated plant effluent would be discharged through 17,700 feet of 48-inch force main, including 7,500 feet of subaqueous line, across Mill Cove and Quarantine Island to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system tributary to the Dunes Area Plant would be quite similar to that serving the Millcoe Road site. This system was estimated to require 32 pumping stations, including 2 master pumping stations, and 248,100 feet of force main ranging from 6-inch to 54-inch in diameter.

4) Alternative 2b - Dunes Area Site (System B)

This alternative is the same as 2q except that the outfall line is rerouted along Merrill and Fort Caroline Road and discharges into the ship channel in the St. Johns River opposite the eastern end of Blount Island. This disposal location will require approximately 25,000 feet of 48-inch force main, including 200 feet of subaqueous line.

5) Alternative 3 - Dame Point/Fort Caroline Freeway

(a) Plant Location

It was proposed that the Arlington-East District Sewage Treatment Plant be located beneath the intersection of the proposed Fort Caroline Freeway and the Dame Point Freeway (northwest of the Millcoe Road site), the intersection being of the elevated type over the plant area. In addition to treatment plant costs, it is estimated elevated roadway support structures would cost an additional $16,000,000 in order to accommodate plant structures constructed beneath. Also, approximately 24 additional acres of land would need be purchased, over the basic 47 acre area contemplated, for clearance purposes.

Treated plant effluent would be discharged through 11,200 feet of 48-inch force main, including 4,300 feet of subaqueous line, north across Mill Cove and Quarantine Island to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system tributary to this location would, for the most part, be similar to that used for the Millcoe Road system. It is estimated this system would require 33 pumping stations, including three master pumping stations, and 250,100 feet of force main, ranging from 6-inch to 54-inch in diameter.

6) Alternative 4 - North of Craig Field

(a) Plant Location

Investigation was made of a plant site on the north side of Craig Field, south of Monument Road, east of and adjacent to Derringer Road. This location would not be in the flight path of aircraft using Craig Field, although height restrictions would need be observed. This location is in an area of high groundwater as evidenced by palmetto growth and cypress swamps. Average ground elevation is 40± feet above mean sea level.

Treated plant effluent would be discharged through 17,800 feet of 48-inch force main, including 200 feet of subaqueous line, north to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system for this location would be a further modification of the Millcoe Road system. It is estimated this system would require 33 pumping stations, including three master pumping stations, and 253,500 feet of force main, ranging from 6-inch to 54-inch in diameter. 1,200 feet of 54-inch line would need be installed on pile supports because of swamp conditions.

7) Alternative 5 - East of Craig Field, System "A"

(a) Plant Location

Investigation was made of a plant site on the east side of a power line easement extending in a north/south direction and one-half mile east of the east boundary of Craig Field. This is in an area of relatively high ground, 40+ feet above mean sea level, between Mt. Pleasant Creek on the east side, and Possum Head Swamp on the west. Approximately 3,000 feet of access road would be required to reach the plant site from Atlantic Boulevard.

Treated plant effluent would be discharged through 21,500 feet of 48-inch force main, including 200 feet of subaqueous line, north to the main channel of the St. Johns River.

(b) Pressure Manifold System

Under System "A", tributary to the site east of Craig Field, sanitary sewage from those areas on the north side of the Arlington-East District would be collected and brought in by force main around the north side of Craig Field and south along the power line to the plant site. The southern areas of the District would be collected into a 54-inch pressure line routed around the south side of Craig Field and north along the power line to the plant site.

It is estimated this system would require 34 pumping stations, including five master pumping stations, and 254,300 feet of force main, ranging from 6-inch to 54-inch in diameter. Approximately 21,000 feet of 54-inch force main would be required for this system. It is estimated some 4,000 feet of 36-inch line would require pile bent supports, and 9,000 feet of 54-inch line would require pile bent supports.

8) Alternative 6 - East of Craig Field, System "B"

(a) Plant Location

Plant location and facilities including the outfall line would be the same as in System "A" for the site east of Craig Field.

(b) Pressure Manifold System

This system is similar to System "A" discussed above, except that the southern areas of the Arlington-East District were collected to a point on the west side of Craig Field, then carried in a 54-inch line across the center of Craig Field to the plant site. It may be necessary to shut down this airfield while such construction was taking place.

It is anticipated this pressure system would require 34 pumping stations, including five master stations, and 258,000 feet of force main, 6-inch to 54-inch in diameter. Special casing or tunnel liner would be required for construction beneath the runways. Because of swamp crossings, some 4,000 feet of 36-inch line and 5,000 feet of 54-inch line would require pile bent supports.

9) Alternative 7 - Inside East Boundary, Craig Field, System "A"

(a) Plant Location

As an alternate to the plant site located adjacent to the power line east of Craig Field, a site was investigated inside and adjacent to the east boundary of Craig Field. This site would be in a swamp area known as Cedar Swamp. In order to provide suitable support for plant facilities, it would be necessary for the entire area within the plant's perimeter road, exclusive of building structures, to be demucked and backfilled with suitable material to a depth of five feet. Areas around building structures, 10 feet beyond the building line, would be demucked and backfilled with suitable material to a depth 15 feet below ground surface.

Plant access road would be extended across Cedar Swamp east to the power line easement area, then south to Atlantic Boulevard for a total of approximately 4,300 feet. Treated plant effluent would be discharged through 25,400 feet of 48-inch force main, including 200 feet of subaqueous line, east across Cedar Swamp to the power line area, thence north along the power line easement and to the main channel of the St. Johns River. Because of the swamp crossing, it is estimated 1,400 feet of this outfall will require pile bent supports.

(b) Pressure Manifold System

The pressure manifold system for System "A" tributary to this site inside Craig Field is the same as System "A" for the site located east of Craig Field along the power line. Plant influent lines (as well as the effluent line) would be routed along the power line easement, in order to stay out of the swamp area between McCormic Road and Atlantic Boulevard (Cedar Swamp). Approximately midway between these two roads, all lines would be routed west from the power line, across 1,400± feet of swamp to the plant site. It is anticipated this system would require 34 pumping stations, and 259,500 feet of force main, ranging from 6-inch to 54-inch diameter. Also, it is estimated 5,400 feet of 36-inch and 10,400 feet of 54-inch line will require pile bent supports.

10) Alternative 8 - Inside East Boundary, Craig Field, System "B"

(a) Plant Location

Plant location and facilities, including the outfall line, would be the same as in System "A" for the site inside the east boundary of Craig Field.

(b) Pressure Manifold System

As an alternate to routing the 54-inch force main around the south side of Craig Field and along the power line easement, an investigation was made of routing this 54-inch trunk through the center of Craig Field from the west. It probably would be necessary to shut down the airfield while such construction was taking place.

It is anticipated this pressure system would require 34 pumping stations, including five master pumping stations, and 256,700 feet of force main, ranging from 6-inch to 54-inch diameter. Special casing or tunnel liner would be required for construction beneath the runways. A total of 17,100 feet of 54-inch force main would be required under this system, as compared to 3,700 feet for the Millcoe Road system. Because of swamp conditions, it is estimated 1,400 feet of 42-inch and 3,600 feet of 54-inch force main will require pile bent supports.

11) Alternative 9 - Beacon Hills System

(a) Plant Location

An investigation was made of a plant site location northwest of the Beacon Hills Development, on the north side of Mill Cove Road and approximately 1600 feet west of Fulton Road. This site, adjacent to the St. Johns River, is in a very low area, less than 10 feet above mean sea level, and would require either perimeter diked construction, or a considerable amount of fill to raise the general level above the high water elevation. Groundwater would also be a major problem of construction. However, the plant effluent pumping station required at all other previously discussed locations could be deleted and the 48-inch pressure outfall replaced with a 60-inch gravity line. Plant effluent would be discharged through 2,000 feet of this 60-inch gravity line, including 500 feet of subaqueous line, north to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system tributary to this plant location would essentially be a modification of the Millcoe Road system. Additional master pumping stations would be required at the intersection of Lone Star Road and Monument Road; and at the intersection of Monument and McCormick Roads. It is estimated this system would require 34 pumping stations, and 261,600 feet of force main ranging from 6-inch to 54-inch diameter. In this system, 31,600 feet of 54-inch force main would be required.

12) Alternative 10 - Spanish Point System

(a) Plant Location

The Spanish Point plant site is located approximately 500 feet east of Mt. Pleasant Road and just north of Mud Flats Creek. Plant site elevations range from 10 to 40 feet above mean sea level, and groundwater is high in certain areas.

Treated plant effluent would be discharged through 14,000 feet of 48-inch force main, including 300 feet of subaqueous line, extending north and west along Mt. Pleasant Road and Fort Caroline Road, thence north through the Beacon Hills area to the main channel of the St. Johns River. This routing was selected in order to bypass the large sand dunes along the St. Johns River and the Fort Caroline Memorial.

(b) Pressure Manifold System

The pressure manifold system tributary to this plant location would also be essentially a modification of the Millcoe Road system, as was the Beacon Hills system. It is estimated this system would also require 34 pumping stations, including 4 master pumping stations, and 262,800 feet of force main ranging from 6-inch to 54-inch diameter. In this system, 28,000 feet of 54-inch force main would be required.

13) Alternative 11 - Quarantine Island System

(a) Plant Location

The Quarantine Island plant site is located on the east end of the island, center point of the site being located approximately 2,000 feet due west from the center of the "weir" between Quarantine Island and Reed Island on the mainland. Road access to this site would be through Beacon Hills, and would require construction of some 9,000 feet of new roadway plus 800 feet of bridge across to the island.

The Quarantine Island site is a very low area, less than 10 feet above mean sea level, of poor foundation material, and, as the area is surrounded by the St. Johns River, would require special dewatering facilities, piling support, and a considerable amount of sand fill to raise the plant site perimeter road and the area within to elevation 10 feet above mean sea level. This elevation is considered the minimum safe elevation above high water for building construction. Because of the proximity of the river, the perimeter slope of the sand fill should be covered with riprap to a depth of two feet.

The plant effluent pumping station required at all other locations, except the Beacon Hills site, could be deleted and the 48-inch pressure outfall replaced with a 60-inch gravity line. Plant effluent would be discharged through 2,200 feet of this 60-inch line, including 1,200 feet of subaqueous line, north to the main channel of the St. Johns River.

(b) Pressure Manifold System

The pressure manifold system tributary to this plant location would essentially be a modification of the Millcoe Road system. An additional master pumping station would be required at the intersection of Millcoe Road right-of-way and Fort Caroline Road. The 54-inch force main serving present City utilities and the 36-inch force main required to serve present utilities in the west and northwest areas of the Arlington-East District, would cross over to Quarantine Island on the west side of Mill Cove, while the force main required for present private utilities in the northeast area of the District would pass through Beacon Hills and come into the Quarantine Island site from the east side.

It is estimated this system would require 33 pumping stations, including three master pumping stations, and 262,200 feet of force main ranging from 6-inch to 54-inch diameter. In this system, 20,800 feet of 54-inch force main would be required.

14) Alternative 12 - Inside the Southern Boundary of Craig Field.

(a) Plant Location

This site is located on the southern edge of Craig Field in an area presently proposed to be for expansion of Craig Field facilities. The site has good access from Atlantic Boulevard. The site is generally well drained with pockets of wet areas. There is a residential area located approximately 900 feet to the south across Atlantic Boulevard.

Treated plant effluent would be routed north across the eastern edge of Craig Airport property and then up Monument Road and Fort Caroline Road with a discharge into the St. Johns shipping channel opposite the eastern edge of Blount Island. Approximately 30,000 feet of 48-inch force main including 200 feet of subaqueous line would be required.

c. Treatment Processes

A complete facility for treatment of wastewater includes many component parts, each to some degree dependent on the previous component to perform properly. The various processes can be broken down into pretreatment, primary treatment, secondary treatment, advanced treatment, and disinfection. The treatment components used and overall system design is dependent on the allowable pollutant concentrations. In the Jacksonville Arlington-East area, all viable disposal alternatives, outfalls to the St. Johns River, are "effluent limited." This means that if secondary treatment is provided for the wastewater, no violations of water quality will result. Therefore, the effluent is limited to the minimum allowable by law, which is secondary treatment.

Secondary treatment is defined as:

1) Biochemical oxygen demand (BOD) shall be limited to a monthly average of 30 mg/l and a weekly average of 45 mg/l.

2) Suspended solids shall not exceed 30 mg/l as a monthly average and 45 mg/l as a weekly average.

3) Fecal coliform counts shall not exceed 200 per 100 ml as a monthly average and 400 per 100 ml as a weekly average.

4) pH shall be within 6.0 and 9.0.

Biochemical Oxygen Demand is the amount of oxygen per unit volume of wastewater (usually mg/l) utilized to degrade that wastewater for a specified length of time (usually five days).

Fecal coliforms are an indicator organism for contamination by untreated sewage. Fecal coliforms are found in all raw sewage, and are more resistant to destruction than practically all pathogens (disease causing organisms). For these reasons, fecal coliforms are considered an appropriate indication of the presence of pathogenic bacterial contamination from sewage.

1) Pretreatment

Practically all wastewater treatment systems require some form of pretreatment to make the wastewater more amenable for primary treatment. These processes may include aeration, chlorination, screening, grit removal, and flow equilization. Aeration and chlorination are used to oxidize reduced compounds to eliminate nuisance odors. Screening is utilized to remove larger objects. Grit removal involves the deposition and removal of larger particle size sand. And flow equilization is utilized to even out the loading on a sewage treatment plant.

The proposed Arlington-East Plant includes all of the above pretreatment processes except flow equilization, which will not be a problem in the Arlington-East Area. No further evaluation of these alternatives is considered necessary in this project since the proposed pretreatment system represents the best approach to attain project objectives and minimize adverse environmental effects.

2) Primary Treatment

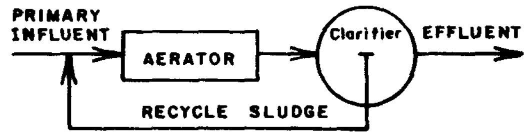
Primary treatment is an integral part of most wastewater treatment systems. This process removes floatables and some solids by detaining the wastewater in a basin for a sufficient time to allow settling, and by skimming the surface to remove floatable matter (oils, solids, etc). This process removes solids and 35 percent of the BOD of the wastewater. The Arlington-East facilities will contain primary treatment and no alternatives to this process are considered viable.

3) Secondary Treatment

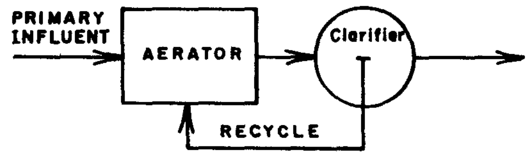
Secondary treatment processes may basically be divided into two major classifications: (1) biological and (2) physical-chemical. Individual waste properties and costs for treatment determine which treatment method is appropriate.

(a) Biological Treatment

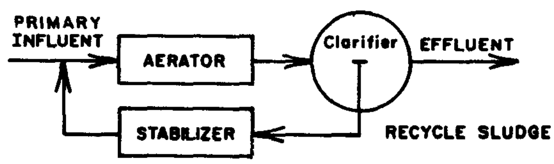
Biological treatment is subdivided into three major processes: activated sludge, trickling filters, and lagooning. Activated sludge utilizes aerobic biological oxidation of wastes. This oxidation can be accomplished by conventional aeration (completely mixed or plug flow), contact stabilization, step aeration, and pure oxygen aeration (Figure 3-13)). Each of these systems can be designed to meet required BOD and suspended solids effluent limitations. Cost factors have indicated conventional aeration is appropriate. Typical BOD removal percentages are 90 percent and above, which meets State and present EPA secondary treatment standards. Trickling filters utilize fixed film aerobic biological oxidation, which is less efficient, and requires greater land area than do activated sludge facilities. Lagooning is not a reasonable alternative in this area due to the large land area required. Further, trickling filters and lagooning generally do not meet State and EPA secondary treatment requirements and, therefore, are not further considered.



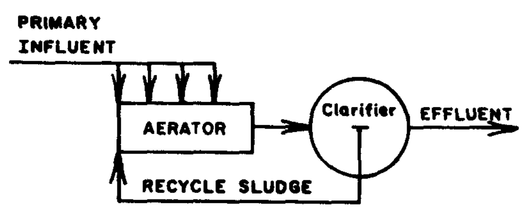
A. PLUG FLOW



B. COMPLETELY MIXED



C. CONTACT STABILIZATION



D. STEP AERATION

FIGURE 3-13

ACTIVATED SLUDGE TREATMENT PROCESS MODIFICATIONS

(b) Physical-Chemical

These processes are primarily chemical additions to aid settling (flocculation) and sedimentation. The addition of alum, lime, ferric chloride or other flocculents can increase solids, BOD, and phosphorus removals. High operating costs, increased sludge solids, and, in the case of lime, pH controls are major drawbacks. This alternative is not recommended in this case.

4) Advanced Waste Treatment

All viable alternatives for disposal of wastewater in Jacksonville will require only secondary treatment. A further discussion or analyses of advanced waste treatment processes is not warranted.

5) Disinfection

There are two major methods used for disinfection of wastewater in the U. S. These are chlorination and ozonation. Each method utilizes basically the same principal that is to oxidize the bacterial organism and viruses and either kill or make them inoperative. Current information indicates that ozonation is stronger than chlorination although each has been shown to be effective. At the present time, high power requirements are the major drawbacks to utilization of ozonation. Costs for chlorination are presently significantly lower than for ozonation and since each meets effluent standards, chlorination is the chosen alternative.

d. Sludge Treatment and Disposal

Sludge is a broad term used to describe the various suspensions of solids encountered and generated during sewage treatment. The nature and concentration of these solids control the processing characteristics of the sludge.

Processes used in the treatment and disposal of sludges are categorized as follows:

1) Thickening (Blending) - The process whereby solid concentrations are increased. Thickening may occur as the objective of a separate process or as a secondary effect of a process provided essentially for a

different purpose. Commonly used methods are gravity, flotation, and centrifugation.

2) Stabilization - The process which converts raw (untreated) sludges into a less offensive form with regard to odor, putrescibility rate, and pathogenic organism content. Major process types are anaerobic digestion, aerobic digestion, lime treatment, chlorine oxidation, heat treatment, and composting.

3) Dewatering - Any process which removes sufficient water from sludge so that its physical form is changed from essentially that of a fluid to that of a damp solid. Methods used are best described by the equipment employed. Some major types are rotary vacuum filters, centrifuges, drying beds, filter presses, horizontal belt filters, rotating cylindrical devices, and lagoons.

4) Reduction - Processes which primarily yield a major reduction in the volatile sludge solids. Principal methods employed are incineration, wet air oxidation, and pyrolysis.

5) Final Disposal - The ultimate disposition of sludge in liquid, cake, dried, or ash form, as a residue to the environment. Principal methods are cropland application, land reclamation, power generation (with solid waste), sanitary landfill, ocean disposal, and incineration (followed by landfill).

To meet the unique conditions of specific design situations, alternative methods available to carry out the above unit processes must be considered, modified, and applied as appropriate. Each unit process must be evaluated as a part of the total system. In the Arlington-East plant, sludge treatment and disposal methods have been selected as follows to arrive at the most viable subsystem:

Unit Process	Selected Method
Sludge thickening	Centrifugation
Sludge stabilization	Heat treatment
Sludge dewatering	Vacuum filtration
Sludge reduction	Multiple heat incineration
Final disposal	Landfill

An option in the selected method of at least two unit processes warrants further consideration; that being the elimination of the incineration process and the use the thickened, dewatered, and heat-treated sludge for a combination land spreading and land reclamation operation. Chapter II described the extensive and barren strip-mined areas which exist in the Arlington-East area. Sludge from the Buckman Street and Sewer District #2 sewage treatment plants, as well as several smaller satellite plants, is currently being used as a soil conditioner to reclaim a portion of this land in the area of Regency Square. The operation has thus far been successful in permitting a vegetative cover to grow on heretofore completely sterile sand. Sixty additional acres which will be adequate for two more years of sludge disposal have recently been graded for spreading. This operation, however, will cease after that time when the Buckman Street incinerator, currently under construction, is completed and is used to incinerate the sludge now being land spread.

Certain adverse factors are inherent in this land spreading operation as it is currently being performed. First, the cost of transportation of liquid-digested sludge from the west side of the city to the east side is high and made even higher by the tolls encountered in crossing the St. Johns River. Second, a certain degree of odor has at times been associated with the operation. The degree of odor and its effect on people in the area varies with wind direction, condition of the sludge, and climatological factors. Odor has not generally been a problem, however. This is notable since the sludge is not heat-treated and is not tilled into the sand.

Not operating the incineration process at the Arlington-East plant, and using the sludge to continue this land spreading operation, will have several advantages. First, the benefits of using this resource for purposes of land reclamation are obvious. Second, transportation costs would be decreased over what they are now since the strip-mined areas are relatively close to the plant. Transportation costs will also be less because the Arlington-East sludge will be dewatered and heat-treated before hauling, thus reducing the volume of sludge produced per gallon of influent treated. Third, heat treatment using the proposed Zimpro or Porteous processes greatly reduces the sludge's potential for odor. The very disagreeable odor of raw sludge under adverse conditions is primarily produced by hydrogen sulfide. Heat treatment breaks down the sulfur compounds found in raw sludge and, in fact, commonly reduces the potential of sludge to generate disagreeable sulfur related odors by 1000 times. The very small degree of residual odor remaining has been described as ranging from that of wet paper to that of chocolate. The primary potential for disagreeable odor from heat-treated sludge results from a lack of storage and vacuum filtration after heat teatment. In the Arlington-East plant this potential will be eliminated as both of these processes are planned. Further, if the thickened, heat-treated, stored, and vacuum filtered sludge is tilled into the sand, the potential for odor will be extremely slight and even more so if an adequate buffer zone is provided between the land spreading operation and the nearest residents. Soil conditioning projects in which heat-treated sludges are tilled have been extremely successful in this regard.

Several other methods of final sludge disposal have been studied for use in Duval County. These methods--lagooning, underground disposal, composting, and ocean disposal--have been rejected for local use for various environmental and/or cost considerations. Landfilling of dewatered sludge is currently being practiced in the county and is a relatively inexpensive method if distance from the treatment plant to the disposal site is short.

In summary, by land spreading the sludge the costs of constructing and running the incinerator and the effects on air quality may be avoided. The major obstacles to this operation are cost of transport, cost of tilling the resource into the soil, a commitment of lands for this purpose, and the possibility of odors if not properly tilled.

e. Odor Control

Potential sources of odor problems at the proposed Arlington-East Regional Sewage Treatment Plant are as follows:

* Bar Screen
* Grit Chamber/Preaeration Tank
* Primary Clarifiers
* Centrifuge and Sludge Blending Tank
* Vacuum Filter and Vacuum Pump
* Poor Operation and Maintenance of Entire Treatment Plant

Hydrogen sulfide produces a detectable odor at levels as low as 0.05 ppm (by volume). A disagreeable level may be detected at any range between 0.1 ppm and 2.0 ppm. The sulfide content of the wastewater reaching the Arlington treatment plant is estimated to range from zero to 20 ppm. Because of the potential for levels of hydrogen sulfide in this range, the unit processes preceding the activated sludge aeration basin are potential odor sources.

These components include the bar screen, the grit chamber/preaeration tank, and the primary clarifiers. The potential exists for the preaeration tank to strip out hydrogen sulfide and ammonia rather than oxidize it, due to the short maximum detention period in the tank. Secondary sources of odors from these units may result from products of decomposition from organic debris, scum, slimes, and grit that are not properly handled by the operators. Odors may also be released by turbulence caused by the flumes and overflow wiers. Excess solids build-up in the primary clarifier may also be a cause of odor.

The potential for odor from sewage treatment plants is wholly due to the possible occurrence of malodorous inorganic (sulfides and ammonia) and organic (mercaptans) chemical compounds in reduced states; such compounds occur during periods of septicity when dissolved oxygen concentrations in sewage are depressed to the point that oxygen is absent. In the presence of some dissolved oxygen, sulfur exists in the oxidized sulfate or sulfite form and nitrogen in the oxidized nitrate or nitrite form; compounds containing these chemical radicals are odorless or inoffensive.

1) Currently Proposed Odor Control

Within the sewage treatment plant's process sequence, points, where septicity and consequent odor problems are most likely to occur, are the raw sewage influent and solids handling processes. The proposed process design for the

Arlington-East District treatment plant includes an aerated grit chamber -- preaeration tank as the first process unit. Introduction of diffused air into the incoming sewage flow in this unit will correct septicity, oxidize any reduced compounds of sulfur and/or nitrogen, and alleviate any odors prior to passage of the flow to open tankage in liquid-phase treatment units within the plant process sequence.

Solids removed from the plant's liquid flow stream include screenings, grit, and primary and secondary sludges. Screenings will be lifted by mechanical bar screens to a trough above the screen channel; screenings will be allowed to drain while on the trough with excess water dropping back by gravity to the channel below. Dewatered screenings will be removed to covered storage containers periodically by manual forking and removed from the plant site routinely in covered containers for disposal by burial. The screen and dewatering trough are enclosed in a steel housing which will minimize and localize any resultant odors.

Velocities and turbulence will be controlled in the grit chamber by diffusion of compressed air into the liquid flowing through; selective sedimentation takes place therein with heavy inorganic solids (grit) settling out to grit collection hoppers and lighter organic sewage solids carrying through in suspension. Periodically grit will be removed from storage hoppers by water jet eductors and piped to an enclosed overhead storage tank. Hydraulic design of eductor discharge piping is such that the grit is washed during transfer to the storage tank with organic solids being returned to the sewage flow with "spent" eductor water. Grit will be removed periodically from the overhead storage tank through a hopper bottom to dump trucks for removal from the plant site. In keeping with present State law, dump trucks will be covered by tarpaulin when hauling grit from the site. Inasmuch as the grit chamber is aerated, septicity and odors will not occur in normal operations; eductor discharge piping and grit storage are enclosed systems so that escape of any odor is physically prevented. Clean washed grit is non-odorous, being used widely as sand fill in treatment plant yards without creation of nuisance. Even if some traces of organics remain in grit being trucked away, escape of odors to the atmosphere will be physically prevented by the canvas cover. Condition of grit will be such that it can be landfilled without nuisance.

Primary and cosettled waste activated sludges will be withdrawn from thickener compartments (hoppers) in the bottoms of primary claifiers by means of closed primary sludge pumping - piping systems. Suction arm clarifier mechanisms will be used in secondary clarifiers, which mechanisms will withdraw secondary sludge to a well open to the atmosphere from which return sludge will be returned by pumping to the aeration tanks and waste sludge will be pumped to the primary clarifiers for thickening by cosettling. Even though the sludge well in each secondary clarifier will be open to the atmosphere, odor will be minimal because the rapidity with which sludge will be collected and lifted to the well precludes the possibility of its becoming septic.

From the primary sludge pumps, thickened cosettled sludge will be transferred via enclosed piping system to covered sludge holding tanks. Anaerobiosis, development of septicity, and generation of potentially malodorous gaseous digestion products will occur in the sludge holding tanks. Gases produced in holding tanks will be passed through a catalytic incinerator for oxidation to non-odorous chemical states prior to venting to the atmosphere. Sludge will be withdrawn routinely from holding tanks via enclosed piping systems to a heat treatment system for conditioning prior to dewatering by vacuum filtration and disposal by multiple hearth incineration. The heat treatment process will produce an essentially sterile sludge devoid of biological organisms which could otherwise further anaerobic decomposition, septicity, and malodorous gas production. Because of its sterility, sludge will be free from odors in those handling, treatment and disposal processes following heat treatment, i.e., vacuum filtration, incineration, and ash disposal.

In summary, the combined vapor from centrifuges, vacuum pumps and filters, and sludge-blending tanks are proposed to be routed to the inlet air fan of the multiple hearth incinerator. When the incinerator is in operation, this is an excellent means of odor control. However, normal operating procedures will inevitably result in the incinerator being out of operation, while the rest of the sludge handling equipment is still in use. During these periods, no odor control would be utilized.

Vapors from the sludge storage and sludge decant tanks are the most concentrated of all sources. The present method of oxidation by catalytic incineration is an effective system for control of those odors although no backup system is proposed.

Four basic areas of odor impact from the proposed sewage treatment plant operation have been addressed as follows:

* Increase in intensity of odors
* Increase in frequency of odors
* Variation in odors with distance from the plant site
* Variation in odors with direction from the plant site

Evaluation of impact is somewhat subjective because of the difficulty in quantifying odors analytically and correlating it with effects on human physiology. The primary tool that was used in developing the evaluation was a public opinion survey. Additional tools were provided by engineering evaluation of odor control technology currently in use as well as climatological information.

In order to determine the degree to which odor would increase, comparisons were made between the survey responses from Holly Oaks and the combined responses from Canton and Ft. Lauderdale. This approach provides a reasonable assessment of 'before' and 'after' reactions. Holly Oaks was labelled the 'control' group and the combined responses from Ft. Lauderdale and Canton were labelled the 'test' group.

Although no precise incremental adjustment can be made to the baseline responses from Holly Oaks, Table 3-1 presents an approximation of the increase in response frequencies which might be expected due to differences in survey results between the test and control groups. Preliminary analysis of the trend of all responses indicates that a 10 to 20 percent increase in degree and frequency of odor pollution annoyance would be a reasonable estimate of impact from the proposed sewage treatment plant on the Holly Oaks community.

Inasmuch as the test group percentages presented in Table 3-1 represent responses to any and all odor sources from the test site, a refinement of this group to eliminate that inherent bias is required. This may be accomplished by eliminating all respondents except those who identified the plant as the major source of odor (A7H) from analysis. Table 3-2 presents how respondents, who identified the plant as a source of odor, answered pertinent survey questions.

Table 3-1 Differences in Frequency of Response, Test and Control Groups

	Test Group*		Control Group*		Percent Difference
1. Respondents who noticed and were bothered by odors (Q7A & Q7E)	44.6	-	33.3	=	+11.3
2. Respondents who were bothered much or very much (Q7A & Q7E)	19.1	-	9.1	=	+10.8
3. Respondents who were bothered one-half or more of the time (Q7A & Q7E)	29.6	-	12.1	=	+17.5
4. Respondents who felt odor pollution has reduced the value of their homes (Q9A)	18.9	-	0.0	=	+18.9
5. Respondents who ever seriously considered moving away because of odor pollution (Q10)	11.9	-	0.0	=	+11.9
6. Respondents who have requested action by some authority or government agency (Q14A)	12.9	-	0.0	=	+12.9
7. Respondents who were willing to sign a complaint concerning odor pollution (Q15A)	31.3	-	27.3	=	+ 4.0

*"Test" group is Fort Lauderdale and Canton, combined.
"Control" group is Holly Oaks

Table 3-2 Odor Impact Cross-Tabulations of Responses to Questions

		(Q7H) Respondents who identified plant as a source of odor (by %)		
		Canton, Ohio	Ft. Lauderdale, Florida	Holly Oaks, Florida
(Q1) In general, how would you rate your area of the city as a place to live?	Excellent	26.3	12.5	45.5
	Good	63.2	17.2	45.5
	Fair	10.5	46.9	6.1
	Poor	-	15.6	3.0
	Very Poor	-	6.2	-
	Don't Know	-	1.6	-
(Q3A) How would you rate the air pollution problem in your area of the city?	Serious	15.8	26.6	6.1
	Somewhat Serious	31.6	25.0	24.2
	Not Serious	50.0	45.3	69.7
	Don't Know	2.6	1.6	-
	No Answer	-	1.6	-
(Q7E) How much have these odors bothered you?	Very Much	13.2	35.9	6.1
	Much	23.7	7.8	3.0
	Moderately	28.9	28.1	6.1
	Little	13.2	10.9	15.5
	Very Little	15.8	9.4	76.3
	Don't Know	-	-	-
	No Answer	5.3	7.8	-
(Q7F) How often have these odors bothered you?	Very Often	7.9	21.9	0.0
	Often	10.5	23.4	6.1
	About half the time	18.4	26.5	6.1
	Infrequently	57.9	3.1	88.8
	Very Infreq.	-	1.6	-
	Don't Know	-	-	-
	No Answer	5.3	7.8	-
(Q9A) Do you feel that odor pollution has reduced the value of your home in any way?	Yes	36.8	32.8	0.0
	No	60.5	54.7	100.0
	Don't Know	2.6	12.5	-
(Q10) Have you ever seriously considered moving away from here because of odor pollution?	Yes	18.4	25.0	0.0
	No	81.6	68.7	100.0
	Don't Know	-	6.3	-

Table 3-2 (Continued)

		(Q7H) Respondents who identified plant as a source of odor (by%)		
		Canton, Ohio	Ft. Lauderdale, Florida	Holly Oaks, Florida
(Q14A) Have you ever requested any agency to take action concerning odor pollution in your area of the city?	Yes	34.2	17.2	0.0
(Q15A) Would you be willing to sign a complaint about odor pollution?	Yes	42.1	40.6	27.3
	BASES	38	64	33

Several interesting observations can be made from evaluation of Table 3-2. A solid majority of respondents from Canton who identified the test plant as a source of odor, indicated that they felt that their area of the city was an excellent (26.3 percent) or a good (63.2 percent) place to live. Yet of this group, 18.4 percent seriously considered moving because of odor pollution from the sewage treatment plant and 36.8 percent felt that the value of their homes had been reduced. This latter figure closely matches 36.9 percent who indicated that odors bothered them much or very much. These odors have bothered 36.8 percent of these same respondents over half of the time. Compensation for baseline response by the control group indicates an 18 to 37 percent increase in frequency of response to four pertinent questions as shown in Table 3-3. Evaluation of the data in Tables 3-1 through 3-3 indicates that there is a definite increase in both frequency and intensity of annoyance in sample groups influenced by existing sewage treatment plants over the control group.

Table 3-3 Differences in Frequency of Response between Canton Respondents Who Identified Test Plant as a Source of Odor and the Control Group.

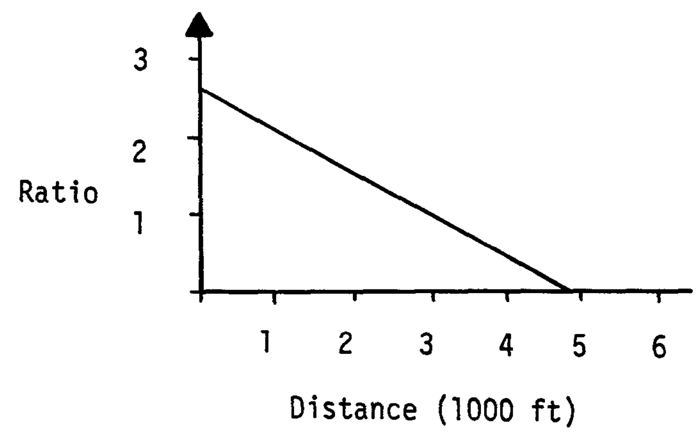
	Canton Group		Control Group		Percent Difference
1. Respondents who were bothered much or very much (Q7A & Q7E)	36.9	-	9.1	=	+27.8
2. Respondents who were bothered one-half or more of the time (Q7A & Q7F)	36.8	-	12.2	=	+24.6
3. Respondents who feld odor pollution had reduced the value of their home (Q9A)	36.8	-	0.0	=	+36.8
4. Respondents who ever seriously considered moving away because of odor pollution (Q10)	18.4	-	0.0	=	+18.4

Correlation of Odor Impact With Distance

In order to predict the impact of projected odors over distance, a least-squares linear regression was performed on the ratios presented in Figure 3-14. The result, as shown below, is represented by the equation: y= -.000557 X +2.65 and has a correlation coefficient of r + -.6658.

FIGURE 3-14

Projection of Odor Impact Over Distance



The plot shows how the people who identified the plant as the major source of odor are likely to be distributed over distance. It further indicates that people will identify the plant as the major source of odor up to a distance of 4750 ft. Based on the data in the previous section, a conservative assumption that the proposed Arlington-East Sewage Treatment Plant will result in a 20 percent increase in the frequency and intensity of odor annoyance is reasonable. Based on the calculated distribution, the percent increase in annoyance responses due to the plant for each 500-foot interval at any site is presented in Table 3-4.

Correlation of Odor Impact With Azimuth

In order to determine the impact of odors based on direction, the survey responses from Ft. Lauderdale and Canton were matched with the corresponding meteorological data from each site. The distribution of responses by

TABLE 3-4

IMPACT OF A PROPOSED SEWAGE TREATMENT PLANT
AS A FUNCTION OF DISTANCE FROM THE PROPOSED SITE

Interval	Percent of People in Each Interval who will identify Plant as Major Source of Odor
0- 500	39.9%
500-1000	35.5%
1000-1500	31.0%
1500-2000	26.5%
2000-2500	22.1%
2500-3000	17.8%
3000-3500	13.3%
3500-9000	8.9%
4000-4500	4.4%
4500-5000	0.0%

$$\text{Average} = \frac{199}{10} = 19.9\%$$

aximuth are shown in Table 3-5 along with the corresponding frequency of occurrence for wind.

Since r, the coefficient of correlation, is quite low at each test plant, there is no means of accurately projecting odor impact as a function of direction from the proposed site. This lack of correlation between odor response and wind frequency of occurrence simply means that other factors such as site topography and atmospheric stability are dominating the dispersion of the odor.

Impact Analysis of Millcoe Road Site

The percent frequency of atmospheric inversions and low nocturnal surface winds for the area is shown in Table 3-6. The wind rose for the Jacksonville area is shown below, Figure 3-15, indicating the percent of time wind blows from each of the specified directions.

TABLE 3-5

DISTRIBUTION OF SURVEY
RESPONSES BY AZIMUTH

	CANTON, OHIO		FT. LAUDERDALE, FLA.	
Octant	Responses (Percent)	Wind Freq. To (Percent)	Responses (Percent)	Wind Freq. To (Percent)
N	18.0	14.6	16.0	7.8
NE	4.5	21.8	11.0	5.9
E	0.0	14.5	17.2	15.7
SE	10.7	14.5	13.5	10.8
S	8.6	7.3	11.1	4.9
SW	22.1	9.1	9.8	7.8
W	11.2	7.3	11.4	21.6
NW	24.9	10.9	9.8	25.5

$Y = -.699\ X + 21.9$ $\qquad$ $Y = -.0365\ X + 12.9$

$r = -.397$ $\qquad$ $r = -.0994$

TABLE 3-6

PERCENT FREQUENCY OF ATMOSPHERIC INVERSIONS
(UNDER 500 FEET)
JACKSONVILLE U.S. NAVAL AIR STATION (HOSLER, 1961)

SEASON	LOCAL STANDARD TIME NOCTURNAL 0700	2200	DAYLIGHT 1900	1000	TOTAL TIME	PERCENT OF TOTAL TIME NOCTURNAL SURFACE WIND ≤ 7 MPH
Winter	59	69	44	27	40	60
Spring	61	53	10	4	28	63
Summer	56	38	11	1	23	75
Fall	71	51	37	12	41	63

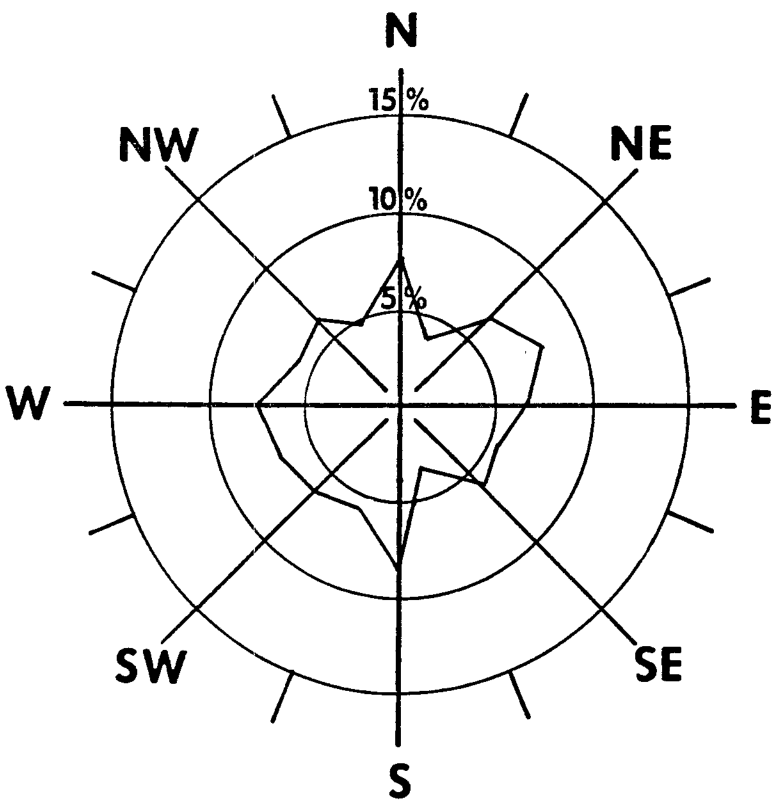


FIGURE 3-15

JACKSONVILLE WIND ROSE

The relatively high probability of nocturnal inversions and low velocity surface winds (28 to 60 percent) supports the use of an odor model in which frequency of annoyance varies with distance rather than aximuth. Fortunately, the results of the public opinion survey are such that it was possible to develop this type of model and calibrate it to a reasonable fit with the survey data from two test sites.

An increase in percentage of annoyance due to the sewage treatment plant will be observed out to a distance of 4500 feet from the center of the plant. It should be noted that this increase is based on the conservative assumption that the difference in response between the test and control group was 20 percent.

A generalized model for identification of treatment plant odor with distance has been developed. The projected percentage of people within each 500-foot interval who will identify the plant as the major source of odor is shown in Figure 3-16.

2) Additional Odor Controls

Good housekeeping is perhaps the most effective means of controlling odors at a sewage treatment plant. Wiers, grit hoppers, bar screens and so forth must be constantly cleaned to minimize odor generation.

Two odor control strategies to mitigate the potential emission of odorous gases from the proposed Arlington-East Regional Sewage Treatment Plant are evaluated as follows:

* Modify plant design to prevent odor detection outside plant boundaries.

* Develop measures to control odor episodes without modifying plant design.

(a) Structural Alternative

Physical confinement of odors through the use of enclosures has been shown to be effective at wastewater treatment plants in Florida and throughout the United States. Once the odors have been confined they may be controlled by incineration, scrubbing, adsorption, ozonization, additives, and dilution. Depending on the source, volume, and concentration of odors

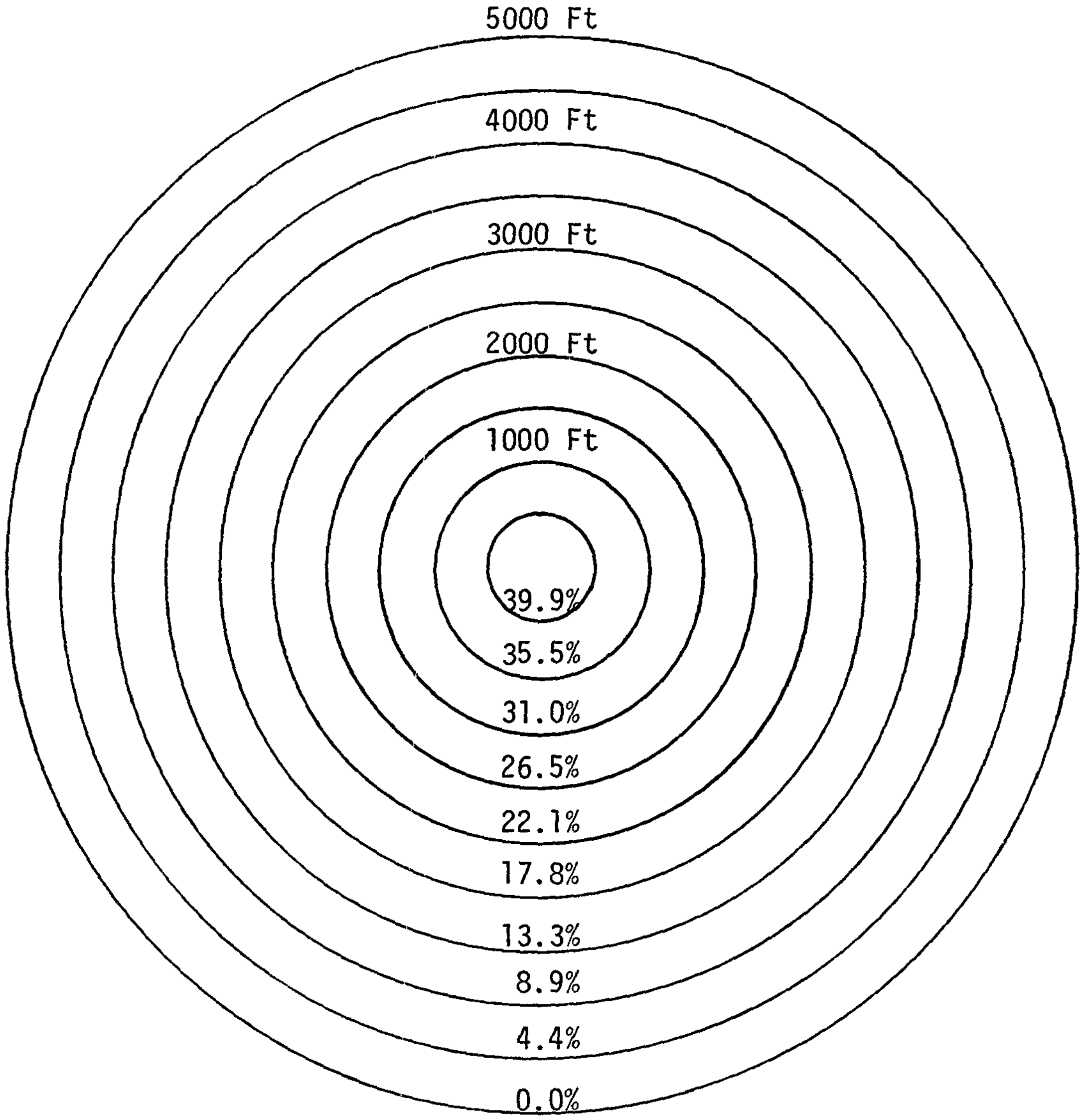


FIGURE 3-16

Generalized Impact Model
Percent of People Who Will Identify Plant
As Major Source of Odors

the cost effectiveness of one or more of these alternatives may be evaluated.

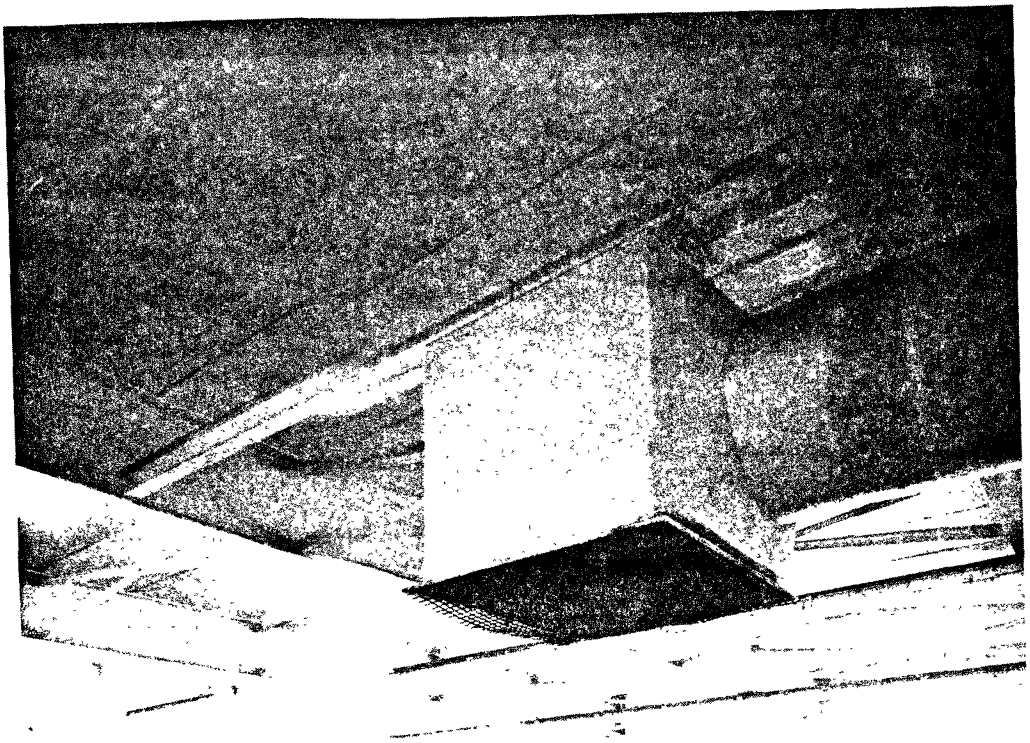
Based on this evaluation, two design alternatives for mitigative measures are presented:

> Alternative 1: This alternative recommends enclosing the bar screen/preaeration tank in a building and covering the primary clarifiers with fiberglass domes with enclosed walkways. A wet scrubbing system similar to that illustrated in Figures 3-17 through 3-20 will be required to treat the vapors. The collection devices of such a system include air collection devices such as hoods (Figure 3-17), and blowers (Figure 3-18), mixing and monitoring equipment (Figure 3-19) and counter-current packed tower scrubber (Figure 3-20).
>
> Alternative 2: This alternative recommends a backup wet scrubbing system for the combined vapors from centrifuges, vacuum pumps and vacuum filters, and sludge blending tanks.

A schematic flow diagram for the two alternatives is shown in Figure 3-21. Conceptual design parameters are shown in Table 3-7.

There is no precedent for predicting the reduction in odor response which will result from the implementation of mitigative measures. A survey taken before and after the proposed action would have to be conducted at a selected site over an interval of several years to develop guidelines for evaluation of the effects of odor control technology.

A reasonably accurate prediction can be made, however, of source reductions of odor emissions due to odor control measures. The implementation of Alternative 1 and Alternative 2 in combination with the odor controls previously planned for the Arlington Treatment Plant should result in all major potential odor sources being brought under control. An estimated 90 percent of potential odor emissions should be removed by these treatment techniques. Minor sources of potential odor emissions should be effectively controlled by good operational and maintenance practices.



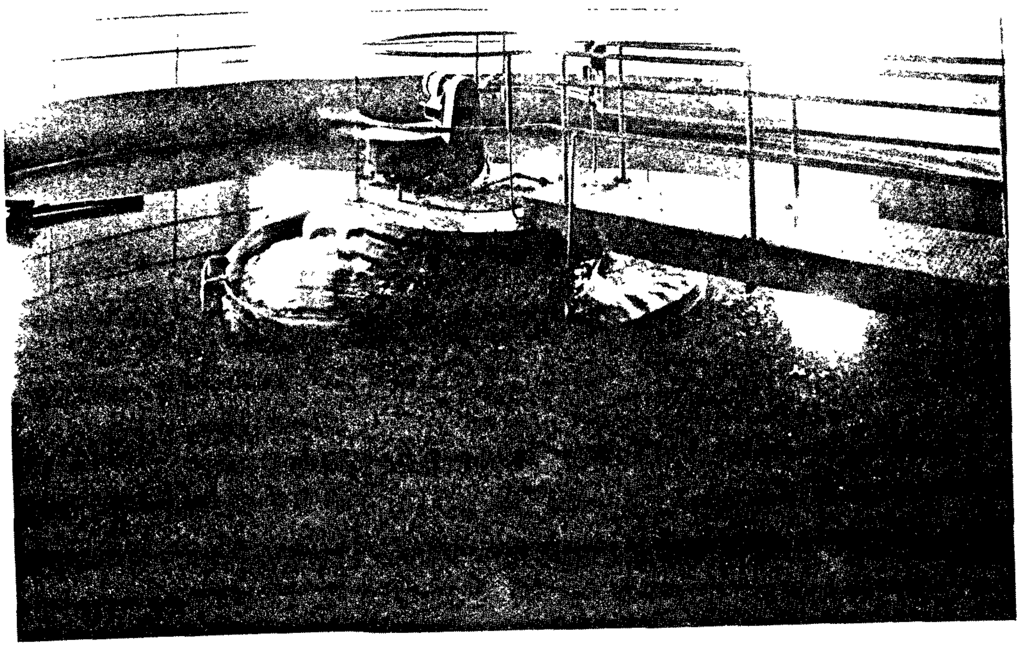


FIGURE 3-17

VENTIL. ION DUCT OVER PRIMARY CLARIFIER

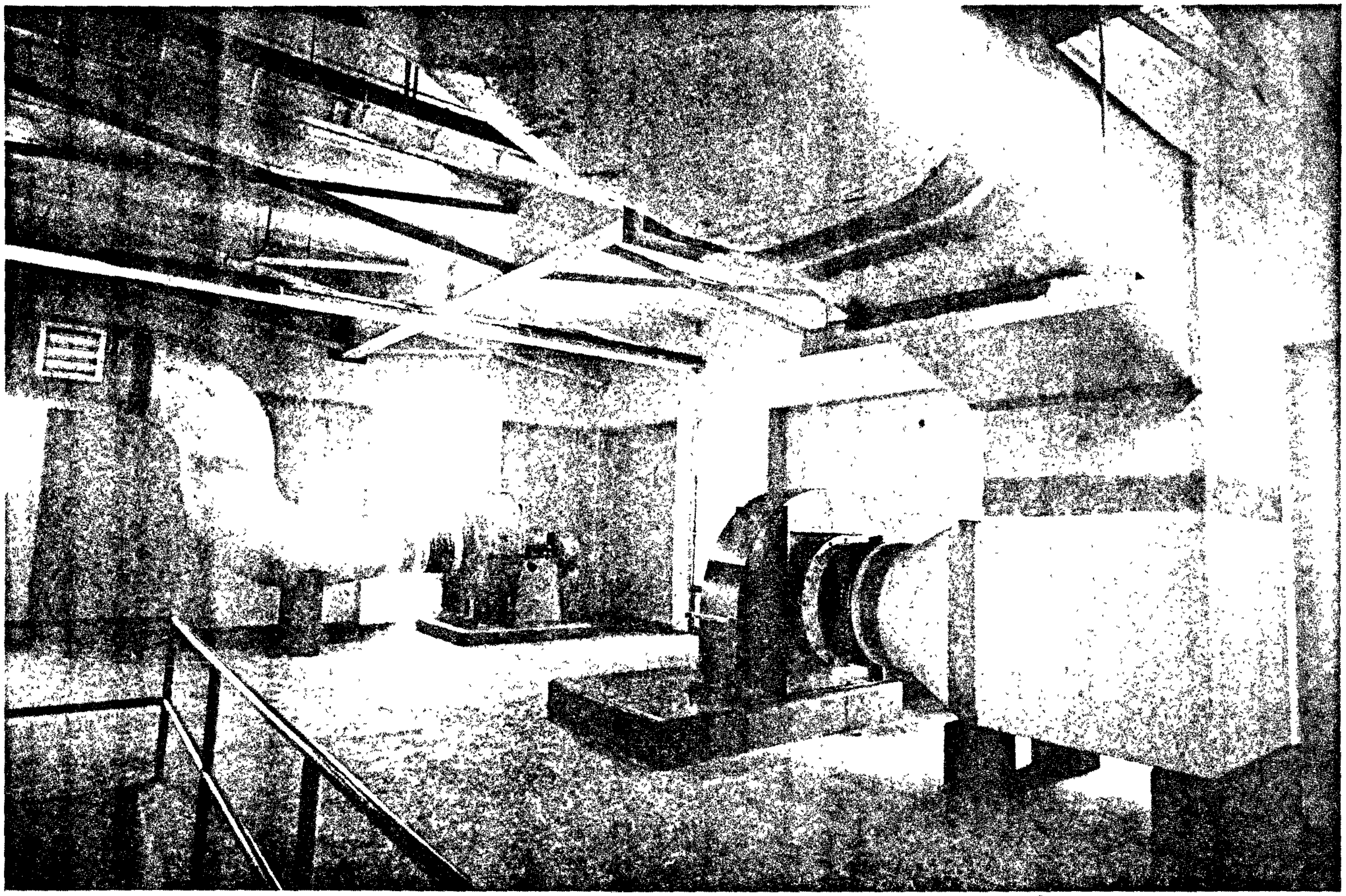


FIGURE 3-18

VENTILATION DUCTS AND BLOWERS

FIGURE 3-19

HYPOCHLORITE MIXING SYSTEM FOR WET SCRUBBER

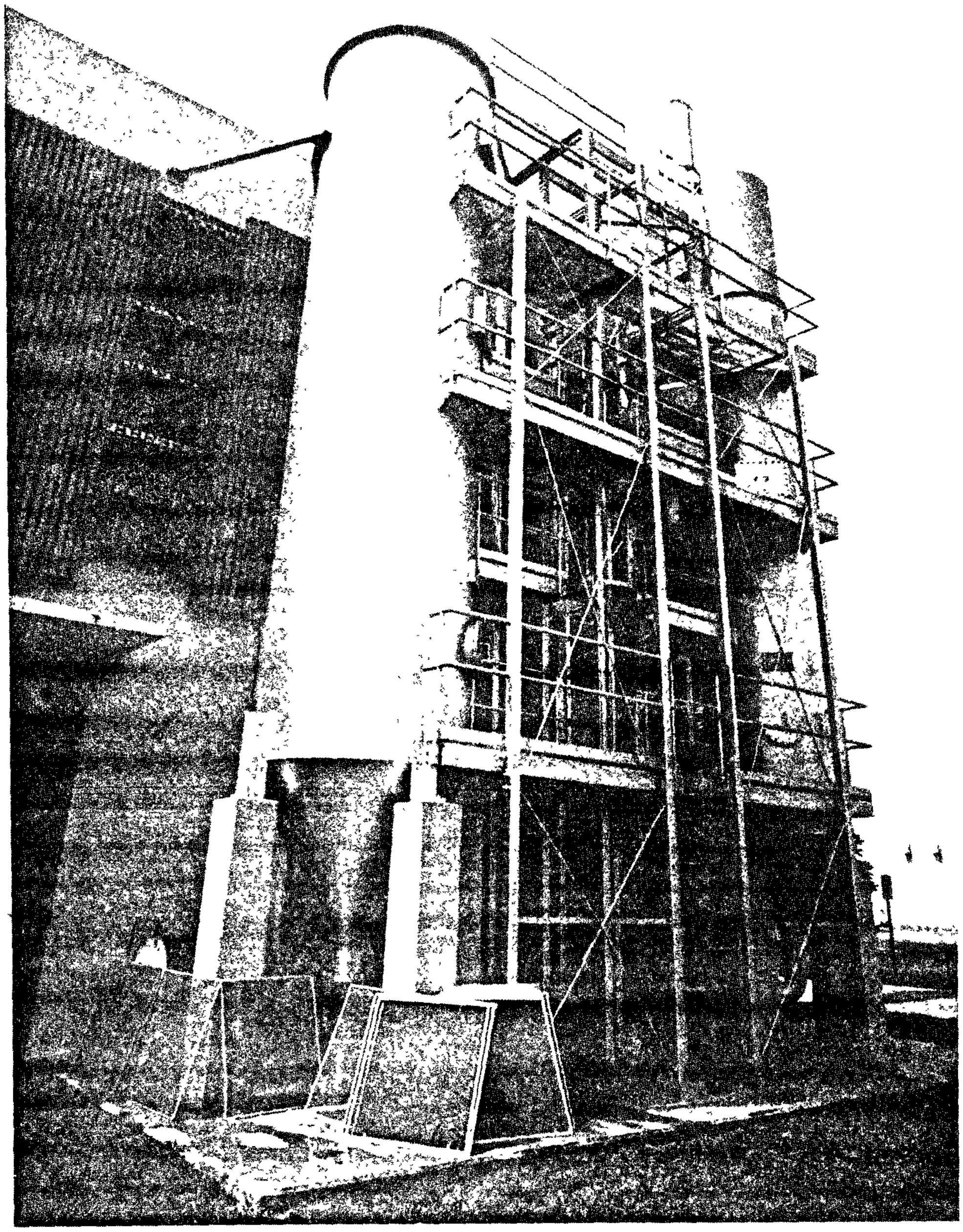


FIGURE 3-20

PACKED TOWER WET SCRUBBER

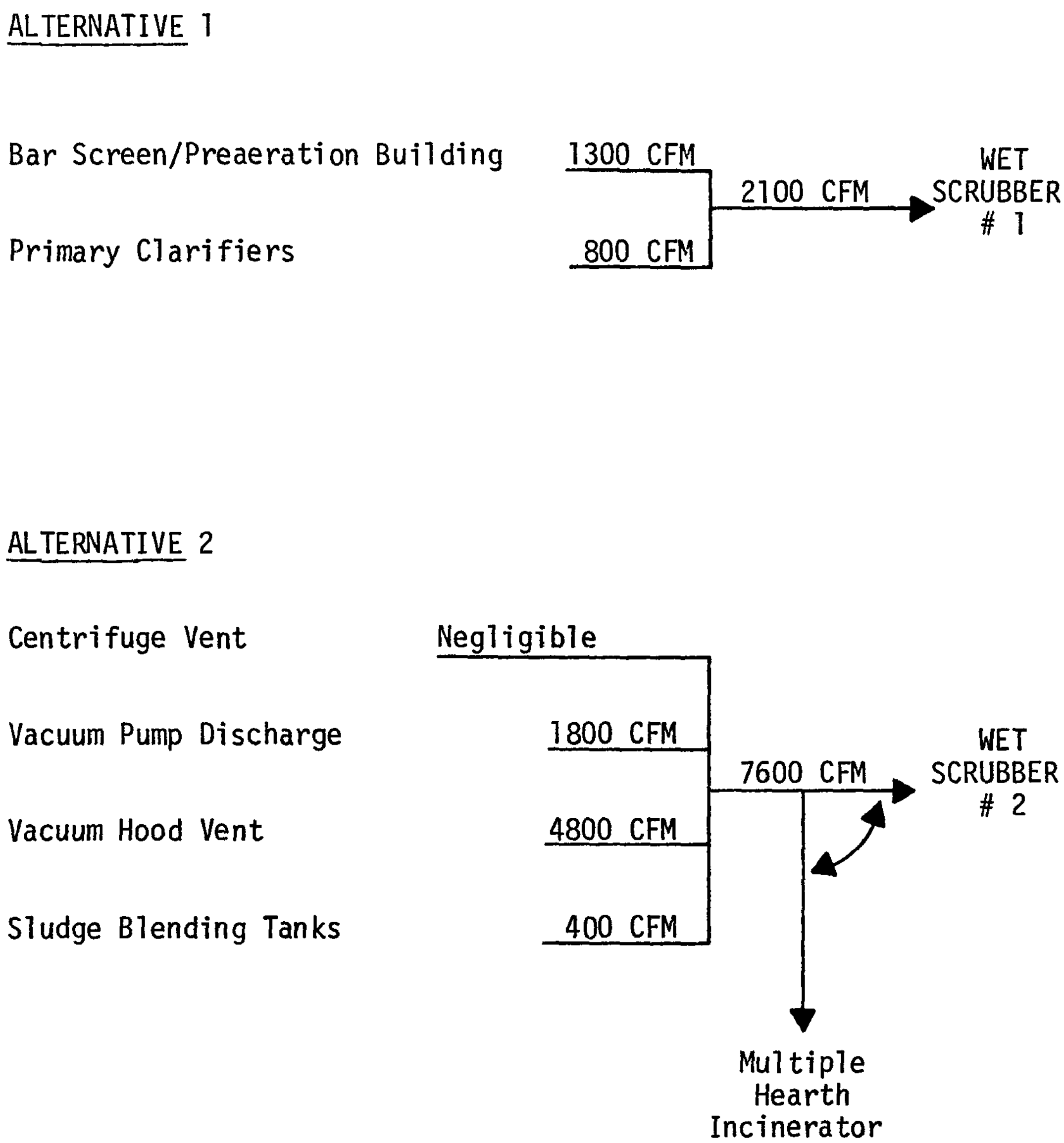


FIGURE 3-21

Flow Diagram of Recommended Odor Control For
Arlington East Regional Sewage Treatment Plant

Table 3-7 Wet Scrubber System Conceptual Design Parameters

	Wet Scrubber # 1	Wet Scrubber # 2
Design Flow[1]	2100 CFM	7600 CFM
Maximum Sulfide Concentration	20 ppm	20 ppm
H_2S Removal	99.9%	99.9%
Type	Counter-current packed tower	Counter-current packed tower
Material	Reinforced fiberglass body with corrosion-resistant internal	Reinforced fiberglass body with corrosion-resistant internal
Packing Material	Plastic media	Plastic media
Height of Packing	10 Ft	10 Ft
Diameter of the Scrubber	3 Ft	6 Ft
Diameter of the Duct	1 1/6 Ft	2 Ft
Length of Duct	40 Ft	180 Ft
Chemical Usage[2]	50% NaOH @ 2/gal/day	50% NaOH @ 4 gal/day

[1]Based on maintenance of negative pressure for closed systems and three air changeovers/Hr in working areas.

[2]Hypochlorite may also be used in place of NaOH.

A very low, yet detectable, odor will probably be noticeable on the plant site for short periods of time under certain atmospheric and plant operating conditions. This type of odor episode would be generally due to operator error, equipment failure, or a maintenance oversight, and should be correctable once detected. It is not possible to completely eliminate these types of minor odor episodes. However, they may be mitigated by proper operator responses.

(b) Nonstructural Alternatives

The alternatives available to control potential odor episodes without significant modification of the plant were evaluated. This type of strategy includes, at a minimum,, the following elements:

* Rigorous and frequent maintenance of all equipment
* Steady state wastewater inflow with no surges in hydraulic or constituent loading
* Elimination of hydrogen sulfide in influent wastewater.
* Continuous clean-up of all process equipment.
* Frequent use of chemical deodorizing agents throughout the treatment plant.
* Sufficient operator control to eliminate process upsets.
* Development of a rapid response odor episode contingency plan.

This type of control strategy is extremely difficult to implement because of the complexity of the treatment plant, the infinite number of operational and maintenance problems which will arise as the plant is brought into service, and the ever present potential for a process upset due to influent loading variations. For example, deodorizing and masking chemicals around the grit chamber and the preaeration tank may provide excellent control over a period of time. However, a surge of high hydrogen sulfide concentration in the wastewater influent would render a chemical dosing operation ineffectual. If a constituent in a surge of wastewater were phenol, for example, a chlorine based odor control chemical would react to form highly malodorous chlorophenols.

A control strategy based solely on operator dependent measures, such as those discussed, will not control potential odors from the Arlington-East Regional Sewage Treatment Plant below the threshold of annoyance in the surrounding community. In-plant survey results indicate that the techniques discussed above are essential to good odor control, and that they are effective a high percentage of the time. However, plant conditions frequently occur which make such controls ineffectual for varying periods of time.

A well operated and maintained sewage treatment plant will generate a minimum amount of odors at a low frequency of occurrence. However, the proximity to nearby residents, the inherent variability in a control strategy based entirely on human operator control, and the potential for odor episodes due to wastewater influent surge loadings and past experiences of three similar sewage treatment plants indicate that this control strategy will not substantially reduce potential odor emissions at the source and consequently will not substantially mitigate the potential impact of the Arlington-East Regional Sewage Treatment Plant.

3) Summary

Since odors from the plant without additional controls are anticipated, all sites which have the potential for residents experiencing nuisance odors will include the additional odor controls described herein.

These controls include enclosing the bar screen/preaeration tank in a building and covering the primary clarifiers with fiberglass domes. Also, a wet scrubbing system will be required to treat vapors. The collection devices of this system will include air collection devices, mixing and monitoring equipment, and a countercurrent packed tower scrubber. A backup wet scrubbing system for the combined vapors from centrifuges, vacuum pumps and vacuum filters, and sludge blending tanks will also be included.

f. Noise Control

Potential noise source in sewage treatment plants are air moving devices (fans, blowers, and compressors), liquid control equipment (pumps, valves, and vents, process machines (grinders, centrifuges), materials handling systems (conveyors, belts, hoppers, chutes, lifts), power transmission systems (gears, shafts, drives, and clutches), mechamical and electrical power systems (turbines, engines, boilers, transformer, and electrical motors), combustion systems (flare stacks, incineratiors), and miscellaneous machine shop and hand tool use. In addition, the truck traffic involved in chemical deliveries, and sludge or ash hauling are intermittent noise sources.

These sources generate noise due to impact phenomena, gas flow phenomena, perturbations in liquid flow, friction, dynamic imbalance, and combustion. Types of noise frequently differentiated are continuous noise and impulsive noise. Continuous noise may be further classified according to type of exposure as either steady-state (such as water noise from aeration basins or weirs or electrical substation hum), fluctuating noise (such as process machinery noise, and traffic noise), or intermittent noise (such as truck traffic, aircraft, and construction noise).

1) Currently Proposed Noise Control

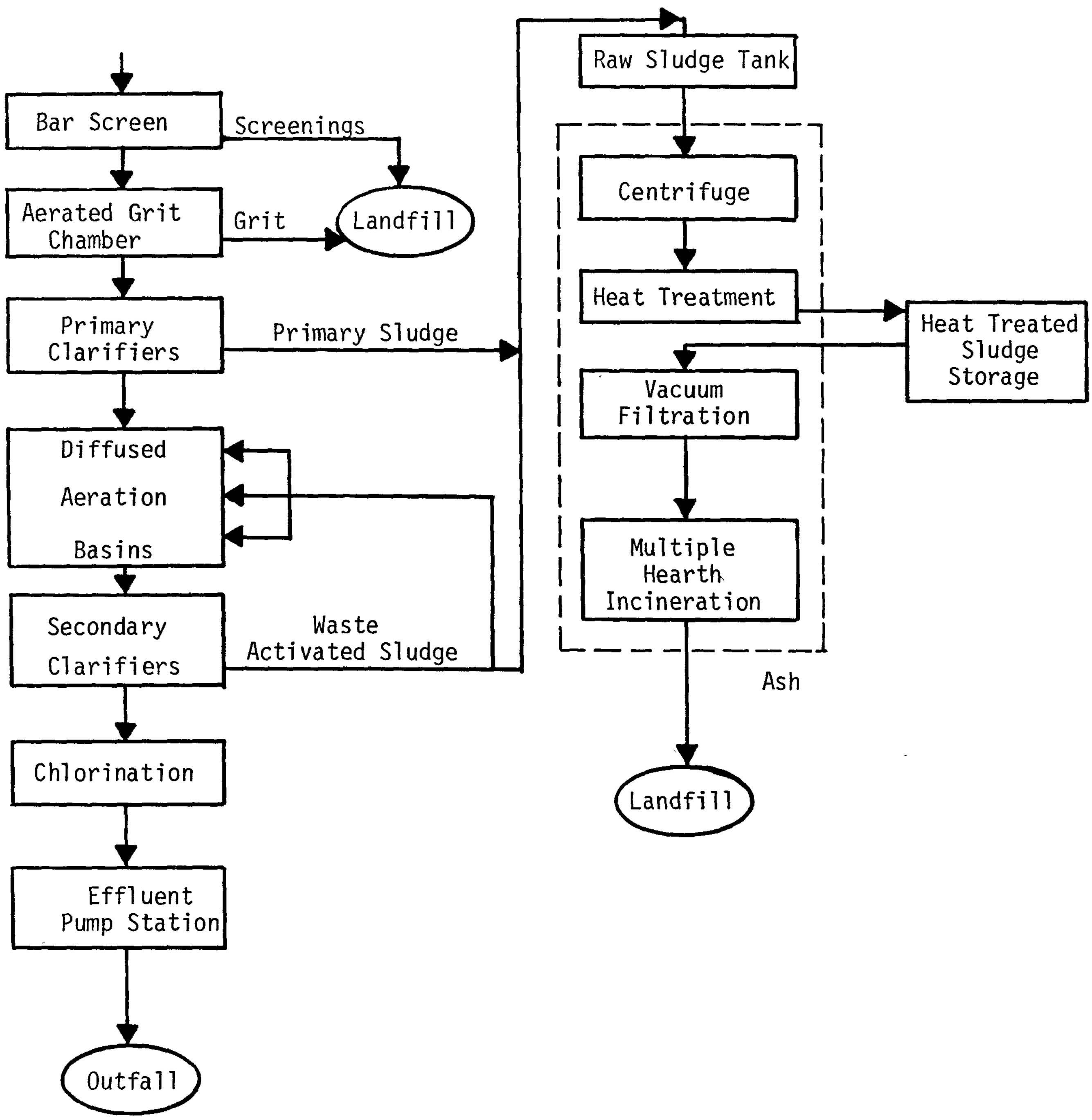
The following discussion identifies potential noise sources and describes planned noise controls for the Arlington-East Sewage Treatment Plant. The flow schematic for the plant treatment processes is presented in Figure 3-22.

<u>Bar Screen and Preaeration Tank</u>

Noise will ge generated by two blowers located in the concrete enclosure below the bar screen, the pintle type chains used to continuously clear the bar screen, and water perturbation at the influent sluice gates, preaeration tank, by-pass channel, and associated weirs. Intermittent noise will be generated by the motor controlled sluice gates, and the regular removal of grit hoppers by truck.

The bar screen is completely enclosed in a steel housing. All motors and blowers are rigidly mounted and the blowers are equipped with inlet filter silencers. Access to

Figure 3-22 Proposed Arlington East Flow Schematic.



the blower room is through one 3-foot wide door below ground level. Noise from removal and washing of grit by water jet eductor should be effectively contained in the enclosed overhead system.

Primary Clarifiers

The primary clarifiers will generate steady-state water noise from the weirs, and intermittent noise from two sludge pumps with motors. The drive units (1/2 hp, 1750 RPM Motors), sludge collection arms, and skimming devices will run continuously.

The clarifiers will be constructed of concrete with the surface above ground and open to the atmosphere. The drive units will be enclosed in fabricated steel housing; main gear and worn gear assemblies will be enclosed in cast iron housings and all gears and bearings will run in oil. The sludge pumps and motors will be located in the enclosed pipe gallery.

Reuse Water Pump Station

This pump station supplies the plant with reuse and washdown water and contains the Parshall flume for effluent flow monitoring. Reuse water is pumped by two 800 gpm pumps (60 hp motors) located in a concrete walled enclosure below ground level. However, it is open to the atmosphere. Scrubber water is pumped by two 2000 gpm pumps and motors (150 hp) fully enclosed by the concrete structure. The flume channel is open to the atmosphere.

Noise control at this pump station consists of locating the reuse pumps and the flume channel below ground level and enclosing the scrubber water pumps.

Effluent Pump Stations

Noise sources include four effluent pumps (11,574 gpm, 100-ft TDH) powered by 400 hp, 720 RPM motors, the effluent channel and wet well, and miscellaneous heating and ventilization ducts and roof fans.

The circular building fully encloses the motor room, pump room, and chlorination room. The building will be constructed with ten-inch double cavity walls with four inches each of lightweight concrete block and face brick. The roof will be built-up concrete on a four-inch concrete slab.

Wet Well Pump Station

Potential noise sources at this point are the two 2222 gpm, 46 ft. TDH pumps used to return centrate, filtrate, and scum to the influent splitter box. The pump and the motor will be totally enclosed below ground.

Chlorine Handling Facility

Although roofed, this structure is open to the atmosphere. Impact noise and intermittent noise will be generated due to handling of chlorine cylinders.

Aeration Basins

Aeration basins will generate steady-state water perturbation noise produced by intorducing diffused air into the aeration basins and water flow in distribution and collection troughs and the effluent channel. Other potential noise sources from this source include sludge and scum pumps and motors. If mechanical aeration is used in place of diffused aeration, the aerator motors would be an additional noise source.

Sludge and scum pumps will be located in an enclosed pipe gallery. The aeration tanks will be constructed above ground and are open to the atmosphere. Their configuration will tend to direct much of the noise vertically.

Blower Building

The blower building supplies air for the diffused aeration basins and is the primary potential noise source in the wastewater treatment chain. It will house three multi-stage centrifugal blowers (13,000 CFM each) with motors (3600 RPM). Inlet air enters through louvers at ground level at the southwest corner of the building. Other noise sources include three roof fans (2 hp, 13,600 CFM each) and ventilation inlet louvers on the east end of the building.

Each blower will have a 24-inch straight through absorption type silencer on the intake line and a 20-inch silencer on the discharge line. In addition, an inlet air baffle chamber is planned to reduce direct propagation of blower noise through the inlet louvers. The building itself will be constructed with ten-inch thick cavity walls made of four inch lightweight concrete block and four-inch face brick with an air space in between. Aluminum roll-up doors and louvers are not specified. The roof is to be built-up over concrete double tee sections.

Secondary Clarifiers

The construction and configuration of the secondary clarifiers is similar to that of the primary clarifiers. The clarifiers will be equipped with four return sludge pumps (4629 gpm, 7 ft TDH) located inside the adjoining galley structure powered by motors (15 hp, 495 RPM) located outside the structure. Two waste sludge pumps (340 gpm, 24.34 ft TDH) will also be located inside the structure. Eight roof fans (1/2 hp, 700 CFM) with two drive motors (3/4 hp) will utilize 26 square feet of inlet and exhaust louvers are specified. Louvers are not specified to have the acoustic dampening characteristics.

Sludge Storage and Control Building•

Sludge from primary and secondary clarifiers will be pumped to a covered storage tank prior to heat treatment. The sludge control building houses the following noise sources: two sludge transfer pumps (200 gpm, at 30 ft TDH), two sludge recirculation pumps (350 gpm at 17 ft TDH), four roof fans totaling 22,600 CFM, and a 200 SCFM catalytic incinerator vented through a roof stack to the atmosphere.

All of this equipment is located within the control building. The building will be constructed with a ten-inch cavity wall and a built-up roof on a four inch concrete slab.

Heat Treatment and Incineration Building

This three-story building is the major potential noise source on the Arlington-East Sewage Treatment Plant site due to the large equipment access doors and the high noise levels generated by sludge handling equipment located in the building. Significant noise sources within the building include:

* Boilers
* Centrifuges
* Sludge conditioning equipment (grinders, compressors, high pressure pumps, heat exchangers, safety valves)-see Figure 3-23.

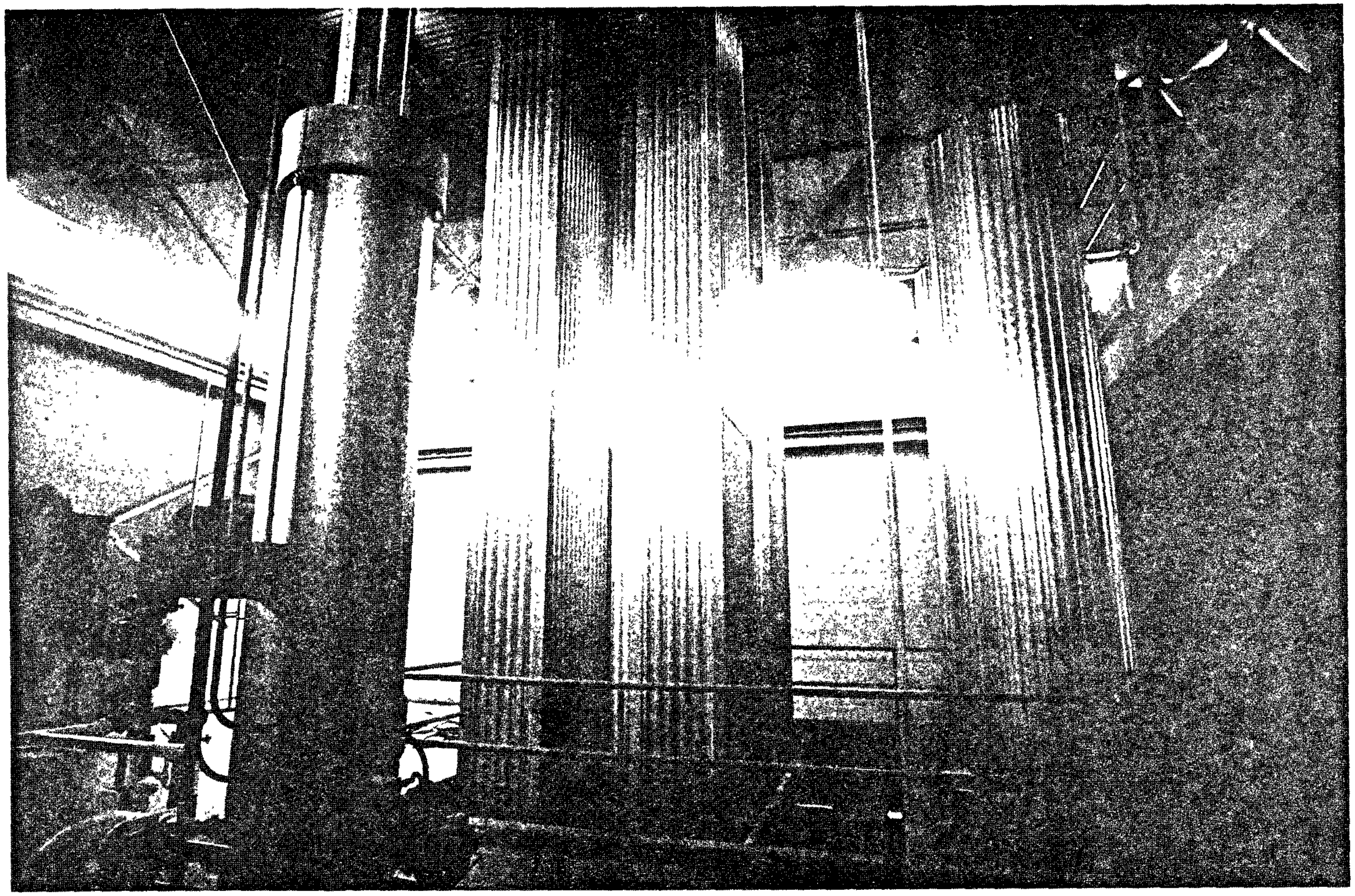


Figure 3-23

Heat Treatment Reactor and Heat Exchanger

* Multiple hearth incinerator (cooling air fan, induced draft fan, auxiliary combustion fan, exhaust gas scrubber).

* Vacuum filters (vacuum pumps, sludge cake conveyors)

* Ash conveyors (screw and bucket elevator)--see Figures 3-24 and 3-25.

* Sludge blending tanks and pumps.

Figure 3-24

Multiple Hearth Incinerator Ash Conveyor

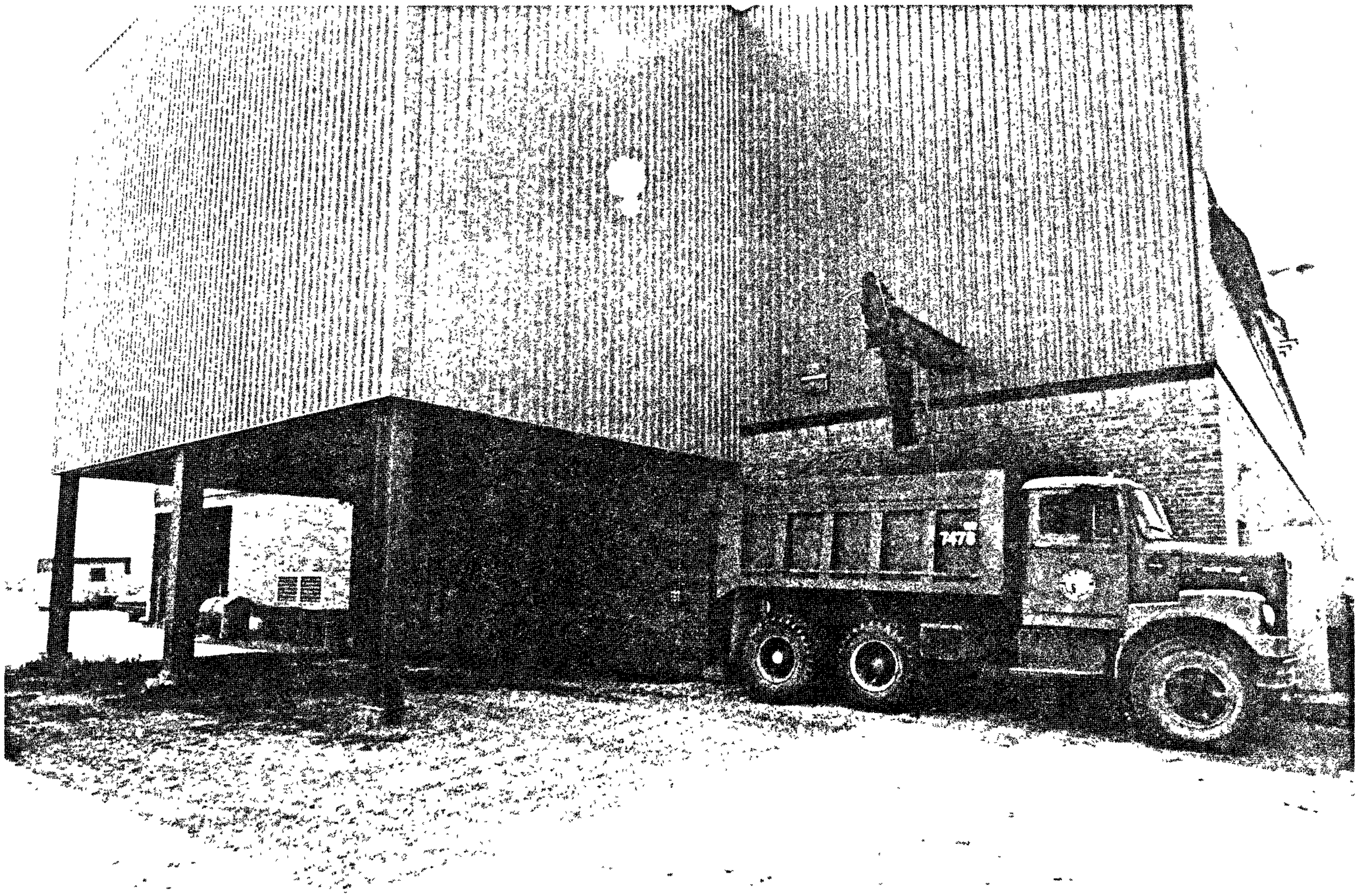


Figure 3-25

Incinerator Ash Disposal

* Heating and ventilation equipment.

Noise generated within the building may be transmitted to the outside primarily by the two 16 ft x 49 ft equipment access doors on the east wall. Minor sources include a boiler stack, a furnance and by-pass stack, the opening for the ash bucket elevator in the south wall, several access doors on the ground floor, and miscellaneous roof vents and fan outlets.

Although enclosed conveyors and hoods over the vacuum filters provide some noise control, the primary noise abatement consists of enclosure of all the above equipment within the heat treatment building. The building will be constructed with exterior walls of precast concrete double tee panels hung on a structural steel frame, the roof will be built-up lightweight concrete on a corrugated metal deck and the roll-up doors will be aluminum. With the exception of the central room, there are no apparent acoustical controls planned in the process equipment areas of the building.

Included Traffic

The volume of light vehicular traffic generated by plant operational and maintenance personnel will be insignificant; it is not anticipated either the volume or character of such traffic will noticeably alter present ambient noise levels, even on residential streets. The access road to the Millcoe Road site has not been routed yet.

The magnitude of heavy truck traffic resulting from chemical delivering; ash, grit, and screenings disposal; and septic tank and portable toilet tank truck emptying has been estimated at the equivalent of 30.14 and 48.66 one-way trips daily for plant flows of 10 mgd and 25 mgd, respectively. The noise impact of this induced traffic will be proportionate to the routes travelled and time of deliveries relative to normal traffic loads.

Operations and Laboratory Building, Shop Building

Operation of these facilities may be expected to have a noise impact similar to that of a typical garage or service station. Noise sources will include office and laboratory heating and air conditioning, machine tool use, and hand tool use.

No special noise controls are planned. This building will be constructed with a ten-inch cavity wall, a built up concrete tee section roof, and aluminum roll-up doors.

Electrical Substations

The three electrical substations could be potential sources of electrical hum typical of the pure tones generated by such equipment. However, all three substations are located in concrete block buildings with only one access door.

Survey and Modeling Results

Four basic areas of noise impact from the proposed sewage treatment plant have been addressed as follows:

*Frequency and degree of potential annoyance based on public opinion survey results.

*Percent of time that existing background noise levels will be exceeded.

*Degree of increase in background noise levels.

*Variation in noise intensity as a function of distance and direction from the plant site.

Impact on Level of Annoyance Caused by Noise

Evaluation of the public opinion survey results from Canton and Fort Lauderdale yielded the conclusion that it was not possible to use the survey results to quantitatively predict perceived response to noise in the area surrounding a proposed plant site. The public opinion survey indicated that 37.2 percent of respondents living in both survey areas felt that noise in the community was a problem but that only 2.4 percent identified the sewage treatment plant as the source of that noise. Traffic was identified as the source of noise by 61.3 percent and aircraft as the source by only 3.7 percent of all respondents.

The control group in Holly Oaks had only 27.2 percent indicate that noise was a problem, however, 50 percent of those respondents identified aircraft as the major source of noise while none identified traffic.

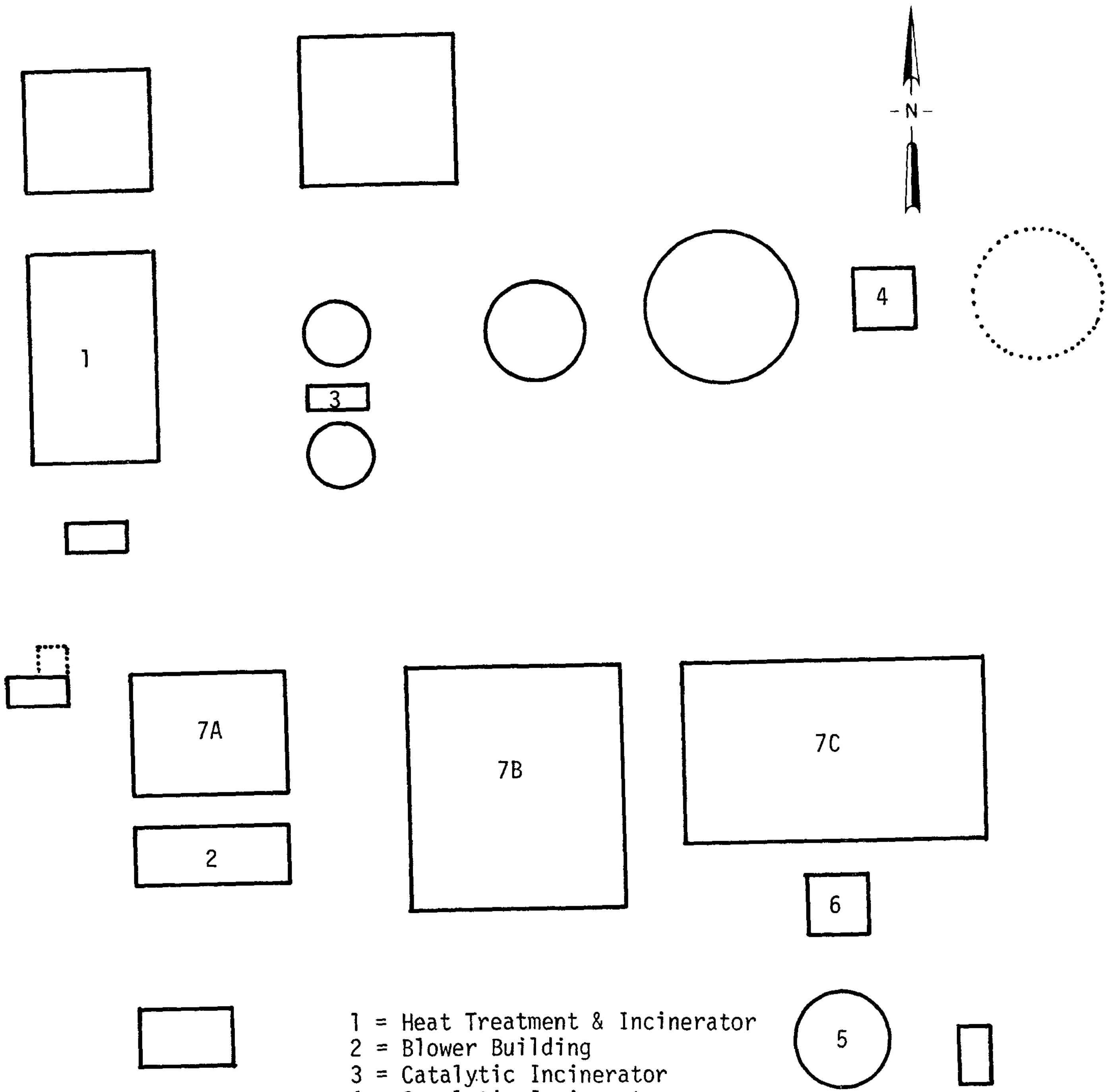
It was determined that the traffic noise impact on respondents at both test plant sites was so great that the survey results cannot be modeled and applied to Holly Oaks. The Holly Oaks survey does indicate, however, that the majority of respondents feel that aside from the intrusive periodic influence of aircraft that the community has no substantive noise problems.

The impact of noise on the Holly Oaks community was evaluated for two quantitative noise models of the proposed sewage treatment plant. The first is for a worst case situation with the plant constructed as designed and operated with no regard given to control of environmental noise. The second is for a mitigated situation where certain design modifications were made and operational criteria tightened to achieve a higher degree of control over environmental noise.

Figure 3-26 illustrates the site plan of the proposed plant with the seven projected noise sources identified. Table 3-8 shows the baseline criteria utilized in applying the two noise models.

FIGURE 3-26

PROPOSED SITE PLAN
WITH MAJOR NOISE SOURCES



1 = Heat Treatment & Incinerator
2 = Blower Building
3 = Catalytic Incinerator
4 = Catalytic Incinerator
5 = Effluent Pumping Station
6 = Water Reuse Pumping Station
7A = Primary Clarifiers
7B = Aeration Basins
7C = Secondary Clarifiers

TABLE 3-8

ASSUMED SOUND POWER LEVELS AND DIRECTIVITY INDICES FOR
ARLINGTON EAST SEWAGE TREATMENT PLANT NOISE PROPAGATION MODEL

Noise Source	Worst Case	Mitigated Case
1. Heat Treatment and Incineration Building		
A. East side	A. L_W = 115, DI = 6	A. L_W = 100, DI = 6
B. West side	B. L_W = 100, DI = 3	B. L_W = 100, DI = 3
2. Blower Building		
A. South side	A. L_W = 108, DI = 6	A. L_W = 101, DI = 6
B. North side	B. L_W = 99, DI = 3	B. L_W = 99, DI = 3
3. Catalytic Incinerator	L_W = 88, DI = 3	L_W = 88, DI = 3
4. Catalytic Incinerator	L_W = 88, DI = 3	L_W = 88, DI = 3
5. Effluent Pumping Station	L_W = 94, DI = 3	None
6. Water Reuse Pumping Station	L_W = 86, DI = 3	None
7. Aeration Basins/Clarifiers	L_W = 101	L_W = 101

For the purpose of estimating the community response to increases in background noise level, the following criteria were followed:

Increase in dBA Over Existing Background Sound Level	Estimated Community Response
0	No reaction
5	Sporadic complaints and widespread increase in annoyance
10	Widespread complaints and severe community annoyance
15	Severe complaints and strong community action

Impact of Worst Case Model on Holly Oaks

The increase on background levels at three selected sites due to worst case modeling assumptions is shown in Table 3-9. Sites B and C are located in the nearby Holly Oaks residential community. Site A may be considered to be located at the plant boundary. Application of the estimated community response criteria to the increases in levels demonstrates that for the worst case model people living in the Holly Oaks community will experience significant increases in background noise levels. Increases in the L(10) level may cause cumulative night time levels to equal or exceed the 55 dBA sound level limit of the proposed Jacksonville noise ordinance. Increases of L(90) levels ranging from 8.5 dBA in the day to 13 dBA at night may cause widespread complaints and severe community annoyance. Since the increase in L(neq) is greater than L(deq) it is probable that most of the annoyance will be experienced during the night and that it may result in sleep interference for sensitive people.

TABLE 3-9

INCREASE IN BACKGROUND NOISE LEVELS DUE TO
WORST CASE MODELING (dBA)

Background Noise Level (dBA)	Site A Day	Site A Night	Site B Day	Site B Night	Site C Day	Site C Night
L_{10}	7	6.3	2.5	3.5	0.5	2
L_{50}	11	12	7	6	4	5
L_{90}	17	18	12	13	8.5	10
L_{deq}	9.5	--	4	--	2	--
L_{neq}	--	11	--	6	--	5
$L_{d/n}$	5.5		2		1.5	

TABLE 3-10

INCREASE IN BACKGROUND NOISE LEVELS DUE TO
MITIGATED CASE MODEL (dBA)

Background Noise Level (dBA)	Site A Day	Site A Night	Site B Day	Site B Night	Site C Day	Site C Night
L_{10}	1.5	1.2	--	--	--	--
L_{50}	2.6	2.2	0.85	0.68	--	0.52
L_{90}	0.85	0.68	2.6	3.0	1.5	2.2
L_{deq}	2.6	--	--	--	--	--
L_{neq}	--	2.6	--	0.68	--	0.52
$L_{d/n}$	1.0		--		--	

Figure 3-27 represents the generalized model for noise propagation from the proposed plant for the worst case model. Equal level isopleths to the north, south, and east extend farther than to the west due to the orientation of buildings and location of openings.

Impact of Mitigated Case Model on Holly Oaks

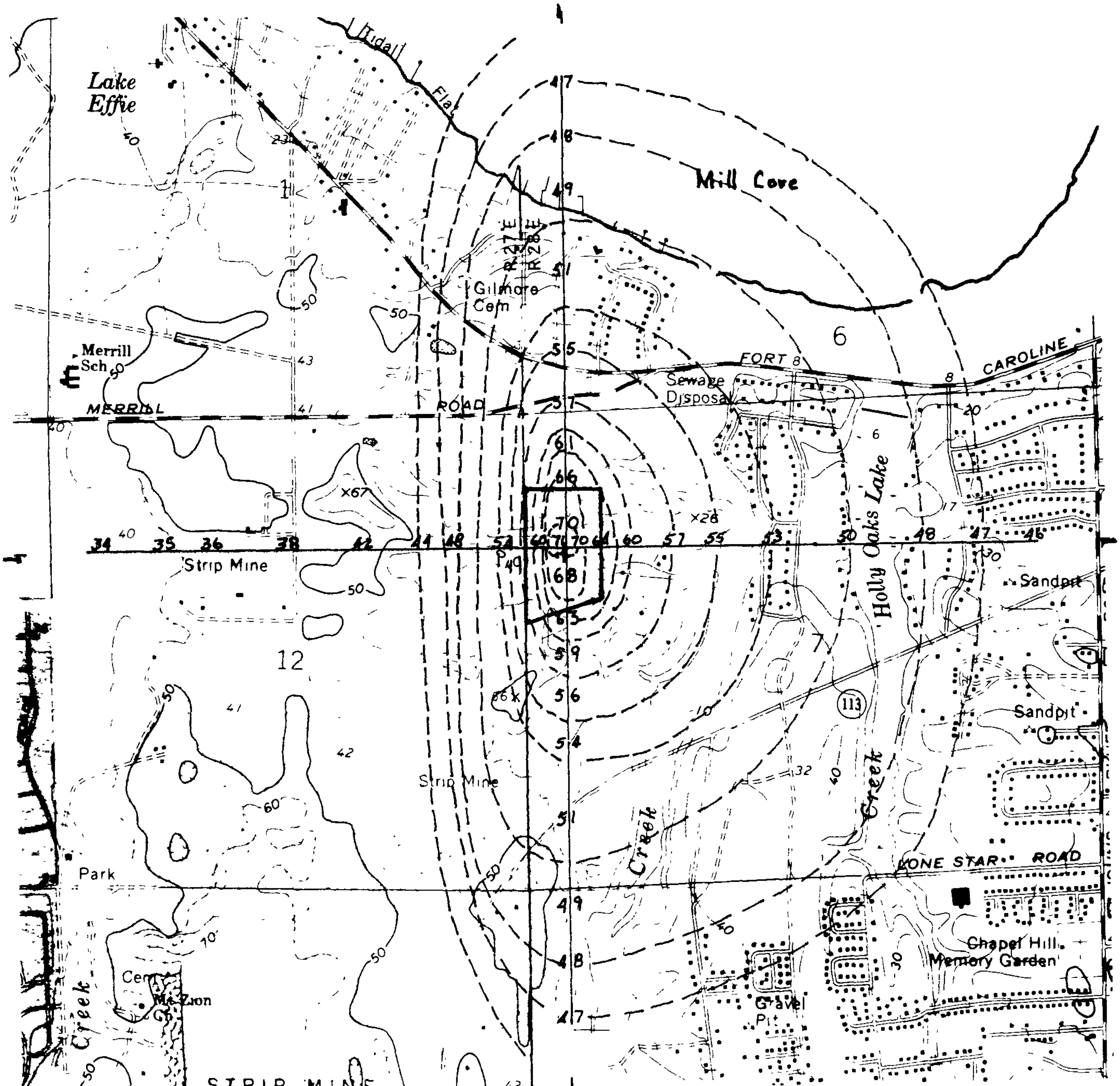
The increase in background noise levels at the three receptor sites due to the mitigated case model is shown in Table 3-10. It is immediately obvious that there is no increase in L(10), L(d/n), or L(deq) levels at the two receptors located in the Holly Oaks community, (sites B and C). There may be a slight increase in both the L(50) and the L(neq) levels and a definite increase in the L(90) level. However, the degree of even the largest increase does not appear sufficient to provoke significant community annoyance.

There will continue to be increases in all levels at the plant boundary (site A), but the increases are less than 3 dBA in all cases. There would be no violation of the proposed Jacksonville noise ordinance.

The generalized noise propagation model for the mitigated case presented in Figure 3-28. The directive characteristics of the noise sources on the site are still obvious, however, the intensity of the levels as a function of distance is much lower.

FIGURE 3-27

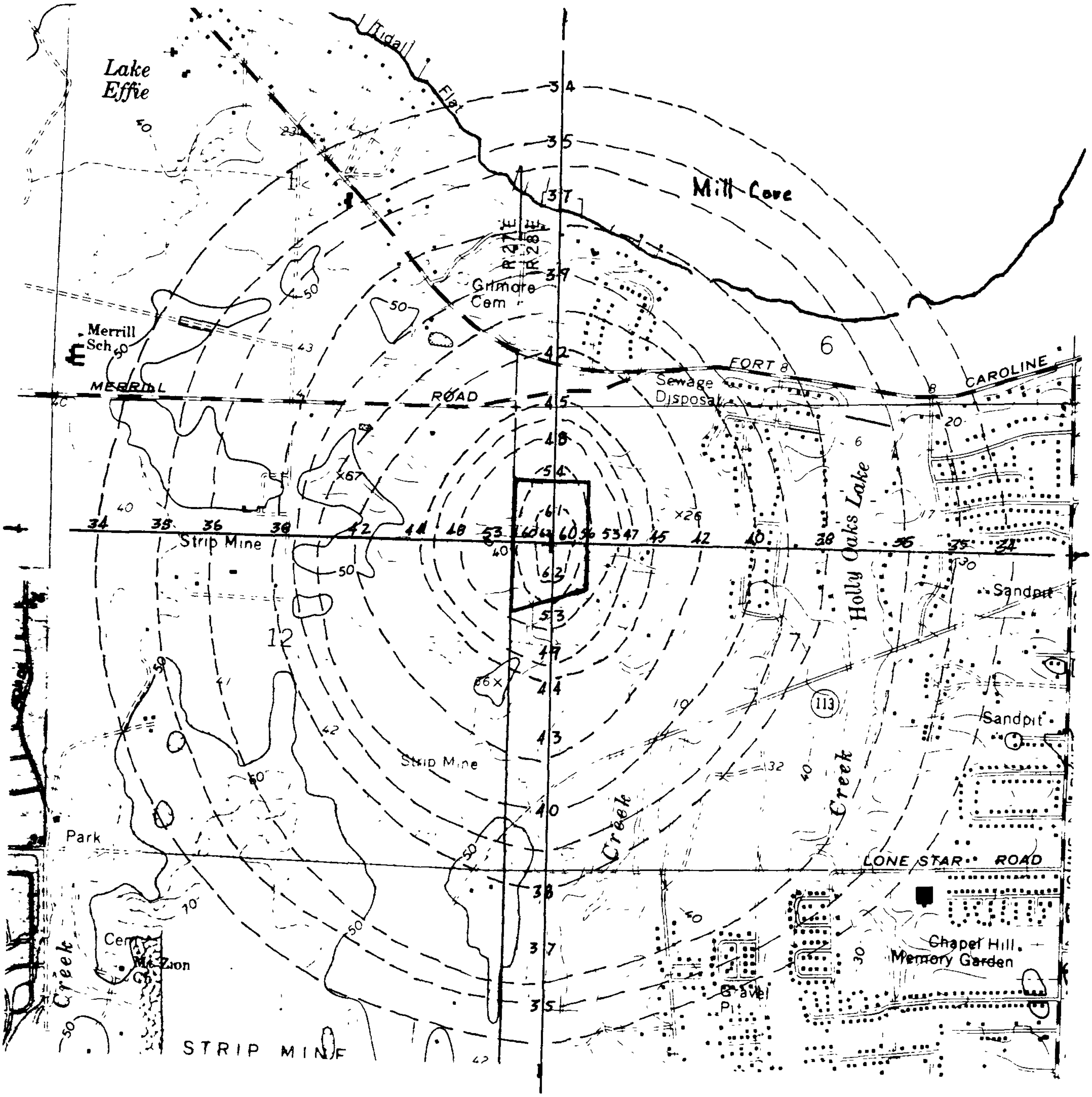
WORST CASE NOISE MODEL FOR AESTP



Scale 1 in. = 1758 ft

FIGURE 3-28

NOISE MODEL FOR AESTP WITH MITIGATIVE MEASURES



Scale 1 in. = 1758 ft

Summary

The Arlington East Sewage Treatment Plant is well designed from the standpoint of control of environmental noise. Enclosure of clarifier and aeration pumps within pipe galleries, and the use of blower building air duct silencers are several design features which have the potential to diminish noise levels generated by the system. All buildings are structurally designed so that noise transmission through walls shoild be minimal. Walls generally will be ten-inch cavity with four inches each of block and brick and a two-inch air space. There are a minimum number of openings in each building.

There is a potential for significant radiation of noise from buildings which are designed to provide equipment access aluminum roll-up doors. It has been observed to be a common operating practice to leave these doors at least partially open. This will result in a significant transmission of noise energy out through the open door. Enery will also be transmitted through the low density doors when they are closed and radiated to the surrounding community. Those areas in which louvers are provided for air movement create a similar noise radiation problem. Both of these are directional sources which propagate perpendicular to the wall of the building in which they are located. In addition, roof mounted ventilation fans are a potentially significant noise source.

2) Additional Noise Controls Alternatives

Two noise control strategies are presented to reduce the noise impact to the levels approximated by the model developed for the mitigated case.

*Re-evaluate design specifications for buildings and major process equipment to develop low noise specifications where feasible. Also evaluate potential for noise reduction through operational modifications. This engineering evaluation should consider frequency distributions as well as weighted sound pressure levels in developing revised specifications.

*Construct plant with as many of the above design and operational modifications made as practical to mitigate identified noise sources. Then follow-up with an operational noise monitoring program to identify oversight noise problem areas, if any, and to develop final solutions.

Re-evaluation of Design Specifications and Operational Practices

There is one operational practice which will substantially mitigate noise emissions if vigorously enforced. The simple act of keeping all openings on all buildings closed will have a significant mitigating effect on noise levels. The transmission loss (TL) in dB of any wall or barrier is significantly reduced by any openings. The maximum attenuation possible when openings are present is dependent on the percentage of open area and may be approximated by the following:

$$TL + 10 \log \left(\frac{\text{Total area}}{\text{open area}}\right)$$

This relationship is conservative because it does not take frequency into consideration. Low frequencies will be attenuated by smaller openings more than this equation would predict. For example, the TL for the solids handling building is reduced to a maximum value of eight (8) when both equipment access doors are open. This represents a decrease in sound attenuation for that wall of the building of at least 400 percent.

The second operational modification would be to schedule practices such as ash removal, chlorine drum transfers, grit hopper removal, and bar screen hopper removal during periods of the day with a high background noise levels.

Design modifications that should be considered in the effort to reduce environmental noise may also have an impact on operator noise exposure. Consequently the most efficient utilization of resources would be to consider Occupational Safety and Health Act (OSHA) requirements when developing noise generation specifications for process equipment.

Design modifications may be considered to fall into two categories as follows:

*Equipment or building modifications to attenuate direct propagation of noise energy from the plant.

*Equipment or building modifications to reduce overall sound levels inside the sludge heat treatment/incineration building and the blower building.

Modifications to Attenuate Direct Noise Propagation

As can be seen from Table 3-8, the sludge heat treatment/incinerator building, the blower building, the water reuse pumping station, the effluent pumping station, aeration/clarification components as well as several other buildings have several noise sources which radiate noise energy directly to receptors off the plant. Modifications common to all these sources include the following:

*Specify low noise level ventilation fans and blades such as centrifugal air foil or centrifugal reverse curved fan blades.

*Specify sound absorbing roll-up doors in place of sheet metal doors.

*Minimize area of openings in walls of all buildings for roll-up doors, windows, and louvers.

*Totally enclose all motors, especially the water reuse pump motors and other motors outside the pipe gallery, or specify low noise level motors.

*Specify acoustically absorbent louvers.

*Enclosure of the bar screen, preaeration tank and primary clarifiers would attenuate noise, as well as control odors, provided blowers were located with the instructure.

*Evaluate installation of acoustically absorbent material in blower building intake structure.

*Site the access road from Memorial Road to minimize traffic near Holly Oaks.

*Plant heavy evergreen barriers as close to noise sources as possible (see Figure 3-26) to provide maximum noise attenuation and visual obstructions.

Eliminate flashy signs and expanses of well cut grass in order to keep a low profile with the surrounding community.

<u>Modifications to Reduce Sound Levels Inside Buildings</u>

Several design modifications should be considered for the sludge heat treatment/incineration building and the blower building to control the level of noise generated by the equipment within those buildings. Noise generated by machinery contained within a building can radiate to outdoor areas by transmission through walls and openings in the building. Sound radiating through a wall will be attenuated by the transmission loss typical of the materials used to build the wall and the frequency of the sound.

The material properties which affect transmission loss are the mass and internal stiffness. Estimated sound transmission losses for the three most commonly used wall constructions designed for the facility are found in Table 3-11.

It is obvious from Table 3-11 that aluminum roll-up doors will transmit more sound energy to the outside environment than cavity or concrete walls. Measures to reduce sound pressure levels inside the parts of the buildings where the roll-up doors are located could significantly decrease effective radiated noise power from the building. Design modifications applicable to the solids handling building and/or the blower building are as follows:

*Construction of internal walls to isolate high noise components such as centrifuges, compressors, grinder pumps, solids pumps, vacuum pumps and blowers.

*Specification of low noise motors.

*Specification of low noise blowers and compressors.

*Construction of enclosures to isolate high noise components mentioned above.

TABLE 3-11

ESTIMATED SOUND TRANSMISSION LOSSES

	Sound Transmission Loss (dB)							
Octave Band Frequency (HZ)	63	125	250	500	1000	2000	4000	8000
Aluminum Roll-up Doors	14	20	26	29	29	29	29	35
10" Cavity Wall	33	34	36	39	49	59	69	--
Lightweight Concrete Tee Panel	33	33	33	33	39	45	51	57

Post-operational Noise Evaluation Program

Many of the operational and design modifications outlined in the previous section may be implemented with minimal additiona l cost and substantial noise reduction benefits. However, many modifications may be of marginal utility at this point. The reason for this is that evaluation of noise sources and the development of specific noise controls for many noise problems cannot be made until the equipment and/or plant is operational. It is simply impossible to theoretically model and predict all significant noise sources in a complex industrial facility in a cost--effective manner. The attenuation of primary noise sources--such as blower inlet louver noise--frequently allows a slightly lower intensity noise source to become a subsequent problem.

Therefore, a very important and integral part of this noise abatement program is a vigorous post-operational noise evaluation program to identify problem areas, if any, and expedite the development of a solution.

3) Summary of Noise Impact

A significant noise impact on the Holly Oaks community may occur if the proposed plant is located and constructed as planned and operated in a manner similar to the two test plants.

Since a comparable effect can be expected at all site locations either on present residents or on future residents, all plant sites will have the preceding noise control measures taken.

These control measures include modification to design specifications to include such things as low noise level ventilation fans, sound absorbing roll-up doors, total enclosure of all motors, and enclosure of the bar screen, preaeration tank and primary clarifiers. Modification of operational practices will also have a significant effect upon noise emissions. Keeping all openings on all buildings closed and scheduling all truck traffic during peak background noise periods will have a significant mitigating effect upon noise levels. Final controls will be implemented after the plant is operational. At that time, an extensive post-operational noise evaluation program will be conducted to identify problem areas, if any, and expedite the development of solutions.

TABLE 3-12

POTENTIALLY VIABLE SUBSYSTEMS

Subsystem	Viable Alternatives
1. Effluent Disposal	- St. Johns River Outfall (proposed)
	- Septic Tank Drainfields (proposed)
2. Treatment Plant Locations	- Millcoe Road (A) (proposed)
	- Millcoe Road (B)
	- Dunes Area (A)
	- Dunes Area (B)
	- Dames Point/Ft. Caroline Intersection
	- North of Craig Field
	- East of Craig Field (A)
	- East of Craig Field (B)
	- Inside East Edge of Craig Field (A)
	- Inside East Edge of Craig Field (B)
	- Beacon Hills
	- Spanish Point
	- Quarentine Island
	- Inside Southern Edge of Craig Field
	- Individual Septic Tanks
	- Package Plants
3. Treatment Processes	
(a) Pretreatment	- Aeration (proposed)
	- Chlorination (proposed)
	- Screening (proposed)
	- Grit removal (proposed)
(b) Primary Treatment	- Sedimentation (proposed)
	- Skimming (proposed)
(c) Secondary Treatment	- Conventioanl Activated Sludge (proposed)
(d) Advanced Waste Treatment	- None
(e) Disinfection	- Chlorination (proposed)
4. Sludge Treatment and Disposal	
(a) Sludge Thickening	- Centrifugation (proposed)
(b) Sludge Stabilization	- Heat Treatment (proposed)
(c) Sludge Dewatering	- Vacuum Filtration (proposed)
(d) Sludge Reduction	- Incineration (proposed)
(e) Final Disposal	- Landfill (proposed)
	- Land Spreading
5. Odor Control	
(a) Currently Planned Odor Control (proposed)	
(b) Additional Odor Controls Alternative	
6. Noise Control	
(a) Currently Planned Noise Controls (proposed)	
(b) Additional Noise Controls Alternative	

C. Development of Viable System Alternatives

The preceding description of subsystems has left various potentially viable alternatives (Table 3-12). These subsystems must now be combined into viable system alternatives. Interaction between subsystems are discussed and certain combinations excluded which do not reach project objectives or are eliminated by other constraints on the project.

Certain non-structural subsystems are incorporated into the various system alternatives. However, nonstructural alternatives to the subsystems are not expected to significantly affect attainment of project objectives other than the "no action" alternative. Therefore, no additional non-structural evaluation is proposed other than for the "no action" alternative.

There are some alternative outfall disposal locations which are worthy of consideration. These involve a routing of the outfall along Fort Caroline Road up to a disposal point located opposite Blount Island. The Millcoe Road and Dunes Area sites appear to be the only sites for which these alternatives appear viable. The Dame Point-Fort Caroline alternative would involve a considerably longer outfall line and will not be evaluated.

The discussion of sludge treatment and disposal has provided an alternative to incineration of the sludge, land spreading. The option of land spreading is available for all site alternatives and is included in each. With land spreading of the sludge, however, the incinerator must be built as a backup since there is no assurance that land would be provided by landowners for this purpose. The inclusion of land spreading in the environmental analysis is meant to help determine the desirability of this option and the effort that should be made to implement this sludge disposal method.

From data on the present and potential future residents living within certain distances of the proposed plant sites (Table 3-13), and the data given covering the percentage of persons identifying the plant as a major odor source (Figure 3-16), the number of persons at each site identifying the plant as a major source of odor without the additional controls has been calculated and is given in Table 3-14.

The East of Craig Field and Quarentine Island sites have the least number (0) of persons who have been calculated to identify the plant without additional controls as a major odor source. Inside the eastern boundary of Craig Field is a close third with one. Following in order are the Dunes Area (17), Spanish Point (23), North of Craig Field (30), Inside the southern boundary of Craig Field (72), Dames Point-Fort Caroline (91), Millcoe Road (117) and Beacon Hills (151). The primary impact of odor production from the proposed plant would therefore be proportional to the number of persons affected. There would be substantial secondary impacts also from operating the plant without additional odor controls. Future residents would be subjected to odor as indicated in Table 3-13. For the preceding reasons, all viable alternatives will include odor controls excepting the Quarentine Island Site which is sufficiently isolated to preclude the need for controls.

Structural subsystems which remain as viable alternatives are listed in Table 3-12. These subsystems are then combined to give viable system alternatives. The system alternatives have been divided first by plant site and then subdivided by process subsystems. Table 3-15 lists the identified system alternatives.

TABLE 3-13

COMPARATIVE RESIDENT POPULATIONS

Present			Potential		
1. Millcoe Road					
On site	-	0	displaced by site	-	624
0 -1,000	-	18	0 -1,000	-	3,208
1,000-2,000	-	329	1,000-2,000	-	4,981
2,000-3,000	-	217	2,000-3,000	-	6,323
Total		564	Total		14,512

2. Dunes Area

On site	-	0	displaced by site	-	861
0-1,000	-	4	0-1,000	-	4,038
1,000-2,000	-	32	1,000-2,000	-	7,249
2,000-3,000	-	49	2,000-3,000	-	7,890
Total		85	Total		19,177

3. Dame Point-Fort Caroline

On site	-	0	displaced by site	-	1,991
0-1,000	-	95	0-1,000	-	6,825
1,000-2,000	-	98	1,000-2,000	-	6,497
2,000-3,000	-	200	2,000-3,000	-	7,059
Total		393	Total		22,372

4. North of Craig Field

On site	-	0	displaced by site	-	1,341
0-1,000	-	14	0-1,000	-	3,456
1,000-2,000	-	18	1,000-2,000	-	2,941
2,000-3,000	-	105	2,000-3,000	-	2,855
Total		137	Total		9,252

5. East of Craig Field

On site	-	0	displaced by site	-	80
0-1,000	-	0	0-1,000	-	367
1,000-2,000	-	0	1,000-2,000	-	514
2,000-3,000	-	0	2,000-3,000	-	609
Total		0	Total		1,490

6. <u>East of Craig Field</u>

On site	-	0	displaced by site	-	80
0-1,000	-	0	0-1,000	-	367
1,000-2,000	-	0	1,000-2,000	-	514
2,000-3,000	-	0	2,000-3,000	-	609
Total		0	Total		1,490

7. <u>Craig Field inside East Boundary</u>

On site	-	0	displaced by site	-	0
0-1,000	-	0	0-1,000	-	0
1,000-2,000	-	0	1,000-2,000	-	134
2,000-3,000	-	7	2,000-3,000	-	429
Total		7	Total		563

8. <u>Craig Field inside East Boundary</u>

On site	-	0	displaced by site	-	0
0-1,000	-	0	0-1,000	-	0
1,000-2,000	-	0	1,000-2,000	-	134
2,000-3,000	-	7	2,000-3,000	-	429
Total		7	Total		563

9. <u>Beacon Hills</u>

On site	-	0	displaced by site	-	80
0-1,000	-	28	0-1,000	-	286
1,000-2,000	-	210	1,000-2,000	-	221
2,000-3,000	-	525	2,000-3,000	-	256
Total		763	Total		763

10. Spanish Point

On site	-	0	displaced by site	-	0
0-1,000	-	11	0-1,000	-	139
1,000-2,000	-	35	1,000-2,000	-	921
2,000-3,000	-	63	2,000-3,000	-	1,939
Total		109	Total		2,999

11. Quarantine Island

On site	-	0	displaced by site	-	0
0-1,000	-	0	0-1,000	-	0
1,000-2,000	-	0	1,000-2,000	-	0
2,000-3,000	-	0	2,000-3,000	-	0
Total		0	Total		0

12. Craig Field inside South Boundary

On site	-	0	displaced by site	-	0
0-1,000	-	0	0-1,000	-	120
1,000-2,000	-	98	1,000-2,000	-	2,488
2,000-3,000	-	277	2,000-3,000	-	4,138
Total		375	Total		6,746

TABLE 3-14

PERSONS IDENTIFYING PLANT AS MAJOR ODOR SOURCE

Site		#Present Residents	#Future Residents	#Added Residents
1. Millcoe Road				
On site	-	0	250	
0-1,000	-	6	1,230	
1,000-2,000	-	72	1,096	
2,000-3,000	-	39	1,381	
	Total	117	3,957	3,840
2. Dunes Area				
On site	-	0	344	
0-1,000	-	1	1,413	
1,000-2,000	-	7	1,595	
2,000-3,000	-	9	1,420	
	Total	17	4,772	4,755
3. Dames Point-Fort Caroline				
On site	-	0	796	
0-1,000	-	33	2,389	
1,000-2,000	-	22	1,429	
2,000-3,000	-	36	1,271	
	Total	91	5,885	5,794
4. North of Craig Field				
On site	-	0	536	
0-1,000	-	5	1,210	
1,000-2,000	-	6	647	
2,000-3,000	-	19	514	
	Total	30	2,907	2,877
5. East of Craig Field				
On site	-	0	32	
0-1,000	-	0	128	
1,000-2,000	-	0	113	
2,000-3,000	-	0	110	
	Total	0	383	383
6. Craig Field inside East Boundary				
On site	-	0	0	
0-1,000	-	0	0	
1,000-2,000	-	0	29	
2,000-3,000	-	1	77	
	Total	1	106	105

TABLE 3-14 (Cont'd)

Site		#Present Residents	#Future Residents	#Added Residents
7. Beacon Hills				
On site	-	0	32	
0-1,000	-	10	100	
1,000-2,000	-	46	49	
2,000-3,000	-	95	46	
Total		151	227	76
8. Spanish Point				
On site	-	0	0	
0-1,000	-	4	49	
1,000-2,000	-	8	203	
2,000-3,000	-	11	349	
Total		23	601	578
9. Quarantine Island				
On site	-	0	0	
0-1,000	-	0	0	
1,000-2,000	-	0	0	
2,000-3,000	-	0	0	
Total		0	0	0
10. Craig Field Inside South Boundary				
On site	-	0	0	
0-1,000	-	0	42	
1,000-2,000	-	22	547	
2,000-3,000	-	50	745	
Total		72	1,334	1,262

D. Description of Alternative Impacts

As may be seen from Table 3-15, there are many alternatives. Further, for each alternative there are construction effects, operational effects, and secondary effects. In order to simplify the impact description, the impacts are divided initially by environmental categories; secondarily, by construction impacts; operation impacts and secondary impacts, thirdly, by site alternative, and finally, by subsystem alternative.

Construction and operation are readily understood terms and no discussion of these is necessary. Secondary effects, however, require some explanation. Secondary impacts are those effects whicy may occur indirectly or be stimulated to occur due to the project. Usually, it is difficult to quantify the actual secondary effect of the project since a number of other factors may also contribute to this effect. In some instances though, the realization of a primary impact of the project may remove a limiting factor and cause other factors to exert more influence.

An example of this situation may be helpful. The location of a municipal airport in a rural area will directly change the use of that site. A secondary impact of this placement would be the stimulation of commercial or industrial development on adjacent properties. Certainly in this case, the primary impact of the airport is to provide air transport facilities. As a result, decreasing transport costs at the adjacent properties, plus the combined effect of other factors such as market demand, resource availability, land availability, adequate labor force, etc., may allow the property to be economically desirable for development.

It should be noted that the effect on certain environmental categories may not change due to varying the treatment plant site and/or varying certain subsystem alternatives. For these categories, a discussion of the common impact and a statement that the impacts are not expected to vary with the alternative will be made.

1) Air Quality

Sources of air pollution related to sewerage construction include construction dust, construction vehicle and equipment exhaust emissions, and smoke from burning of cleared vegetation, rubbish and debris.

TABLE 3-15

VIABLE SYSTEM ALTERNATIVES

ALTERNATIVE	SITE	EFFLUENT DISPOSAL SITE	SLUDGE TREATMENT & DISPOSAL	INTERCEPTOR ALLIGNMENT ALTERNATIVE
IA1	Millcoe Rd.	Quarentine Island	Incineration (INC)	--
IA2	Millcoe Rd.	Quarentine Island	Land Spreading (LS)	--
IB1	Millcoe Rd.	Blount Island	INC	--
IB2	Millcoe Rd.	Blount Island	LS	--
IIA1	Dunes Area	Quar. Is.	INC	--
IIA2	Dunes Area	Quar. Is.	LS	--
IIB1	Dunes Area	Blount Is.	INC	--
IIB2	Dunes Area	Blount Is.	LS	--
III1	Dames Point/ Fort Caroline	Quar. Is.	INC	--
III2	Dames Point/ Fort Caroline	Quar. Is.	LS	--
IV1	North of Craig Field	Blount Is.	INC	--
IV2	North of Craig Field	Blount Is.	LS	--
V1	East of Craig Field	Blount Is.	INC	Off Craig Field
V2	East of Craig Field	Blount Is.	LS	Off Craig Field
VI1	East of Craig Field	Blount Is.	INC	On Craig Field
VI2	East of Craig Field	Blount Is.	LS	On Craig Field
VII1	Inside East Craig Field	Blount Is.	INC	Off Craig Field

TABLE 3-15

VIABLE SYSTEM ALTERNATIVES (CONT'D)

ALTERNATIVE	SITE	EFFLUENT DISPOSAL SITE	SLUDGE TREATMENT & DISPOSAL	INTERCEPTOR ALLIGNMENT ALTERNATIVE
VII2	Inside East Craig Field	Blount Island.	LS	Off Craig Field
VIII1	Inside East Craig Field	Blount Island	INC	On Craig Field
VIII2	Inside East Craig Field	Blount Island	LS	On Craig Field
IX1	Beacon Hills	Blount Island	INC	--
IX2	Beacon Hills	Blount Island	LS	--
X1	Spanish Point	Blount Island	INC	--
X2	Spanish Point	Blount Island	LS	--
XI1	Quarentine Isl.	Quarentine Is.	INC	--
XI2	Quarentine Is.	Quarentine Is.	LS	--
XII1	Southern Edge Craig Field	Blount Is.	INC	--
XII2	Southern Edge Craig Field	Blount Is.	LS	--

Clearing, excavation, and grading on treatment plant and pumping station sites and along pipeline routes, may be expected to generate some dust problems. The degree of impact caused by wind erosion of disturbed soils will be related to soil type. For example, soils of larger particle size, as in sand hill locations, are less susceptible to wind transport than are smaller and/or lighter, organic particles as are more common in low-lying areas. The degree of dust problems attendant to plant construction can be expected to be less at sites 1,3,5-6, and 10, which are predominately sandy, than at sites 4,7-8, and 12, which are swampy. Based on this rationale, Table 3-13, a comparison of population proximity densities, shows site 12 to have the greatest potential for exposure of the public to construction generated dust, followed by sites 4 and 7-8. In all cases, however, construction specifications will require the spreading of calcium chloride as needed on disturbed earth areas as a dust control measure.

The extent of dust problems associated with transmission system construction will be directly related to the number of pumping stations and total footage of pipeline constructed. These factors do not vary drastically among the alternatives. Depending on the alternative chosen, the number of pumping stations to be constructed will be 32 to 34, and the total length of force main needed will be 245,500 to 262,800 feet.

Smoke from burning of cleared vegetation, rubbish, and debris will not be a problem under any alternative since open burning will be prohibited by construction specifications. The contractor will be required to haul debris to a disposal site designated by the city. Cleared vegetation may either be hauled to that site or chipped and spread on the construction site.

During construction, a certain amount of unavoidable traffic will be needed to move construction and process equipment, and construction labor and materials to the sites and to remove debris from the sites. The amount of such traffic is essentially independent of which site is selected since the treatment plant will be largely the same regardless of site. Some site-dependent variations will doubtless occur, however. For example, subsoil and soil conditions might necessitate the use of piling or fill and thus induce greater truck traffic to move these materials. Therefore, the impact of truck and equipment emissions is proportional to the density proximity figures although little actually noticeable effect is anticipated from these emissions.

The "no action" alternative would necessitate, at minimum, expansion and upgrading of existing package plants in the service district. Undoubtedly, similar construction effects would therefore occur at each of these smaller sites at different times. Such actions would probably affect a greater proportion of the population over a greater length of time than would construction of a regional plant and interceptors.

All alternatives considered presently include multiple hearth incinerators for sludge disposal. The incinerator will be the primary source of air emissions and, since no operational incinerator is completely efficient, its operation will result in unavoidable discharge of some particulate (fly ash) and gaseous (oxides of sulfur and nitrogen, and carbon monoxide) pollutants. Incinerator operations and emissions, however, will conform fully to all provisions of Federal, State, and local air quality standards, codes, and permits. Dry gas emissions will be limited to .02 grains per standard cubic foot of dry gases corrected to 12 percent CO_2. Based on an initial plant capacity of 10 mgd, the plant incinerator operating five days per week would result in an average yearly production of 5,070 lbs. particulate matter. By way of comparison with total particulate emissions for the entire city, this figure represents less than 0.02 percent of existing emissions. Ultimate plant capacity of 25 mgd will result in particulate emissions representing approximately 0.045 percent of total existing emissions for the city.

Particulate fallout per unit acre resulting from incinerator operation will not be significant even under critical operational and meteorological conditions. Assuming that these critical conditons are: (1) larger particulate size (10 microns) than actually anticipated, which would result in inordinantly large fallout per unit acre surrounding the plant, (2) no thermal updraft, and (3) year 2002 emission rate of 12,675 lb./year, the calculated fallout rate surrounding the source would be 0.0297 lb. per acre per year within a radius of 33,000 feet surrounding the source when wind is 3.0 mph or less (18.4 percent of the time). Further, when wind velocity is between 3.0 and 12.0 mph and critical conditions are assumed, fallout will occur

33,000 to 132,000 feet from the source. Based on wind records, the greatest percentage of time (6.6 percent) this fallout will occur lies in an arc of 22.5 degrees oriented toward a southwest compass reading. (See Figure 2-1; wind rose). Under these conditions, a calculated fallout rate of 0.0114 lb. per acre per year would result. Since all alternative sites are located relatively close together with respect to overall dimensions of fallout areas, it is concluded that air pollution effects will not vary greatly in degree of significance among the alternatives.

Not utilizing the incineration facilities would eliminate by far the largest portion of operational emissions. This option would, of course, entail an alternate means of sludge disposal such as land spreading. This alternative method of sludge disposal will result in significantly less air emissions, such as those produced by trucks used to haul sludge to land spreading sites.

Under the "no action" alternative, there would obviously be no emissions of air pollutants from a regional treatment plant in Arlington. However, sludge disposal procedures would still need to be carried out for existing package plants. The volume of sludge to be disposed would undoubtedly increase as these small plants underwent expansion and upgrading. Should it be decided to incinerate the sludge at another incinerator rather than landfill it, air emissions would still result.

Population projections discussed in Chapter II show that with implementation of a regional wastewater treatment system, the population of Arlington will continue to grow at faster rates than that of the city as a whole. Projections show the Arlington population nearly doubling in the period 1980-2002. By permitting this growth to take place, implementation of the proposed project will induce a certain degree of change in air quality of the area through secondary effects, most notably by permitting the development of areas; heretofore not favorable to development due, for example, to septic tank limitations. The project will thus induce an increase in air emissions in the service area brought on by the functions and services attendant to newly developed areas. For example, given a 1980 service area population of 19,000, particulate emissions from automobiles in the Arlington-East district will amount to approximately 204 tons per year. However, assuming a 2002 service area population of 220,000 with the project, particulates from automobiles will increase to approximately 377 tons per year. Since all alternatives will encourage the same amount of growth as forecasted by the Regional Land Use Plan, secondary effects on air quality will not significantly vary with alternative choice.

It is predicted that the "no action" alternative would bring about an approximate 25 percent reduction in the growth rate for the service area with a regional treatment system. The secondary effects on air quality brought about by population increase may thus be assumed to be proportionately less for the "no action" alternative regarding total quantities of emissions. However, since the "no action" alternative will probably cause increased pressure for development at higher densities where package plants may be constructed, notably the northern section, the potential for increases in emissions in these areas exists.

2) Odor

Sources of construction-related odor will be primarily exhaust emissions of construction equipment and vehicles and odors emanating from organic materials in soils (primarily muck) excavated during construction. Exhaust emissions should not vary markedly from alternative to alternative. The extent of nuisance odors associated with much excavation, however, will vary markedly from site to site. Those alternatives involving plant site locations generally on sand hills, i.e., Alternatives 1,3,5,6 and 10, generally entail no demucking and hence no potential for related odors. Those sites located in freshwater swamp areas, i.e., Alternatives 4,7,8 and 12, will entail disturbance of existing muck deposits and the potential for related odor. If construction in the freshwater pond portion of the Dunes Area site (Alternative 2) involves demucking as is suspected, nuisance odors could result therefrom. Placement of fill on the Quarantine Island site (Alternative No. 11) and the Beacon Hills site (Alternative 9) could perhaps most economically be accomplished by spoiling dredged materials from channel maintenance dredging on these sites. It is known that bottom deposits in portions of the harbor, more particularly in the vicinity of downtown Jacksonville, contain significant amounts of organic solids. Such material could be quite malodorous when spoiled. However, such material would not be as satisfactory as would sand for plant construction purposes and every attempt would be made to have any material so placed be relatively clean sand. In that case there would be little potential for nuisance odors during the spoiling (site filling) operation.

The degree of severity of construction odor is directly related to the degree of public exposure. Exposures of resident populations and transient populations, respectively, to plant construction activity and odor, are generally in keeping with residential density proximity figures, Table 3-13, and proximity to thoroughfares of the various alternative sites. The effects of construction odor will be totally short-term in duration, limited to the construction period. No long-term effects are anticipated.

The odor production from operation of the controlled plant is expected to result in no detectable nuisance odors noticeable off the plant site. The implementation of controls should result in all major potential odor sources being brought under control. An estimated 90% of potential odors from the proposed plant should be removed by these treatment techniques.

A very low, yet detectable, odor will probably be noticeable on the plant site for short periods of time under certain atmosphereic and plant operating conditions. This type of odor episode would be generally due to operator error, equipment failure, or a maintenance oversight.

Even with these unusual breakdowns, several backup systems will work conveniently to preclude noticeable odors. First, the wastewater is chlorinated, thereby reducing most odor production; secondly, the wastewater is aerated, thereby further reducing potential odors by assuring the wastewater does not become septic; thirdly, all gases from all processes through the primary sedimentation basin will be treated at the wet scrubber. Following primary sedimentation comes the activated sludge aeration units which will keep high dissolved oxygen content in the waters. The very low probability of all wastewater treatment systems being down simultaneously, along with the reception of an unusually septic influent at the plant, makes the occurrence of an odor episode due to these processes highly unlikely.

The additional process of routing the combined vapors from sludge centrifuges, vacuum pumps, and filters, and sludge blending tanks to the inlet air fan of the multiple hearth incinerator, provides excellent control of these sources during incinerator operation since operating temperatures of 1400 degrees F will cause complete oxidation of all odors. The provision of a second wet scrubber for periods when the incinerator is not in operation gives additional control of these odors. Finally, the catalytic incineration of vapor from the sludge decant tanks provide complete oxidation of these odors. The combination of these systems provide the best control systems for odor known today.

Nevertheless, should a highly unlikely episode occur, which also would very likely be an odor of low intensity, the degree of impact would be proportional to the density-proximity table and the "Persons Identifying Plant as Major Odor Source" table. (Tables 3-13 and 3-14)

Secondary effects due to odor production are related to the changes in human usage of lands which are subjected to odor episodes. One means of quantifying the relative effects is by looking at the future increase in residential populations that has been calculated to identify the plant as a major odor source according to the comprehensive plan for Jacksonville. Certainly some effect or change of usage of these lands could result if offensive odors were present. As stated before, all alternatives will• have excellent odor control measures taken and no adverse effect is anticipated.

Nevertheless, Table 3-14 gives, ranked in order, the additional populations for each alternative site that might be affected according to the comprehensive plan should an odor episode occur.

Implementation of the "no action" alternative could be expected to have substantial secondary odor effects. The increased usage of package plants in close proximity to residential areas would have great potential to adversely affect surrounding residents, since odor controls would probably not be included, overloads would be more common, breakdowns more frequent, and maintenance more difficult. Further, there would be an increase in septic tank malfunctions and the associated odors since lands that are marginally suitable for septic tank installation may be pressured into development. Further, the plants which are proposed to be closed after construction of the regional plant would remain, and odors associated with operation and occasional septic discharges would continue to occur.

3) Noise

Sources of construction noise will be operational noises of construction equipment and vehicles. These noises are unavoidable. Their adverse impacts will be mitigated by having construction specifications require that particularly noisy operations such as pile driving be carried out only during normal daylight working hours. The degree of impact occasioned by pursuit of various alternatives will be dependent on the resident population density-proximity figures and on proximity to traffic thoroughfares.

For each plant site, operational noise control measures will be required. From Figure 3-28, it can be seen that very minimal effects on noise levels in communities surrounding any proposed site would result. Further the additional requirement of a followup on noise levels measurements and the taking of corrective actions will provide an excellent post construction control strategy should some noise source be overlooked in initial control efforts.

By varying the sludge disposal from incineration to land spreading the noise generated by the incinerator would be eliminated while the noise generated by trucks would be increased (20 more trucks per day). The trucks would operate during daylight hours and should not appreciably increase noise levels for sites with good arterial access. Further, there would not be an appreciable decrease in sound levels should incineration be eliminated. Therefore, little difference between these alternatives is expected other than for sites with poor access.

Secondary effects of implementing the regional system as proposed versus the "no action" alternative may be considered a direct function of human occupation and use since the major sources of noise in the Arlington-East Area are aircraft and automobiles. The difference in noise levels, therefore, may be estimated to correspond to the difference between the amount and location of population growth for each case. The estimated difference in population growth is 25 percent less under the "no action" alternative. Further, the general location of the growth is not expected to be significantly different under "no action." Noise levels, therefore, are not expected to be significantly different under the two alternatives.

4) Topography

Effects of plant construction on topography will be minimal and will not differ greatly with each alternative Most of the alternative plant sites occupy land parcels which have slopes of less than one percent and should thus require a minimum of grading and land surface alteration. Sites 1,3 and 10, however, consist of land with slope generally greater than eight percent and may thus require somewhat more grading.

Due to the relatively flat topography throughout the Service District and general similarities between alternative interceptor plans, alterations to the land surface brought about by interceptor construction will not be significant and will not vary greatly with alternative choice.

The "no action" alternative would eliminate grading procedures for construction of a wastewater treatment system. This action, however, does not eliminate the possibility of grading at the alternative sites should they ultimately be used for private construction. Further, while the "no action" alternative eliminates the considerations attendant to a regional system, it will probably cause the eventual construction of additional package plants in the service area along with necessary (and decentralized) alterations to the landscape.

Operational effects as related to topography center around the visibility of the treatment facilities at the alternative plant sites. Due to lack of vegetation at plant sites 2 and 11, facilities constructed there would be most visible at the greatest distances. Other sites will vary in visibility from being nearly completely hidden by existing vegetation to being partly visible from thoroughfares both existing and proposed.

To determine the visibility of the proposed 74-foot incinerator stack at site 1, two approximately three-foot diameter helium-filled balloons were raised at the sight--one to a height of 85 feet and the other to 100 feet--and observations made at various surrounding locations. From the highest elevation to be found north of the site (about 2,800 feet away) the 85 foot high balloon was not able to be seen and the 100 foot high balloon was barely visible at treetop level. The same was also true at the highest elevation to the east (about 2,000 feet away). From the highest elevation to be found south of the site (about 3000 feet away), the 85 foot high balloon was barely visible at treetop level and the 100 foot high balloon was plainly visible. It is to be remembered, however, that the proposed incinerator stack will be only 74 feet high and 4 feet in diameter at the top. The balloon observations indicated that an incinerator stack at site 1 will, for practical purposes, not be visible by residents. Moreover, at any wooded plant site under consideration, the incinerator stack should not be visible at distances greater than 500 feet provided that a suitable buffer of existing vegetation is left standing. Reference to Table 3-13 showing population proximity densities for the various alternative sites, will facilitate an understanding of aesthetically affected residents.

Another operational effect to be considered is that which would result from the land-spreading alternative used in lieu of incineration for sludge disposal. It is probable that a land spreading operation would necessitate a certain amount of grading to facilitate the process. The net result would be to generally flatten or smooth out the area to be used. This effect, however, would be more than offset by the benefits to be derived from subsequent soil enrichment.

The "no action" alternative would, of course, obviate the need for aesthetic concerns at the alternative sites since no plant would be constructed. This is not to say, however, that some other type of private construction would not be undertaken at one of these sites which would ultimately prove more visible to the public than a regional wastewater treatment facility. For example--the removal of surrounding vegetation and construction of high density residences.

Since drainage is largely a function of topography, possible secondary effects relating to changes in the surface and shallow groundwater regime of the service area are to be considered. As has been stated, there are extensive areas in Arlington which are unsuitable for development because of septic system limitations but which will probably be opened up for development by the installation of a regional treatment system. As this occurs, it is possible that areas which are now fairly wet could be partially or completely drained for development with the concomitant physical and biological effects of changing from a wet to a dry regime. The "no action" alternative would probably limit such a situation by contributing to the confinement of future development to naturally well-drained areas.

5) Soils

While cleared and under construction, all sites will be subject to erosion by wind and water. The latter can be contained on site by temporary berms and/or ditches. In addition, the generally flat to moderately sloping terrain at all sites will help to minimize erosion by water.

The potential for land erosion damage is, in part, a function of soil particle size and specific gravity of disturbed soils. Larger and inorganic particles tend to have more resistance to wind and water erosion while smaller particles and lighter organic soils are more easily eroded. Those alternate plant sites, where sand hill type and/or dune type vegetative cover predominates, are characterized by relatively coarse sandy surface soils. Conversely, those sites where terrain is swampy have finer surface soils with higher organic content. On this basis, soil erosion is a greater potential problem at sites 4, 7-8, and 12 than at the others. While predominately large soil particle diameters at some sites will tend to minimize amounts of soil eroded by wind, contract specifications will require the contractor to spread calcium chloride as needed to further reduce wind erosion. In addition, the contractor will finish, grade, and regrass disturbed areas as soon as possible both at the plant and pump station sites and along pipeline routes.

The potential for land erosion is related in degree to the area cleared during construction. Land requirements for all alternative plant sites are the same (46 acres) except for site 3 which requires 69 acres. This larger area is necessitated by accommodation of both the plant site and an expressway interchange. Areal clearing requirements for transmission system construction are related directly to length of pipeline and number of pumping stations constructed. As stated earlier, these factors do not vary significantly with alternative choice.

In summary, soil erosion during construction is not considered a major impact and does not vary greatly among the alternatives.

The "no action" alternative would result in no regional treatment system construction and no construction-related soil erosion. Once again, it does not preclude the possibility of private construction at an alternate site with attendant erosion. It might, however, necessitate the construction of additional package plants, some of which might have potential for an erosion problem.

All pipeline routes will be required by contract specification to be returned to a condition comparable to their preconstruction state. No long-term effects on land erosion are anticipated under any alternative system during the period of operation.

Chapter II described soil conditions in Arlington and related them to the very limited area available for land disposal of sludges. Should the option of land spreading of sludge from the Arlington-East plant on the strip-mined areas be chosen, the soils of these barren areas would continue to benefit greatly. Should the incineration option be selected in Arlington, there will be no continuance of the program after completion of the Buckman Street incinerator in 1977.

Since all pipeline routes will be returned to their preconstruction state, no improvement over operational erosion conditions would result from the "no action" alternative. This alternative would also preclude the possibility of continuing land spreading operations in Arlington. Probably the greatest role of soils in the service area under the "no action" alternative, however, would be that of limiting development in poorly drained areas unsuitable for septic systems.

Possible secondary effects on soils as a result of regional treatment system implementation are related to drainage and have been discussed in the previous section on topography.

6) Terrestrial Vegetation

Short term primary impacts of the treatment system involve construction of the plant and the interceptors. Site specific impacts are mentioned.

Two major cover types exist on site 1. The southern half has higher elevations where the dominant species is turkey oak (Quercus laevis), 20 to 30 ft. tall. Numerous young long leaf pines are evident everywhere but most are still in the "grassy stage", 1 or 2 feet tall. Some magnolia trees are located around an abandoned house on the east side. Ground cover is predominatly wire grass. Other species are pawpaw, lopsided indian grass, huckleberry, and muscadine vine. According to projected limits of clearing, grubbing, and grading by Flood and Associates, all will be done on this cover type.

The northern half of the site is about ten feet lower than the southern half. A low slash pine flatwoods with several areas of hardwood swamp cover this half. Dense scrub and ground cover exists here especially near a creek which flows west to east. Projected clearing would not extend into this hardwood swamp.

Approximately 25 acres of longleaf pine/turkey oak forest would be eliminated. Twenty-three acres of low slash pine flatwoods and considerable amounts of hardwood swamp is not projected to be cleared on the north half of the site.

Barren strip-mined sand covers nearly all of site 2. A strip mine pond covers the northern quarter of the site. Sparse scrubby vegetation, such as red cedar exists on the fringe of the water. This is the only vegetation present on the site so no real impact would occur to the terrestrial vegetation if this site is chosen.

Site 3 is situated nearly parallel to Ft. Caroline Road. A small dirt road bisects the site. The area southeast of this road has higher elevations with longleaf pine/turkey oak the predominant cover type. Northeast of this road a low flatwoods of slash pine exists with characteristic palmetto in the understory. Within this flatwoods a small stand of cypress and freshwater swamp, about 160 feet wide, occupies the lowest elevation at this alternate site.

This site is larger than the other alternatives because a highway interchange is also planned at this location. If the treatment plant is constructed here, about one half the affected area is longleaf pine/turkey oak, and half slash pine flatwoods with one half acre of cyprus swamp also eliminated.

Site 4 is immediately to the north of Craig Field. A dramatic fringe effect is evident with the vegetation. Two-thirds or about 31 acres of this site is cypress swamp. It is concealed behind a fringe of slash pine and a few hardwoods, such as sweetgum and red maple. Both the cypress stand and slash pine fringe are composed of mature specimens. A thick understory composed of holly and other low scrub is present.

Selection of Site 4 would eliminate 31 acres of cypress swamp and 15 acres of a mixed slash pine and hardwood fringe.

Sites 5 and 6 occupy nearly the same ground area. Location is 1.5 miles east of Craig Field runways. Vegetation cover type is predominantly longleaf pine/turkey oak. However, small live oak and small laurel oak are common. Wire grass is the dominant ground cover with muscadine vine clinging to low scrubby growth. A small creek runs along the eastern side of the site through a 50 to 80-foot wide hardwood swamp assemblage.. Species in this area are sweetgum, yellow poplar, small live oaks, black cherry, water oak and sassafras.

Ninety-five per cent of this site is the abundant longleaf pine/turkey oak cover type which would be lost if this alternative is selected; but a small hardwood area would probably need to be cleared.

Alternative sites 7 and 8 occupy almost the same ground area for the treatment plant. Location is 2000 feet east of the confluence of the Craig Field runways. The entire site is covered by cypress. Surface water normally stands over this area. Several species of bay trees are present under taller cypress. The site is within the largest cypress swamp area in the service district. Selection of this site would necessitate raising the elevation by filling in about 46 acres of cypress swamp plus that needed for access roads.

Site 9 is east of Mill Cove and 700 feet inland from the St. Johns River. It is a ruderal area since it has received dredged spoil from time to time hindering proliferation of natural vegetation. Diked spoil ponds are nearby but the alternate site has not received dredged material for at least eight years.

A minimal amount of biologically valuable vegetation would be lost if the plant were to be put here. A small area, about 1.8 acres, of hammock vegetation on the Beacon Hills side of the site would be sacrificed. The remainder of the area is low scrub; wax myrtle, 10 to 15 feet high, is the most common plant present. Palmetto and a few red cedar are also present. Most of the site has no scrubby cover only grasses, some cactus, and other ground cover plants, somewhat characteristic of coastal dunes.

On site 10, arboristic cover type is hammock. Three species of mature oaks dominate the canopy with nearly 95% cover. Many of these oaks, especially the live oak, Quercus virginiana are greater than 2.5 feet dbh and heavily laden with spanish moss. Some mature red bays and hickorys are also present in the canopy. Sufficient light penetrates to bush palmetto, holly, and partridge berry underneath.

Plant location at this alternative would eliminate ±46 acres of mature hammock, the cover type least abundant within the service district. Maturation time is also very slow compared to the pine species.

The Quarantine Island site (site 11) is another ruderal area. It has received periodic use as a spoil site, several places quite recently. Vegetation is similiar to site 9, where wax myrtle is the dominant shrubby plant. Elevations are lower than site 9. Therefore, some high marsh salt-tolerant scrub vegetation such as Baccharis halimifolia exists adjacent to the site. Coastal dune grasses cover ground area not recently spoiled upon.

Site 12 is inside Craig Field property about 1400 feet south of the confluence of the runways. Tree cover is mostly slash pine flatwoods. The eastern third is a freshwater swamp which once had tall cypress trees. Tall cypress and slash pines have been removed to comply with FAA height restrictions. A small stand of cypress exists on the southwest corner of this site.

Selection of this site would eliminate young slash pine along with a portion of young cypress. Twelve acres of disturbed freshwater marsh would be lost through fill work.

Construction of the waste treatment facility will permanently remove a certain number of acres of natural vegetation from the biological system since the site will not be allowed to reforest. No action obviously eliminates this commitment of a resource.

The technique of sludge disposal is currently being practiced on the strip-mined area east of alternate site 2. Barren, non-nutritive sand is being enriched and is currently supporting a healthy grass cover. Gradually, the organic content of the soil will increase. Soil conditioning started with sludge application renders a viable substrate from which more substantial vegetation could grow. From an agricultural and aesthetic standpoint the land is more valuable to man and wildlife.

Regardless of where the treatment plant is built long-term secondary impacts pertain to more land rendered suitable for development. The Jacksonville Area Planning Board has projected residential development for portions of the service district which could not develop with septic tanks for disposal. Low flatwoods and hardwood stands will be acutely affected. Hardwood areas, of maples, sweetgums and hickorys, where septic tanks could not be used, are prime lands for housing development with sewerage systems. There will be a loss of scenic beauty as naturally vegetated hardwood stands are sub-divided and developed.

The no action alternative will keep many of these low, wet areas in a natural state. But in general, development will only be postponed.

7) Terrestrial Animals

Extensive acreage of longleaf pine/turkey oak areas xist adjacent to site 1 and elsewhere within the service .istrict. Displaced species able to relocate could find uitable habitat elsewhere. The gopher tortoise (Gopherus)olyphemus) appears on the Florida Fish and Game :ommission's list of threatened species in the State. It)refers this habitat and could be present since suspect)urrows recently excavated were seen. The indigo snake (Drymarchon corais couperi) appears on this same list and)robably is present at this same alternative as well as all)thers. Partridge pea, a favorite food of game fowl, was)lentiful. Quail and dove were seen on the site.

Some evidence was seen of small animal activity at site 2. However, no significant wildlife habitat will be altered as a result of treatment plant construction.

Three different habitat areas would be affected if site 3 were chosen, longleaf pine/turkey oak, slash pine flatwoods, and a small cypress swamp. More animals are directly dependent on the cypress swamp habitat than the others so it is considered most biologically important even though it is quite small.

Beneficial use by numerous animals and birds can be expected on site 4 since both the slash pine-hardwood fringe and cypress swamp have good forage and cover available in the understory thickets. Additionally, about one-third of site 4 is open slash pine area which has less suitable wildlife cover. If the plant were to be located here, animals would either die or move away from the cleared area. Similar cypress swamp habitat having excellent ground cover is available immediately to the east of this site. Animals which prefer slash pine flatwoods could easily seek that type since the flatwoods are the most abundant cover type in the service district. Species able to relocate to a favorable habitat could do so from site 4.

Many signs of wildlife are evident on sites 5 and 6 primarily because the site is so remote. Ground cover is quite good. Partridge pea, a favorite food of game fowl, was noticeably plentiful. The hardwood assemblege near the creek provides a variation in habitat for animals that prefer cool, dense thickets. The creek is a close water source.

This site and sites 7 and 8 are the most remote. As such these areas have the best potential for supporting the black bear (Ursus americanus floridanus) which Florida Fish and Game biologists believe might inhabit the southern portion of the service district. It presently appears on the threatened list within the state.

The cypress stand habitat (sites 7 and 8) supports the most diverse assemblage of amphibian, reptile, and mammalian species. Many species common elsewhere are at least indirectly dependent on the existence of cypress swamps. Water, food supply, and good ground cover attracts herbivores and carnivores. The cypress swamp is remote enough to allow these wildlife communities to function with minimal disturbance by man.

About 46 acres of this prime habitat would be lost if this site is chosen. Those species that could move could find suitable habitat nearby, however.

Terrestrial animals inhabit site 9 but few require this specific type of vegetative cover. Most species could exist elsewhere with equal success. Minimal effects would be felt by the animal community. Ruderal areas, because they have been altered, tend to lack sufficient cover to support numerous animals. Aerial predators, the hawks and owls, hunt these areas where cover is a limiting factor for ground inhabitants especially mice and rats. The animal community is in a state of transition as the normal vegetative succession proceeds.

Numerous animals, especially tree dwellers (aviafauna) utilize the extensive tree canopy located on site 10. Several owl species and crows prefer the highest vantage points, the tall oaks provide. This cover type is in shortest supply of the five terrestrial types within the service district. Therefore, species favoring this area would be limited in relocation possibilities. It is possibly the most aesthetically pleasing area to man within the service district.

Value to terrestrial animals is limited in site 11, as in site 9 having similiar vegetation. Utilization is primarily for nesting by wading birds, particularly terns. These birds lay their eggs directly on sand dune-like areas. The eggs are best camouflaged on recent dredged spoil. The island restricts encroachment on nesting areas by man.

Most of site 12 is cut-over slash pine being of minimal value to wildlife. The freshwater swamp, although devoid of its tall cypress, still supports considerable wildlife.

Elimination of habitat at this site would have a reduced effect on animals because the tall vegetation has been removed and will continue to be harvested.

Without construction of the facility, a certain acreage of habitat would remain available to resident wildlife.

As development increases, secondary impacts will occur. Wildlife habitat will be lost. Animal behavior patterns are forced to change as more animals are crowded into fewer acres of needed habitat. Many natural predators and omnivores (racoons, bobcats, foxes, hawks and owls) are sensitive to development. Man's mere presence will preclude the use of the area by the endangered bald eagle. They will be removed resulting in their natural prey (rats, mice, and some snakes) to increase. This process results in a loss of species diversity as natural habitats are replaced by cultured ones.

Increased road accessibility to the more remote southeastern portion of the district will cause more road kills. At first animals will avoid this increased noise and light but gradually they will get accustomed to it and kills will increase.

8) Water Quality

Erosion and sedimentation in streams can be caused by treatment plant construction or by pipeline construction which entails stream crossings. With three exceptions, no alternative treatment plant sites are so located as to create any potential for significant erosion sedimentation impacts on surface waterways. The exceptions are the

Quarantine Island site, Alternative 11; the Beacon Hills site, Alternative 9; and the Spanish Point site, Alternative 10. No other sites are traversed by, or are contiguous to streams, other than extremely small localized tributaries and/or ill-defined "runs" of swampy areas. In the former case, streams are so small that temporary berms and/or ditches could be used to contain erosion sedimentation effects within plant site boundaries. In the case of swamps, the ill-defined channels, extreme flat gradients, and heavy natural vegetative cover along such "streams" will tend naturally to minimize erosion and will cause redeposition of temporarily suspended sediments quite close to their sources. Effects would, therefore, be confined to plant sites.

The Quarantine Island site is located on Quarantine Island in the St. Johns River estuary between Mill Cove, a shallow, poorly flushed, tidal basin, and the Dame Point Cutoff, the dredged shipping channel. The Quarantine Island site is very low with elevations on the eastern end of the island generally below ten feet msl. The U. S. Army Corps of Engineers has conducted flood frequency studies of the St. Johns River estuary and has determined that tidal stages of approximately ten feet msl can be anticipated in the vicinity of Quarantine Island at a frequency of once in fifty years. Regulatory agency requirements and the dictates of good design practice will necessitate that the sewage plant be designed and constructed at elevations not subject to flooding. This consideration would dictate that the Quarantine Island site be filled to an elevation above maximum anticipated fifty-year flood tide stage. Required fill could be most economically provided on this site by spoiling dredged material from river channel deepening and/or maintenance dredging activities on the treatment plant site. This procedure could be pursued as a complementary adjunct to needed harbor improvement and maintenance dredging activites; such dredging has been hampered in the recent past by lack of available feasible and environmentally acceptable spoil sites. The placement of dredge spoil on Quarantine Island to bring surface elevations to those required for development as a sewage plant site could result in introduction of significant quantities of sediment into both Mill Cove and the Dame Point Cutoff as material was spoiled near existing shorelines. The Dame Point Cutoff is a narrow, deep channel with tidal currents of significant velocity such that sedimentation should be a minimal problem. In contrast, Mill Cove is a shallow, poorly flushed, tidal basin where siltation is a major problem already.

The Beacon Hills site is located northwest of Beacon Hills Subdivision and adjacent to the Dame Point Cutoff. Existing ground elevations in portions of the site are such that filling will be required to bring the plant elevations above maximum flood tide stage. Portions of the site are sufficiently high that filling of lower areas could be accomplished by on-site grading. An alternative would be spoiling of dredged materials in lower portions of the site to bring them to minimum required finished grade elevations. In either event, until such time as fill material placed near the shoreline could be consolidated, compacted, graded and grassed, erosion and resulting turbidity in contiguous waters could be a problem. Because of the geometric and hydraulic characteristics of the maintained channel in the Dame Point Cutoff, as described in the prior discussion of the Quarantine Island site, sedimentation is not considered a major impact.

The Spanish Point site encroaches into saltwater marshlands bordering tidal creeks which are tributary to Chicopit Bay, a shallow tidal embayment with openings to both the St. Johns River and the Intracoastal Waterway. While most likely development on this site can be restricted to higher elevations without actual construction in the marsh, heavy rains during construction could wash significant loads of sediments from disturbed areas into the marsh.

Among the alternatives considered, 1 and 2 entail construction of effluent pipelines either directly across Mill Cove or generally parallel to Fort Caroline Road and entering the St. Johns River near the southeast corner of Blount Island. Alternative 3 provides for construction of an effluent pipeline across the narrowed portion of Mill Cove. In each of these three cases, the subaqueous crossing would be approximately 6,600 linear feet in length. Alternative 11 (plant site located on Quarantine Island) would entail construction of a raw sewage force main crossing of Mill Cove. Length of the subaqueous portion of the required crossing is approximately 3,200 linear feet. Practical design considerations, specifically low initial flows, high ultimate flow rates, the sag in the raw sewage force main crossing profile, and the need to design force mains to flow at scouring velocities to prevent deposition of raw sewage solids and consequent stoppages in the pipelines led to the decision that the Mill Cove crossing should consist of two parallel force mains. Further, considerations of feasibility led to the design decision that one crossing should be installed initially to convey sewage collected by the immediate transmission system construction program (intended to collect sewage from subdivision type systems, presently owned and operated by the City, to permit abandonment of existing small treatment plants and cessation of effluent discharge therefrom to small tributary streams). The second crossing's construction should feasibly be deferred until such future date as the City acquires present privately owned systems, constructs transmission system elements to phase out their treatment plants, and flows increase to the extent that a parallel force main and its capacity are needed. The construction impacts of the Mill Cove crossing under Alternative 11, thus, would be exerted twice, separated in time by several years.

A significant short-term construction-related effect will be the increased turbidity in Mill Cove associated with the installation of the outfall pipe or raw sewage force main. Placement of piling and/or entrenchment may be necessary to seat the pipeline adequately. This operation will result in an increased concentration of oxidizable suspended solids, hence lower dissolved oxygen content in the immediate waters. However, only about 50 feet of easement will be utilized during the preparation and installation operations, therefore, any adverse effects to the shoreline and marshes will be held to a minimum. Once the installation operations have been terminated, the turbidity will begin immediately to decrease and the waters should revert back to preconstruction state within a short period of time.

An additional characteristic unique to the Quarantine Island site is the necessity for constructing an access bridge and raw sewage force main across the narrow channel between Reed Island and Quarantine Island. It is through this channel that much of the limited tidal flushing of Mill Cove occurs. Access bridge design would be such that only piling would be installed in the channel so as to impair existing current and flushing patterns as little as possible. Also the required 18-inch raw sewage force main crossing should be constructed by suspending the pipeline from the bridge rather than by subaqueous trenching and

)ackfill. In summary, design and construction practices vould be such as to minimize any blocking or constriction of :his channel and impairment of currents so as to minimize :emporary additional incremental siltation problems in Mill Cove.

The treatment plant outfall, under all alternatives, will be extended into the main shipping channel of the St. Johns River to provide dilution and dispersal of the discharged effluents. The length of subaqueous outfall in the channel is short and is similar (1,000 feet or less) under all alternates. There will be turbidity and sedimentation problems attendant to the trenching and backfilling required for installation of the subaqueous piping. The large available dilution flow rates, strong prevalent currents and proximity to the river mouth are expected to result in good dispersal of resuspended sediments and prevent major localized sedimentation problems. The magnitude of such problems is expected to be generally the same under all alternatives; however, special care must be taken during design and construction to assure that the outfall at the shoreline (transition from land portion to subaqueous portion) is protected from future erosion by currents and wave action. This will be accomplished by burying the pipeline deeply enough to remove it from the zone of surface scouring, by providing concrete anchor blocking as required, and by providing riprap along the completed trench at the shoreline where wave and current erosion is a potential problem.

The transmission force main system is generally similar under the several alternatives and will entail construction of several stream crossings under each. With the exception of the Villa Armada force main crossing of Big Pottsburg Creek, the streams to be crossed are generally small, narrow, shallow, and are of value primarily for aesthetics and for drainage of small localized drainage areas. Aesthetic considerations will favor installation of buried pipelines rather than installation of elevated pile-supported crossings. Excavation in stream beds will be required and will present a potential for erosion, turbidity and sedimentation problems during the construction period. However, because of the general short lengths of subaqueous crossings, construction time required for each crossing is expected to be brief and the streams should revert quickly to their preconstruction states. The exception is the Big Pottsburg Creek crossing of the Villa Armada force main; the creek is approximately 150-200 feet wide at the point of the proposed crossing. Big Pottsburg Creek is used extensively for pleasure boating and waterskiing. It is considered essential that the pipeline crossing be buried in the streambed so as not to create an obstruction and safety hazard for boat traffic and skiers. Disturbance of bottom sediments, turbidity and subsequent resedimentation are considered to be necessary and unavoidable construction-related impacts; their duration will be limited to the construction period and the time required subsequent to construction for resedimentation to occur. Siltation curtains and/or turbidity screens will be required of the construction contractor.

Appropriate protective measures, concrete anchor blocking, riprap and/or sodding will be provided at points where pipeline construction crosses stream banks to minimize long-term erosion by stream currents and wave action.

In summary, stream erosion and sedimentation are expected to be significant short-term construction-related impacts under any alternative. With regard to treatment plant construction, their degree will be maximum under those alternatives (9, 10, and 11) which require or may require earthwork in shoreline or island sites. Those alternatives (1, 2, and 3) requiring subaqueous outfall construction across Mill Cove will have more significant problems than will outfall construction under other alternatives. Localized problems will result from construction of transmission system force main stream crossings under all alternatives; these would be much more extensive under alternative 11, which entails two pipeline crossings of Mill Cove, than under any other alternative. No significant long-term impacts are anticipated under any alternative.

The "no action" alternative would, of course, eliminate all the previously described short-term construction effects on local waters. Additional options for disposal of spoil from harbor improvement and maintenance dredging (as in the Quarantine Island alternative) would also be precluded. In addition, the "no action" alternative would, as mentioned earlier, undoubtedly necessitate expansion and upgrading of existing package plants as well as construction of some new ones. Certainly this situation would result in at least a number of them and more decentralized short-term episodes of stream damage resulting from construction of treatment plants, and, in some cases, new outfalls to the St. Johns River.

All alternatives considered will meet water quality objectives for the St. Johns River as established by the Water Quality Management Plan. Under all alternatives, effluent will be discharged to the maintained shipping channel of the river. Large available dilution factors, thorough mixing as afforded by strong tidal currents, and the ability of pollutants to exit the estuary on ebb tidal cycles because of location of point of discharge near the river mouth, will assure maintenance of accepted water quality standards. The implementation of any alternative will have beneficial impacts on water quality in tributary streams in that existing small treatment plants located on the tributaries will be phased out and their effluent discharges terminated.

Diversion of effluent flows from the tributaries will represent a major reduction of inflow in dry weather in many such cases where treated effluent now constitutes a major part of dry weather inflow. Such diversion, however, will result in anticipated improvements in present water quality in the tributaries as noted in the preceding paragraph. No significant effects on stream stage are anticipated; stage is a function primarily of tidal height because of flat stream bed gradients and open connection to the ocean via the St. Johns River, rather than of rate of inflow.

Operation of the facilities included under any alternative will not result in groundwater contamination. Moreover, construction of any of the wastewater treatment collection systems would minimize the need for future installation of septic tank systems with attendant frequent contamination of shallow aquifers.

The "no action" alternative would obviate the requirement for a regional treatment plant outfall, Water quality of the tributaries would eventually improve although not as much as with the regional system since existing package plants would undergo required expansion and upgrading to meet standards. However, it is to be noted that it would be more difficult to feasibly incorporate such a decentralized treatment system in any future plan for attainment of more stringent water quality objectives. Finally, the "no action" alternative would maximize the need for future installation of septic tank systems. Pressure would undoubtedly be created to install new septic tank systems in areas of the county not entirely adequate for their proper operation. The possibility of seepage to surface water bodies and/or contamination of shallow aquifers would thus be increased.

By permitting Arlington development to take place in keeping with the forecasts outlined in the Comprehensive Development Plan for Jacksonville, the proposed project will indirectly cause an increase in urban runoff which will doubtlessly accompany the growth. Such an increase -- though difficult to quantify -- would probably be less under the "no action" alternative. "No action", however, would likely tend to concentrate a somewhat smaller degree of development into a disproportionately smaller area, resulting in disproportionately higher concentration of pollutants in the urban runoff.

9) Aquatic Flora and Fauna

A major reason for areawide wastewater treatment facilities is to remove inadequately treated waste loads presently entering waters not capable of assimilating them. Pottsburg Creek and Jones Creek are receiving waters where the regional proposal should enhance water quality and the aquatic biota.

Construction effects on aquatic life would primarily be from excavation of interceptor and outfall pipeline trenches in aquatic habitats. Pipeline construction under Mill Cove as required under Alternatives 1, 2, 3, and 11 is the major area of impact on aquatic biota. Similar impact would occur in Big Pottsburg Creek but to a lesser degree. Localized sedimentation and downstream increases in turbidity will cause mortality in filter feeding and deposit feeding invertebrates. Many are quite sensitive to localized depression of dissolved oxygen levels which will undoubtedly occur from construction. Such effects are not irreparable since affected benthic organisms will recolonize the pipeline area soon after completion of construction.

Effluent discharge will be to the St. Johns River to meet water quality standards in receiving waters. Discharge will be at the bottom of the 38-foot deep ship channel to assure quick mixing. Three outfall discharge points along the ship channel are proposed. They are: the Quarantine Island location for alternatives 1, 2, 3, and 11; opposite the eastern tip of Blount Island for 4 through 8, 10 and 12; and the discharge from alternative 9. The effects on aquatic flora and fauna from the three alternate outfall locations will not vary significantly.

Operational effects on biota are unavoidable. First, the chlorinated effluent will cause a very localized planktonic kill. Second, the peripheral area of the mixing zone will be enriched above ambient river conditions by effluent nutrients. Since there are high rates of flow in the St. Johns River, rapid dilution and mixing of the wastewater will eliminate the likelihood of any significant biostimulation. Fish species will be attracted to the outfall plume, however momentary contact will not be detrimental.

If the "no action" alternative is adopted, the aquatic communities within small effluent receiving streams would certainly be adversely affected by not up-grading or tying these local waste treatment plants into the regional system. Accelerated eutrophication has no benefit to the aquatic biota. Obviously the short-term construction effects mentioned above will not occur.

More people living within the service district will increase the recreational use of aquatic resources. Shrimping and sport fishing will increase within the small tidal creeks, Intracoastal Waterway, and the St. Johns River. The distribution of the nekton in the estuarine waters may occur due to greater activity in and on these waters. Man's waste such as heavy metals, pesticides, oils, and greases will elude treatment and ultimately enter surface waters. They can interfer with the internal functioning of aquatic animals affecting behavior and reproduction. These stresses will favor a community of stress-tolerant species.

(10) Impacts to Freshwater Wetlands

Several treatment plant alternatives would severly impact inland marshes. Sites 7 and 8 would remove 46± acres of wetland habitat. Portions of sites 3, 4, and 12 are marsh but the quantity is not nearly as significant as in sites 7 and 8. Pipeline corridors will intercept freshwater marsh areas. Modification in routings can minimize the occurrences.

Cattail marsh, although not as extensive as salt marsh, borders land which will be developed. Long-term stresses upon it would be from urban runoff carrying excess nutrients and the oils and greases from additional areas of road pavement. Closer proximity of development to remote inland cypress swamps will affect animals intolerant to man's presence. Animal diversity will decrease.

(11) Impacts to Salt Marshes

Alternative 10 includes a portion of salt marsh adjacent to Mt. Pleasant Creek. No other alternative is in salt marshland. Construction of the plant on Quarantine Island would have the most primary effect on salt marsh which borders the island. A 50-foot easement corridor will also be impacted within marsh areas for outfall pipeline construction. If the organic marsh soil is properly replaced over the trench, revegetation will slowly occur. The outfall site crossing Quarantine Island would impact more salt marsh area than the other proposed outfall point near Beacon Hills. The alligator, a nationally endangered species is found in this type habitat although the alligator is not likely to be found in Mill Cove due to the presence and activities of man in this area. If they are encountered during construction, effects to the animals would be minimal if they are relocated in suitable habitat elsewhere.

Florida development in the past has encroached upon saltwater wetlands. Better knowledge of the environmental values of these areas along with increased protective jurisdiction by the Corps of Engineers and EPA will undoubtedly help preserve salt marshes. Increased recreational use of marshlands for hunting will undoubtedly occur in the future. Aesthetic appeal of marshes for just enjoying nature can remain with increased conservation of them.

12) Demography

The location of the plant on any of the proposed sites will not cause the relocation of any people (see Tables 3-13). Likewise, the location of all proposed interceptor lines, outfalls, and sludge disposal sites will not directly affect population. The "no action" alternative will have no primary impacts upon current population.

The project will have two major secondary impacts upon population. The first relates to project phasing. Alternatives 1-4 will serve population growth as projected by the Jacksonville Area Planning Board. Alternatives 5-12, however, will encourage population growth in areas east of Craig Field sooner than the Comprehensive Plan recommends. This encouragement will result from early phasing of lines connecting these sites with the heavily populated section of the service area.

The second major impact to population concerns the total population which can be supported by the wastewater treatment system selected. All of the twelve regional system alternatives will support the 2002 population forecast of 219,000 by the JAPB. The "no action" alternative, however, will constrain the population increase to perhaps no more than 185,000. This will happen because of two factors. First, existing waters quality regulations prohibit additional discharges into the surface water of the service area other than the St. Johns River. This will somewhat limit the ability of package plants and private systems to serve the same population which the regional system could serve. Second, existing regulations limit septic tank development to areas with a water table of at least 36 inches and a minimum lot size of 1/3 acre. The maximum size office development allowed cannot have a discharge of greater than 2,000 gpd.

These regulations will guide population growth in the service area away from the region east of Craig Field which is identified in Figure 2-10 as being largely unsuitable for septic tank use.

Population will be guided toward the northern section of the service area which can be served by package plants discharging into the St. Johns River. The distance south of the river which can be served by package plants discharging into the St. Johns will depend upon economic considerations. The more valuable the land the greater the likelihood that disposal can be provided.

13) Land Use

All of the proposed sites for plant location are currently vacant of urban uses (see Table 3-16). The Comprehensive Development Plan does, however, forecast urban uses for most of the sites by 1990 if the treatment plant is not constructed on them. Sites 1, 2, 3, and 4 would have medium to high residential development while sites 5-6 and 9 would have low density residential development. Sites 10 and 11 are designated for conservation and preservation while sites 7-8 and 12 would remain as undeveloped airport property. The construction of a treatment plant on any of these sites would pre-empt the use of the site and supersede the use forecast in the Comprehensive Plan. The "no action" alternative would allow all the sites to develop as projected.

The compatibility of a sewage treatment plant located on each of the alternative sites with the surrounding land uses must also be considered. Table 3-15 shows what types of land uses now surround each site. As can be seen on the table, most of this development is low density single-family residential. Sites 1, 3, 9, and 12 are closest to the largest amounts of residential development. Sites 2, 4, and 10 are close to a smaller amount, and sites 5-6, 7-8, and 10 are close to almost no surrounding development.

The compatibility of the construction and operation of the proposed plant with the surrounding land uses will be determined

TABLE 3-16

PRESENT LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac					Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Water
	0-1	1-5	5-10	10-15	15+						
1. MILLCOE ROAD											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	2.0	--	--	--	--	--	--	--	--	--
1,000-2,000'	--	31.0	--	--	--	0.4	--	--	--	--	--
2,000-3,000'	--	20.0	--	--	--	16.3	--	--	--	--	8.0
2. DUNES AREA											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	1.0	--	--	--	--	--	--	--	--	--
1,000-2,000'	--	3.0	--	--	--	--	--	--	--	--	--
2,000-3,000'	--	5.0	--	--	--	--	--	--	--	--	--
3. DAME POINT-FORT CAROLINE AREA											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	9.0	--	--	--	--	--	--	0.8	--	--
1,000-2,000'	--	10.0	--	--	--	--	--	--	14.6	--	4.9
2,000-3,000'	--	19.0	--	--	--	--	--	--	16.2	--	102.6
4. NORTH OF CRAIG FIELD											
Site	--	--	--	--	--	--	--	3.0	--	--	--
0-1,000'	--	2.0	--	--	--	--	--	64.3	--	--	--
1,000-2,000'	--	2.0	--	--	--	--	--	161.1	--	--	--
2,000-3,000'	--	10.0	--	--	--	--	--	235.6	16.3	--	--

TABLE 3-16 (Cont'd)

PRESENT LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac					Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Water
	0-1	1-5	5-10	10-15	15+						
5.&6. EAST OF CRAIG FIELD											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	--	--	--	--	--	--	--	--	--	--
1,000-2,000'	--	--	--	--	--	--	--	--	--	--	--
2,000-3,000'	--	--	--	--	--	--	--	17.6	--	--	--
7.& 8.CRAIG FIELD-INSIDE E. BOUNDARY											
Site	--	--	--	--	--	--	--	45.9	--	--	--
0-1,000'	--	--	--	--	--	--	--	124.7	--	--	--
1,000-2,000'	--	--	--	--	--	--	--	197.0	--	--	--
2,000-3,000'	--	--	--	--	--	--	--	214.3	--	--	--
9. BEACON HILLS											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	3.0	--	--	--	--	--	--	--	--	13.0
1,000-2,000'	--	20.0	--	--	--	--	15.8	--	--	--	135.9
2,000-3,000'	--	50.0	--	--	--	--	127.9	--	--	--	134.6
10. SPANISH POINT											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	1.0	--	--	--	--	--	--	--	--	--
1,000-2,000'	--	3.0	--	--	--	--	--	--	--	--	6.2
2,000-3,000'	--	6.0	--	--	--	--	--	--	--	1.7	26.5

TABLE 3-16 (Cont'd)

PRESENT LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac 0-1	1-5	5-10	10-15	15+	Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Water
11. QUARANTINE ISLAND											
Site	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	--	--	--	--	--	--	--	--	--	48.2
1,000-2,000'	--	--	--	--	--	--	14.1	--	--	--	272.2
2,000-3,000'	--	--	--	--	--	--	91.2	--	--	--	314.0
12. CRAIG FIELD- INSIDE SOUTH BOUNDARY											
Site	--	--	--	--	--	--	--	45.9	--	--	--
0-1,000'	--	--	--	--	--	--	--	128.5	--	--	--
1,000-2,000'	--	9.0	--	--	--	--	--	207.7	--	--	--
2,000-3,000'	--	26.-	--	--	--	5.9	--	246.5	13.2	--	--

primarily by the noise, odor, visual and other direct impacts of the plant. The probable severity of these impacts is discussed in detail in those sections. The results of these analyses are the basis upon which any lasting effects upon property values can be judged.

The choice of interceptor and outfall routes should have no primary impact upon land use.

The secondary impacts of the various site alternatives on land use patterns (Table 3-17) can be broken down into three major groups; alternatives 1-4, alternatives 5-12 and the "no action" alternative. The first group of alternatives (1-4) would encouarge growth in the same pattern and sequence as forecast in the Comprehensive Plan. The second group (5-12) would encourage growth near them sooner than projected. This would be because of the construction of transmission lines in the first phase which would otherwise be put off until the second phase.

Construction of the "no action" alternative would significantly alter the pattern of land development forecast in the Plan. Because of water quality and septic tank regulations, development would be limited, particularly east of Craig Field where soil conditions are not suitable for septic tank construction. Larger densities than are now forecast in the Plan would likely appear along the northern boundary of the service area because of existing limitations on new discharges into streams other than the St. Johns River. The same pressures for development that led to the JAPB's forecast of growth in the Arlington service area would still be present. But all of this pressure for development would be put on the land that was not limited in development potential because of wastewater treatment constraints. Thus development densities greater than those considered desirable because of other factors (e.g., transportation facilities, soil characteristics, vegetation, accessibility to community services, and existing neighborhood character) would probably result.

Increased development pressures would also be felt in other areas of the city to absorb people who would otherwise be living in Arlington if the "no action" alternative were not instituted. Of particular concern are the wetlands north of the St. Johns River which are designated for preservation in the Comprehensive Plan. The development of Blount Island as an industrial area will make these wetland areas attractive to residential development.

TABLE 3-17

PROJECTED 1990 LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac					Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Preservation	Conservation	Water
	0-1	1-5	5-10	10-15	15+								
1. MILLCOE ROAD													
Site	--	28.7	17.2	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	107.9	102.0	--	--	--	--	--	--	--	--	--	
1,000'-2,000'	24.3	146.7	181.3	--	--	0.4	--	--	--	--	--	1.5	--
2,000'-3,000'	65.8	152.0	194.6	30.8	--	16.3	--	--	--	--	--	30.8	8.0
2. DUNES AREA													
Site	--	--	45.9	--	--	--	--	--	--	--	--	--	--
0-1,000'	--	--	201.7	8.2	--	--	--	--	--	--	--	--	--
1,000-2,000'	--	30.3	255.0	68.8	--	--	--	--	--	--	--	--	--
2,000'-3,000'	--	195.0	152.2	95.6	--	55.5	--	--	--	--	--	--	--
3. DAME POINT - FORT CAROLINE AREA													
Site	--	--	--	63.7	--	5.2	--	--	--	--	--	--	--
0-1,000'	9.8	--	35.4	196.6	--	13.2	--	--	0.8	--	--	--	--
1,000'-2,000'	104.4	2.3	176.5	95.4	--	1.9	--	--	14.6	--	--	--	4.9
2,000'-3,000'	83.9	41.3	271.0	44.7	--	--	--	--	0.8	--	--	--	102.6
4. NORTH OF CRAIG FIELD													
Site	--	--	--	42.9	--	--	--	3.0	--	--	--	--	--
0-1,000'	37.1	--	--	108.5	--	--	--	64.3	--	--	--	--	--
1,000'-2,000'	89.4	21.8	--	81.8	--	--	--	161.1	--	--	--	--	--
2,000'-3,000'	128.5	50.8	--	67.1	--	--	--	235.6	16.3	--	--	--	--

TABLE 3-17 (Cont'd)

PROJECTED 1990 LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac					Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Preservation	Conservation	Water
	0-1	1-5	5-10	10-15	15+								
5. & 6. EAST OF CRAIG FIELD													
Site	45.9	--	--	--	--	--	--	--	--	--	--	--	--
0-1,000	209.9	--	--	--	--	--	--	--	--	--	--	--	--
1,000'-2,000'	293.8	--	--	--	--	--	--	--	--	--	--	60.3	--
2,000-3,000'	310.4	6.3	--	--	--	--	--	17.6	--	--	--	164.0	--
7. & 8. CRAIG FIELD - INSIDE E. BOUNDARY													
Site	--	--	--	--	--	--	--	45.9	--	--	--	--	--
0-1,000'	--	--	--	--	--	--	--	124.7	--	--	--	85.2	--
1,000'-2,000'	76.3	--	--	--	--	--	--	197.0	--	--	--	80.8	--
2,000'-3,000'	232.6	--	--	0.7	--	--	--	214.3	--	--	--	50.7	--
9. BEACON HILLS													
Site	45.9	--	--	--	--	--	--	--	--	--	--	--	--
0-1,000'	163.7	--	--	--	--	--	--	--	--	--	--	33.2	13.0
1,000'-2,000'	126.1	--	--	--	--	--	15.8	--	--	--	--	76.3	135.9
2,000'-3,000'	146.2	--	--	--	--	--	127.9	--	--	--	--	89.6	134.6
10. SPANISH POINT													
Site	--	--	--	--	--	--	--	--	--	--	35.3	10.6	--
0-1,000'	53.5	4.3	--	--	--	--	--	--	--	--	92.1	60.0	--
1,000'-2,000'	96.9	71.5	--	--	--	--	--	--	--	--	102.2	77.3	6.2
2,000-3,000'	143.5	160.8	--	--	--	--	--	--	--	1.7	70.7	95.1	26.5

TABLE 3-17 (Cont'd)

PROJECTED 1990 LAND USE WITHIN 3000 FEET OF PROPOSED SITES IN ACRES

Site	Residential d.u./ac 0-1	1-5	5-10	10-15	15+	Commercial	Industrial	Airports	Cultural & Institutional	Parks & Recreation	Preservation	Conservation	Water
11. QUARANTINE ISLAND													
Site	--	--	--	--	--	--	--	--	--	--	--	45.9	--
0-1,000	--	--	--	--	--	--	--	--	--	--	--	161.7	48.2
1,000'-2,000'	--	--	--	--	--	--	14.1	--	--	--	--	67.8	272.2
2,000'-3,000'	--	--	--	--	--	--	91.2	--	--	--	--	93.1	314.0
12. CRAIG FIELD-INSIDE SOUTH BOUNDARY													
Site	--	--	--	--	--	--	--	45.9	--	--	--	--	--
0-1,000'	--	--	6.4	--	--	--	75.0	128.5	--	--	--	--	--
1,000-2,000'	--	--	80.4	--	19.6	--	46.4	207.7	--	--	--	--	--
2,000-3,000'	--	43.0	97.9	--	37.0	5.9	31.8	247/5	;3/2	--	--	23.0	--

This attractiveness will increase if Arlington is not able to develop as it otherwise would because of wastewater disposal constraints.

14) Archeological, Historical and Recreational

A search of the records of the Division of Archives, History and Records Management of the Florida Department of State and a preliminary survey by a staff archeologist of the same agency indicate no known archeological or historical sites present upon any of the plant, interceptor, outfall, or sludge disposal sites. When alternative selection is finally made, a detailed archeological survey will be conducted on the plant site, interceptor lines, outfall line, and sludge disposal site. The most likely sites for archeological remains are along the St. Johns River in the northern end of the service area.

The major secondary impact of significance would be the destruction of archeological and historic sites because of increased growth and development. This would probably be most likely if the "no action" alternative were instituted since this would lead to more development in the northern section of the service district where the sites are concentrated. No difference in impacts should be felt among the 12 regional system alternatives since they all were based primarily upon the 1990 Comprehensive Plan. None of the proposed sites will be located on land which is currently designated for park and recreational use. However, most of Site 10 is located in an area designated for preservation. This area might someday be used for passive recreational facilities if it is allowed to stay in its natural state.

Site 10 is the only site with a recreational facility within 3,000 feet of the site boundary. 1.7 acres of the Camp Wil-Le-Ma Camp Fire Girls facility is between 2,000 and 3,000 feet of the proposed site. Possible impacts to this facility from plant location will be determined primarily by the noise and odor impacts of the plant. The probable severity of these impacts is discussed in the noise and odor section of this chapter. The construction of the plant on Site 1 would entail the provision of a 114-acre buffer zone which will be used as a passive recreational area in the future. The "no action" alternative should have no primary impact upon recreational facilities.

No impacts should be felt to recreational lands from the location of the interceptor lines, the outfall line, or the sludge disposal site.

All twelve of the regional alternatives would improve the ability of the tributary streams to safely support body contact recreation because of improvements to water quality. The "no action" alternative would not have any beneficial effect on the existing water quality of the tributary streams.

The major secondary impact to recreational facilities will be the increased demand for use of these facilities caused by population growth. As was stated in Chapter II, there is already a lack of adequate recreational facilities in the service area. The 12 regional system alternatives will all provide a similar impact since they all will support the growth projected by the JAPB. The "no action" alternative will have less of an impact since less new growth could be supported in the service area, thus, it will cause less demand for use of recreational facilities.

15) Transportation

During construction, traffic to and from construction sites will be induced by virtue of the need to move construction equipment, process equipment, and construction labor and materials to the sites and to remove debris from the sites.

With regard to treatment plant sites, the amount of such traffic is considered to be essentially independent of which specific site is selected. Of more concern should be the type of streets and highways over which such traffic must be routed. For instance, movement of heavy trucks and construction machinery is a common occurrence on freeways and major highways and may not be considered as objectionable as would be the same type traffic on residential streets which are normally lightly traveled.

For purposes of this report, transportation facilities in the vicinity of alternative sites were considered to fall into one of three categories -- highways, local arterials, and residential streets. Atlantic Boulevard (State Route 10) was considered to be the only highway where induced traffic of heavy construction vehicles would be least objectionable. Such traffic would be somewhat more objectionable on local arterials. Fort Caroline Road, Merrill Road, Lone Star Road, Mill Creek Road, St. Johns Bluff Road, Monument Road, Mt. Pleasant Road, and Girvin Road are considered local arterials. Heavy traffic is considered most objectionable on residential streets.

Among the alternatives, access to three sites (Alternatives 5-6, 7-8, and 12) could be gained directly from Atlantic Boulevard. Two sites, Alternatives 9 and 11, could be reached only by routing all construction traffic through residential streets in the Beacon Hills Subdivision from Fort Caroline Road. Access roads into all other sites could connect directly to local arterials.

Construction traffic attendant to transmission system construction would be a function of the number of pumping stations and total length of force mains built.

The alternatives are compared on this basis below (these differences are not considered major):

Alternative System No.	Number of Stations	Total Length of Force Main
1	32	245,500
2	32	248,100
3	33	250,300
4	33	253,500
5	34	254,300
6	34	258,000
7	34	259,500
8	34	256,700
9	34	261,600
10	34	262,800
11	34	262,200
12	*	*

*Transmission systems are not specifically laid out for this alternative; number of pumping stations and overall force main lengths are similar to Alternatives 7 and 8.

Operation of a wastewater treatment plant on any site considered will generate traffic. Light vehicular traffic will be generated by ingress and egress of plant operational personnel as they come to and leave their place of employment. Volume of such traffic will be light because of the relatively small number of personnel involved. Moreover, it is anticipated that most, if not all, personnel will travel by passenger auto or light truck (pickup or small van). It is not anticipated that either the volume or character of such traffic would be aesthetically objectionable even on residential streeets.

Of more significance will be heavy truck traffic. Such traffic will result from the hauling of treatment chemicals (chlorine) to the plant site, traffic by septic tank trucks, and temporary portable toilet trucks to the treatment plant for discharge thereto, and traffic caused by screening and grit disposal. The magnitude of such traffic is estimated as follows:

Chemical deliveries: In accordance with dictates of good design and operational practice, chlorine will be delivered in minimum quantities of one-week supplies. Delivery truck traffic will thus consist of one round trip weekly or 0.2 trips per day based on a normal five-day work week.

Septic tanks and temporary toilets: The number of septic tanks serviced at 1973 levels will be 17,426 and at 2002 levels is 25,426. Assuming three years as normal septic tank cleaning frequency, 2.5 tanks pumped per truck hauled and 260 working days (52 five-day weeks) per year, average septic tank truck traffic volume at present is 8.94 round trips per day with year 2002 volume projected at 13.04 round trips daily.

Portable toilet truck trips are estimated at approximately one-third the traffic volume of septic tank truck traffic, i.e., 3.0 round trips per day in 1973 and 4.3 round trips in 2002.

Grit and screening production: No definite data is available relative to grit and screenings production and disposal practices. For purposes of this estimate, it is assumed that grit volume is equivalent to 20 percent of ash volume, thereby necessitating 0.32 and 0.80 trips daily for disposal at 10.0 and 25.0 mgd flows respectively. It is assumed that one screenings disposal trip will be made daily because of the putrescible nature of screenings regardless of the volume of screenings or flow of sewage involved.

The operation of an incinerator for sludge disposal will generate a significant amount of ash which must be transported off the site. Ash production figures for the treatment plant at initial 10.0 mgd and ultimate (year 2002) 25.0 mgd capacity are as follows:

DESCRIPTIONS	PLANT CAPACITY	
	10.0 mgd	29.0 mgd
Primary Sludge, lb/dry solids/day	12,510	31,275
Waste Activated Sludge, lb/dry solids/day	7,110	17,775
Scum, lb/dry, solids/day	60	150
Total Dry Solids, lb/day	19,680	49,200
Total Dry Solids, tons/day	9.84	24.6
Total Ash, tons/day, average	2.46	6.15
Total Ash Volume, cu.yd/day average	4.6	11.4
Ash Volume, cu.yd/day (5-day week)	6.44	15.6
Daily Haul, Trips by 5-yd Dump Truck, 80% average load (5-day week)	1.61	3.99

The use of land spreading for sludge disposal will generate some truck traffic between the treatment plant site and the land spreading site. It is estimated that approximately six times the amount of trips generated by ash disposal would be generated by land spreading. This would be 10 trips daily for 10.0 mgd and 24 trips daily for 25.0 mgd in the same capacity trucks used for ash disposal.

The total traffic generated for the operation of a regional wastewater system in the Arlington East service area will be as follows:

Traffic Sources	Round Trips Daily	
	First Stage	Ultimate
Chemical Delivery	0.20	0.20
Ash Disposal (Sludge disposal)	1.61 (10.00)	3.99 (24.00)
Grit Disposal	0.32	0.80
Screenings Disposal	1.00	1.00
Septic Tank Truck	8.94	13.04
Portable Toilet Truck	3.00	4.30
Total, Truck Round Trips	15.07 (23.46)	24.33 (44.34)
Total, One-Way Trips	30.14 (46.92)	48.66 (86.88)

The impact this traffic will have again depends largely upon the types of roads over which it will travel. Access to three sites (Alternatives 5-6, 7-8, and 12) could be gained directly from Atlantic Boulevard which is considered a highway-access to sites 1, 2, 3, 4 and 10 and could be reached from local arterials including Fort Caroline Road, Merrill Road, Lone Star Road, Mill Creek Road, St Johns Bluff Road, Monumnet Road, Mt. Pleasant Road, and Girvin Road. Alternatives 9 and 11 can be reached only by routing all traffic through residential streets in the Beacon Hills Subdivision from Fort Caroline Road.

The possible effects of the project on air transportation facilities is also an important factor to consider. Craig Field, a general aviation airport, owned and operated by the Jacksonville Port Authority, is located within the Arlington East District. Craig Field occupies a site of 1300 acres east of St. Johns Bluff Road and north of Atlantic Boulevard. The airport is extensively used for governmental (Florida National Guard) and general civilian aviation. In 1972 it had three times as many general aviation aircraft, accommodated 2.2 times as many general aviation aircraft operations, and had as many total aircraft operations as did Jacksonville International Airport.

The significant impacts of constructing a large-scale municipal treatment plant at the airport are twofold. First, land resources are diverted for use as a sewage treatment plant. Alternatives 7-8 and 12 are both on land designated for future airport use in the 1992 Airport Master Plan Study.

The second potential impact is construction of structures where elevations encroach into clear zones on approach zones in violation of minimum air safety standards. The controlling structure in the proposed sewage treatment plant would be an incinerator building and stack (59-foot building height plus 15-foot stack, height totals 74-foot overall height). Two sets of regulations, one local and one Federal, govern building heights in the vicinity of the airport.

Local regulations, as set forth in Part II, Chapter 708 of the Jacksonville Zoning Code, establish maximum building heights in concentric zones around all local airports. Two such zones, centered around Craig Airport and the U. S. Naval Air Station at Mayport, affect the Arlington-East District. The Jacksonville Zoning Code would prohibit erection of any building taller than 50 feet anywhere on Craig Field. Location of the plant on airport property with an incinerator would necessitate obtaining a variance of the zoning code, which it is the prerogative of the Jacksonville city government to grant.

Federal regulations pertinent to air space around airports are promulgated by the Federal Aviation Administration (FAA). Approach surfaces and transition zones were constructed graphically to determine in what locations, inside the southern and eastern property lines, buildings whose top elevations were 75 feet above runway elevations could be constructed without violating FAA regulations. Areas where such buildings could be located include the treatment plant sites under consideration in alternatives 7-8 and 12.

Two alternatives, numbers 6 and 8, propose construction of a 54-inch transmission system force main crossing of the airport. The route would cross Runway 13-31 and its parallel taxiway. In the interest of safety, both of air travelers and of construction personnel, this runway should be closed to aircraft operations during the construction period. Even if it were subsequently determined that such closure was not necessary, construction activity on the field in the vicinity of hangars, aprons, taxiways, and runways would undoubtedly be quite disruptive of normal airport usage. The economic value of the total volume of usage for military training, general business, pleasure flying, and civilian pilot training is significant. The economic impact of any major disruption of normal usage must also be considered significant. Effects of pipeline construction would be temporary, their duration being limited to the period of actual construction.

The secondary impacts of the proposed project on transportation are related to the impact that growth supported by the project will have on use of the service area's transportation facilities. All twelve of the regional system site alternatives will have essentially the same impact upon transportation. The demand on the area's transportation facilities will double by the year 2002 as it grows more or less in proportion to the population increase. Traffic volumes will increase significantly, especially in the areas near major home-to-work trip corridors.

The 'no action" alternative would limit the total demand on transportation facilities because of the limiting of population. The decrease in added demand would be especially felt in the area east of Craig Field where septic tank restrictions would limit growth. However, more traffic would probably be felt in the area near the St. Johns River because of the increased densities projected under the "no action" alternative.

16) Water Supply

There should be no significant primary effects to the Jacksonville water supply system caused by any of the proposed site locations or subsystem alternatives. This is also true in regard to the "no action" alternative.

The major secondary impact to the water supply system will be the increased demand caused by growth in the area. The growth supported by the regional system and forecast by the JAPB will approximately double the water supply demand now present. The "no action" alternative will cause a decrease in this added demand proportionate to the decrease in additional population.

17) Community Facilities

There will be no significant construction impacts to any community facilities and services caused by any of the proposed site locations or subsystem alternatives. This is also true for the "no action" alternative.

One of the alternative sites, site 3, is within 3,000 feet of a school. The possibility of any operational impacts to this site can be determined from the noise and odor sections and is not considered significant.

Secondary impacts from the proposed project will consist of increased demands for the use of community facilities and services. Demands for these facilities and services should more than double by the year 2002 if any of the proposed regional alternatives are chosen. The "no action" alternative will cause a decrease in this added demand proportionate to the decrease in additional population growth.

18) Resource Use

Construction of a plant on any of the proposed sites will cause a permanent and irrevocable commitment of resources in the form of materials used in construction. Treatment plant construction entails commitment of material resources in the form of cement, mineral aggregates, structural and reinforcing steel, pipe materials and valves, manufactured process equipment and pumps, electrical equipment and wiring, and building construction materials. Similar materials, though in lesser quantities, are utilized in pumping station construction, while pipeline construction utilizes piping, values, concrete, and pavement replacement materials. Also, during construction, fuels and consumable supplies are required for operations of vehicles, equipment and machinery.

Differences in value of materials used in construction does not vary with the different site alternatives. The "no action" alternative would, of course, require the use of no construction materials. However, additional package plants would probably be built to discharge into the St. Johns River if no regional plant were built.

Differences in quantities of materials used in construction of the transmission system depends largely upon the differences in length among the various alternatives. These lengths range from 245,500 for alternative 1 to 262,800 for alternative 10. The complete list is presented in the transportation section of this chapter. The "no action" alternative will require no transmission line construction.

The major resources used in plant operation will be electricity and chlorine. The incinerator will use number 2 fuel oil in its operation. Land spreading will require no major outlays of energy.

The electrical use required for the operation of the alternative transmission systems is as follows:

System Number	KWH of Power
1	4,823,333
2	4,858,666
3	5,191,666
4	4,972,666
5	5,876,333
6	5,966,000
7	6,070,333
8	5,850,333
9	6,318,000
10	6,684,666
11	6,034,000
12	5,850,333

Secondary impacts of the project on resource use consist of the materials used in the construction of new development and in the electricity and other fuels used to support this development. This impact should be the same for all of the 12 regional system alternatives since they will all support the same amount of development. Resource use should, however, be somewhat less for the "no action" alternative since there would be less people and development to demand resource use.

E. Alternatives Evaluation

The alternatives evaluation process involves comparing the total environmental effects and monetary costs of each alternative. The environmental analysis follows the same format as the previous description of impacts. Each alternative is rated in each category according to the associated effect, positive or negative. The rating is given according to the combined effect of its construction, operation, and secondary impacts. An arbitrary scale of 0-10 is used where:

0 = highly undesirable effect
2 = moderately undesirable effect

4 = slight undesirable effect
5 = neutral effect
6 = slight desirable effect
8 = moderate desirable effect
10 = highly desirable effect

In order to sensitize the criteria used in this evaluation process, a citizens committee was assembled to provide input into the alternative analysis procedure. The committee members are listed in Table 3-18. The committee was requested to help identify appropriate environmental categories, and to rate these categories as to their significance in the Arlington-East area.

TABLE 3-18

Assistance Committee Members - Arlington East

(City)

Herb Underwood, Chief, Intergovernment Affairs

C. C. Holbrook, Director, Public Works

Mr. Ed Baker, Chairman, Jacksonville Area Planning Board

Mr. Don Brewer, Councilman, Arlington Area

(Affected)

Mr. Charles Morgan, Holly Oaks Community Club

Dr. Bette J. Soldwedel, Univ. of N. Florida

Robert Wilkins, Citizens Advisory Committee to Jacksonville Area Planning Board

Mr. David Evans, Past President Holly Oaks Community Club

Del Revels, Greater Arlington Civic Council

(Others)

Mrs. Charles Platt, III, League of Women Voters
Alternate - Mrs. Tess Durant

Thomas Brewer, Jacksonville Area Chamber of Commerce

Jack Merrion, St. Johns River Water Mgt. Board

John Powers, Urban Designer, Stockton, Whitley, Davin and Co.

Ted Pappas, President AIA

The following criteria were agreed to and used in the evaluation procedure:

1. Air Quality
2. Noise
3. Odor
4. Topography
5. Soils
6. Terrestrial Vegetation
7. Terrestrial Animals
8. Water Quality
9. Aquatic Flora and Fauna
10. Freshwater Wetlands
11. Salt Marshes
12. Demography
13. Land Use
14. Archeological, Historical, Cultural and Recreational
15. Transportation
16. Water Supply
17. Community Services
18. Resource Use

A rating of 0-10 was given to each category where zero indicates a topic of no importance and ten indicates one of maximum importance. The weights that were assigned by each committee member were normalized by dividing the sum of all the category weights into each category value and multiplied by 100 to give that category its percent importance to the area's total environment.

The committee category weightings are given in Table 3-19. These weightings were used in the evaluation of alternatives by multiplying the rating given to each alternative in each category by the appropriate category weighting. The resultant weighted rankings in each category were added for each alternative to give a final environmental score.

The ratings given to each category for each alternative by the EIS preparation team are shown in Table 3-20. The input from the community group was fully considered prior to rating the alternatives. The rationale for these rankings are given in the discussion of impacts found in this chapter. A summary of the ratings and rankings is given in Table 3-21.

TABLE 3-19

ARLINGTON-EAST ASSISTANCE

COMMITTEE WEIGHTED CRITERIA

1.	Air Quality	8.35
2.	Noise	5.7
3.	Odor	7.0
4.	Topography	3.7
5.	Soils	3.3
6.	Terrestrial Vegetation	4.6
7.	Terrestrial Animals	3.9
8.	Water Quality	8.5
9.	Aquatic Flora & Fauna	5.1
10.	Freshwater Wetlands	4.85
11.	Salt Marshes	5.5
12.	Demography	5.2
13.	Land Use	6.9
14.	Archeological, Historical, Cultural and Recreational	4.3
15.	Transportation	4.5
16.	Water Supply	7.1
17.	Community Services	4.5
18.	Resource Use	4.4

TABLE 3-20

EPA ENVIRONMENTAL IMPACT RATINGS

ALTERNATIVE	RATING	RANK
1Q	480.35	6
1B	490.30	2
2Q	479.25	7
2B	489.20	3
3	476.05	8
4	473.40	10
5	481.60	5
6	486.00	4
7	442.60	13
8	447.00	12
9	455.40	11
10	405.70	14
11	474.90	9
12	492.40	1
INCINERATION	468.75	-
LANDSPREADING	540.80	-
NO ACTION	375.80	15

TABLE 3-21

EPA IMPACT RATING WORK SHEET

ALTERNATIVE	AIR QUALITY	ODOR	NOISE	TOPOGRAPHY	SOILS	TERRESTRIAL VEGETATION	TERRESTRIAL ANIMALS	WATER QUALITY
1Q	4	4	4	4	5	5	5	10
1B	4	4	4	4	5	5	5	10
2Q	4	4	4	3	5	5	5	10
2B	4	4	4	3	5	5	5	10
3	4	4	4	4	5	5	5	10
4	4	4	4	4	5	4	4	10
5	4	5	5	5	5	4	4	10
6	4	5	5	5	5	4	4	10
7	4	5	5	5	5	2	2	10
8	4	5	5	5	5	2	2	10
9	4	4	4	4	5	5	5	10
10	4	4	4	5	5	1	1	10
11	4	5	5	4	5	5	5	10
12	4	4	5	4	5	5	5	10
INCINERATION	4	6	5	4	5	5	5	5
LAND SPREADING	5	4	5	5	10	10	7	4
NO ACTION	5	2	5	4	5	6	6	2

TABLE 3-21

EPA IMPACT RATING WORK SHEET (CONT'D)

ALTERNATIVE	AQUATIC FLORA & FAUNA		SALT MARSHES		FRESHWATER WETLANDS	DEMOGRAPHY	LAND USE
	Quar. Isl. Outfall	Blount Isl. Outfall	Quar.Isl. Outfall	Blount Isl. Outfall			
1Q	3		3		5	6	3
1B		4		4	5	6	3
2Q	3		3		5	6	4
2B		4		4	5	6	4
3	3		3		5	6	3
4		4		4	3	6	3
5		4		4	5	4	4
6		4		4	5	4	4
7		4		4	1	4	4
8		4		4	1	4	4
9		4		4	5	4	2
10		4		4	3	4	2
11	2		2		5	6	5
12		4		4	4	5	4
INCINERATION	5		5		5	5	5
LAND SPREADING	5		5		5	5	5
NO ACTION	2		3		5	3	3

TABLE 3-21

EPA IMPACT RATING WORK SHEET (CONT'D)

ALTERNATIVE	RECREATIONAL	TRANSPORTATION	WATER SUPPLY	COMMUNITY SERVICES	RESOURCE USE
1Q	7	4	5	5	5
1B	7	4	5	5	5
2Q	6	4	5	5	5
2B	6	4	5	5	5
3	6	4	5	5	5
4	6	4	5	5	4
5	6	4	5	5	3
6	6	4	5	5	4
7	6	4	5	5	3
8	6	4	5	5	4
9	6	3	5	5	3
10	3	4	5	5	3
11	5	3	5	5	3
12	6	5	5	5	5
INCINERATION	5	5	5	5	2
LAND SPREADING	5	5	5	5	10
NO ACTION	4	4	4	5	4

The costs for each alternative system are given in Table 3-22. Table 3-23 summarizes the project costs and environmental rankings for each alternative. The cost per household is calculated assuming 100,000 Arlington residents will pay for the entire amortized project costs (including Federal funds), and for operation and maintenance.

As may be seen from the environmental effects ratings, Alternative 12 (South edge of Craig Field) appears most desirable, followed very closely by Alternatives 1 (Millcoe Road), 2 (Dunes Area), 4 and 5 (East of Craig Field), 3 (Dames Point-Fort Caroline Freeway), 11 (Quarantine Island), and 4 (North of Craig Field). With regard to costs, the Millcoe Road, Dunes Area, and Dames Point-Fort Caroline alternatives are all within approximately five percent of each other. South of Craig Field, Quarantine Island, and North of Craig Field are approximately ten percent higher in costs.

As may be seen from Figure 3-23, the proposed project (1Q) ranks sixth and an alternate at the same site (1B) ranks second. In view of the substantially greater cost of systems 12, 1B, 2B, 6 and 5 and the relatively close environmental ratings of these alternatives, alternative 1Q is considered a reasonable and cost effective solution to the problem of wastewater treatment and disposal for the Arlington-East area.

TABLE 3-22

COST SUMMARIZATION

1. Millcoe Road

Total Project Cost	$48,559,307.00
Total Annual Operation & Maintenance	1,588,165.46
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	5,864,949.22
Total Annual Cost per Household (Based on 100,000 population or 32,258 households)	181.81

2. Dunes Area

Total Project Cost	$50,615,077.00
Total Annual Operation & Maintenance	1,575,635.46
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,033,477.89
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	187.04

3. Dames Point/Fort Caroline

Total Project Cost	$52,364,776.00
Total Annual Operation & Maintenance	1,748,226.85
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,360,171.24
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	197.17

4. North of Craig Field

Total Project Cost	$56,308,903.00
Total Annual Operation & Maintenance	1,782,508.89
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,741,825.99
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	209.00

5. East of Craig Field- System "A"

Total Project Cost	$62,699,047.00
Total Annual Operation & Maintenance	1,948,299.38
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	7,470,418.25
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	231.58

TABLE 3-22

COST SUMMARIZATION (Continued)

6. East of Craig Field - System "B"

Total Project Cost	$57,887,620.00
Total Annual Operation & Maintenance	1,875,765.06
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,974,125.15
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	216.20

7. Inside East Boundry of Craig Field - System "A"

Total Project Cost	$63,709,227.00
Total Annual Operation & Maintenance	1,983,028.33
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	7,594,117.20
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	235.42

8. Inside East Boundry Craig Field - System "B"

Total Project Cost	$58,363,620.00
Total Annual Operation & Maintenance	1,806,895.30
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,947,178.33
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	215.36

9. Beacon Hills

Total Project Cost	$64,971,606.00
Total Annual Operation & Maintenance	2,137,966.57
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	7,860,237.46
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	243.67

10. Spanish Point

Total Project Cost	$62,707,688.00
Total Annual Operation & Maintenance	2,080,809.05
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	7,603,688.97
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	235.71

TABLE 3-22

COST SUMMARIZATION (Continued)

10. Spanish Point

Total Project Cost	$62,707,688.00
Total Annual Operation & Maintenance	2,080,809.05
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	7,603,688.97
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	235.71

11. Quarantine Island

Total Project Cost	$56,772,182.00
Total Annual Operation & Maintenance	1,943,517.94
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,943,637.60
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	215.25

12. Southside Craig Field

Total Project Cost	$55,749,995.00
Total Annual Operation & Maintenance	1,655,355.79
Total Annualized Cost (Based on 6 1/8% interest rate for 20 years)	6,565,447.96
Annual Cost Per Household (Based on 100,000 population or 32,258 households)	203.53

TABLE 3-23

Environmental Ranking and Project Costs

EIS Ranking		System, STP Location	EIS Ratings	MONETARY COSTS Plant Cost	Project Cost
1	12.	Southside Craig Field	492.40	38,094,179	55,749,995
2	1.B.	Millcoe Road (Blount)	490.30	37,032,984	51,219,085
3	2.B.	Dunes Area (Blount)	489.20	39,440,031	53,274,925
4	6.	E. of Craig, Sys. "B"	486.00	35,883,702	57,887,620
5	5.	E. of Craig, Sys. "A"	481.60	35,883,702	62,699,047
6	1.Q.	Millcoe Road (Quarantine)	480.35	34,373,206	48,559,307
7	2.Q.	Dunes Area (Quarantine)	479.25	36,780,183	50,615,077
8	3.	Dames Point/Ft. Caroline	476.05	33,242,115	51,364,776
9	11.	Quarantine Island	474.90	34,245,873	56,772,182
10	4.	N. of Craig Field	473.40	35,895,000	56,308,903
11	9.	Beacon Hills	455.40	36,621,384	64,971,606
12	8.	Inside E. Craig, (Sys. "B")	447.00	37,592,000	58,363,620
13	7.	Inside E. Craig, (Sys. "A")	442.00	37,592,000	63,709,227
14	10.	Spanish Point	405.70	35,326,358	62,707,688
15	13.	NO ACTION	375.80		

IV. Project Description

The proposed project consists of a sewage treatment plant, outfall, interceptors, and pumping stations. The general layout of the project may be seen in Figure 3-1. The layout of the treatment plant for the proposed project and the expansion is shown in Figure 4-1. The first phase of the system includes a 10 million gallon per day treatment plant and interceptors to hook up presently city-owned small treatment facilities. The proposed system and future expansions are shown in Figure 3-1. The ultimate size of the system is proposed to be 25 million gallons per day. Expansion of the plant will be necessary prior to 1990.

Costs for the proposed project and future expansion are given in Table 4-1.

TABLE 4-1

	10 mgd	25 mgd
Plant	22,178,700	5,499,500
Outfall	2,455,800	--
Plant Pumping Station	2,380,000	--
Access Road	153,000	--
Force Mains	7,227,200	6,614,000
Pumping Stations	4,325,000	7,444,500
Eng., Legal, Cont.	8,828,091	--
Land	1,011,516	--
TOTAL	48,449,307	24,017,224

FIGURE 4-1

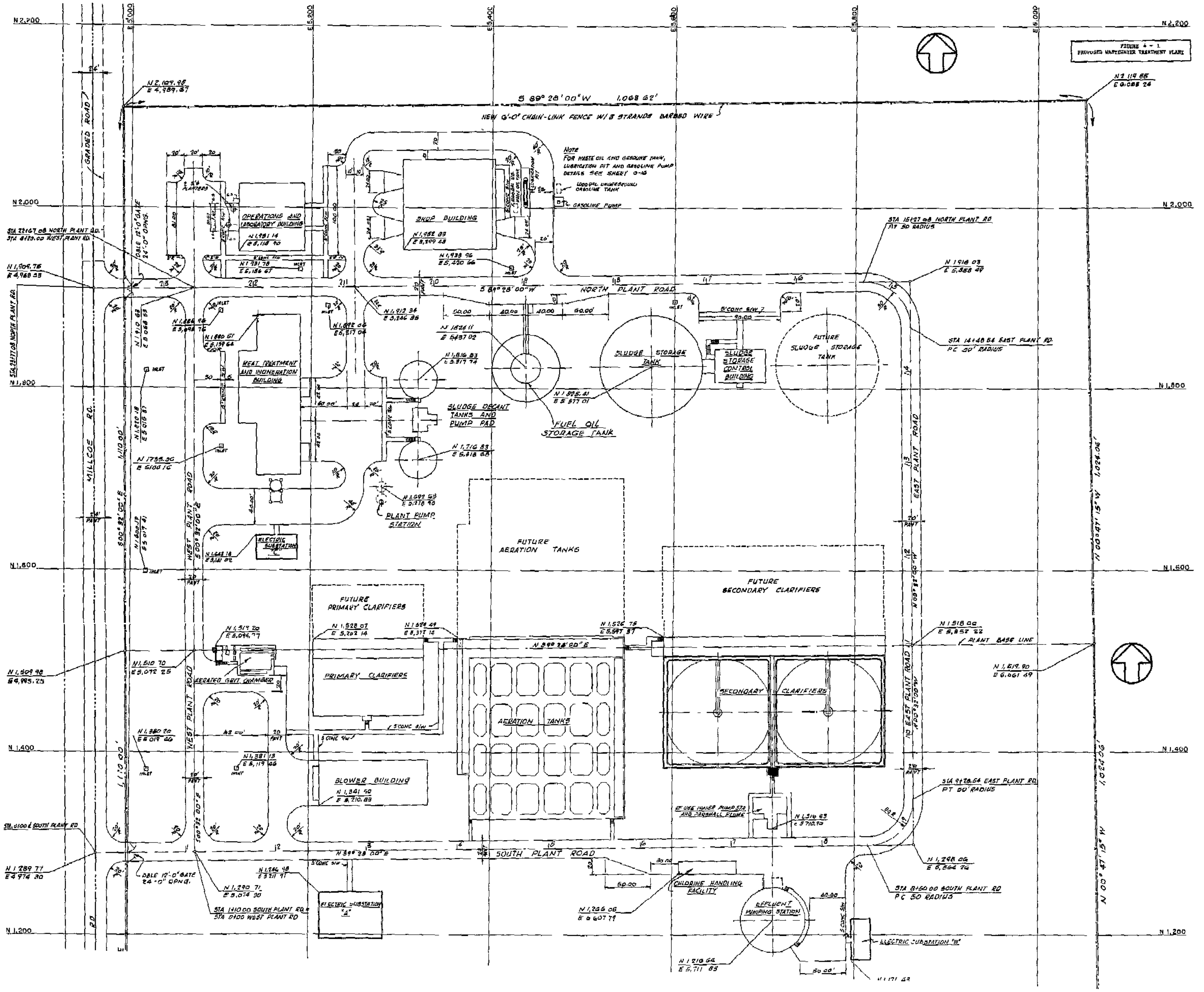


FIGURE 4-1
PROPOSED WASTEWATER TREATMENT PLANT
S 89° 28' 00" W 1,068.62'
NEW 6'-0" CHAIN-LINK FENCE W/ 3 STRANDS BARBED WIRE
OPERATIONS AND LABORATORY BUILDING
SHOP BUILDING
NORTH PLANT ROAD
SOUTH PLANT ROAD
WEST PLANT ROAD
EAST PLANT ROAD
MILLCOE RD.
GRADED ROAD
HEAT TREATMENT AND INCINERATION BUILDING
SLUDGE DECANT TANKS AND PUMP PAD
FUEL OIL STORAGE TANK
SLUDGE STORAGE TANK
SLUDGE STORAGE CONTROL BUILDING
FUTURE SLUDGE STORAGE TANK
PLANT PUMP STATION
ELECTRIC SUBSTATION
FUTURE AERATION TANKS
FUTURE SECONDARY CLARIFIERS
FUTURE PRIMARY CLARIFIERS
PRIMARY CLARIFIERS
AERATION TANKS
SECONDARY CLARIFIERS
AERATED GRIT CHAMBER
BLOWER BUILDING
CHLORINE HANDLING FACILITY
EFFLUENT PUMPING STATION
ELECTRIC SUBSTATION "A"
ELECTRIC SUBSTATION "B"
PLANT BASE LINE
N 2,200
N 2,000
N 1,800
N 1,600
N 1,400
N 1,200
E 5,000
E 5,200
E 5,400
E 5,600
E 5,800
E 6,000

Sludge handling and treatment for the Arlington-East project consists of a centrifuge for initial dewatering to four percent solids, sludge holding tanks, heat treatment to condition the sludge, vacuum filtration to further dewater the sludge to 35% solids and finally incineration. The ash resulting from the sludge incineration will be landfilled.

Additionally, the sludge may be used as a soil condition following heat treatment. The sludge after this process is an odorless, sterile material particularly suitable for use as a conditioner. Provisions for loading sludge following the heat treatment step are to be provided.

Effluent disposal will occur approximately 500 feet off Quarantine Island in approximately 38 feet of water. The outfall will cross Mill Cove, Marian Island and Quarantine Island. Approximately 6300 feet of 48" outfall will be placed on land and approximately 7500 feet will be placed under water.

The flow characteristics at the discharge location are complex and involve tidal flows. The volume of water passing the outfall location due to tidal fluctuations and river flow will provide considerable dilution of the discharge. The depression of dissolved oxygen concentration and the increase in nutrient levels due to the discharge will be insignificant.

The wastewater treatment plant facilities schematic is shown in Figure 3-22. Facilities include prechlorination, screening, aeration, grit removal, primary clarifiers, skimming, activated sludge treatment, secondary clarifiers, return sludge facilities, and effluent chlorination. The design capacity of the first phase is 10 mgd. This capacity is sufficient to serve existing populations in the service area. Many of the existing septic tank installations in the Arlington-East area may remain in operation and it is estimated that the proposed facility will be adequate for approximately ten years. Operation and maintenance costs for the facility are presented and discussed in the resource use section of Chapter V.

Considerable noise and odor control features have been incorporated into the plant and have been described in detail in Chapter III. Additionally, pumping stations will have aerated wet wells to control odors in the interceptor lines and pumping stations.

V. Environmental Effects of the Proposed Action

A. General

The beneficial and detrimental environmental effects of the proposed action described in Chapter IV are discussed in detail in this chapter. The discussion is divided into natural and man-made categories similar to those appearing in Chapter II -- "The Environment Without the Proposed Action" -- to facilitate a direct comparison.

B. Environmental Effects

1. Primary Effects

a. Natural Environment

1) Atmosphere

a) Air Quality

Primary sources of air pollution resulting from project construction will be construction dust and construction vehicle and equipment exhaust emissions. Smoke from burning of cleared vegetation, rubbish, and debris will not be a source since open burning will be prohibited by contract specifications. The contractor will be required to haul debris to a disposal site designated by the City. Cleared vegetation will either be hauled to a designated site and burned in accordance with the requirements of an open-burning permit, or chipped and spread on the construction site.

Some unavoidable dust problems are expected to be generated by clearing, excavation, and grading on the treatment plant and pumping station sites and along pipeline routes. The degree of impact caused by wind erosion of disturbed soils is related to soil type, particularly particle size. This impact will be minimal at the plant site due to the sandy and larger particle soil types found there. The same will also hold true for construction along most of the proposed interceptor system. Although the proposed plant site has residences approximately one-fourth of a mile away, soil types will combine with the vegetative buffer zone to minimize the effects of construction related dust. Further, construction specifications will require the spreading of calcium chloride as needed on disturbed earth areas as a dust control measure.

During the period of construction, a certain amount of unavoidable traffic will be needed to transport construction and process equipment as well as labor and materials to the site and to remove debris from the site. Although proportional to the density and proximity of surrounding residents, the impact of exhaust emissions from this traffic, as well as from construction equipment, is anticipated to have little actual noticeable effect.

The principle source of operational air emissions from the proposed facility will be the multiple hearth sludge disposal incinerator. No operational incinerator is totally efficient and, as a result of incomplete combustion, the resulting emission of air pollutants must be considered an adverse environmental effect. Such materials commonly considered pollutants include particulate matter (fly ash), oxides of sulfur and nitrogen, and carbon monoxide which, in the Jacksonville-Brunswick Air Quality Control Region, have received a priority classification of I, II, III and III, respectively. In this context, it is interesting to note that the City's application to the State of Florida Department of Pollution Control to construct a sludge incinerator at the Buckman Sewage Plant to burn sludges from both the Buckman and District 2 Plants listed each of these pollutants as constituents of the stack emission. However, the subsequently issued permit limited only particulate emissions with respect to total weight (216 pounds per day), grains per standard cubic foot (0.05), and particulate size (0 to 5 microns) from 302 tons per day of dry sludge incinerated, a volume far in excess of that actually expected from the Buckman Plant (approximately 70 tons per day). This compares to projected particulate emissions from the Arlington-East incinerator of 19.5 pounds per day, 0.02 grains or less per standard cubic foot of dry gases corrected to 12 percent CO_2, and particulate size of 0 to 5 microns.

In the context of comparing the proposed Arlington incinerator with the Buckman installation, it should be noted that the sludges to be burned at Buckman are largely of industrial origin while those at Arlington will be totally domestic in character. This means that the Arlington sludge will more nearly approach complete combustion by virtue of its more volatile and readily oxidizable nature. Further, there is no potential for heavy metal concentrations in the Arlington incinerator stack emissions because no sludges of industrial origin will be burned. Inasmuch as the Buckman incinerator emissions conform to pertinent State standards and the sludge from Arlington-East is more readily conbustible, it is concluded that emissions from the Arlington incinerator stack will consistently fall well within emission limitations as set forth in State air quality standards for both initial and ultimate plant capacities. However, just as no real incinerator installation attains the ideal of perfect and complete combustion, neither does any stack emission scrubbing device achieve total removal of air pollutants. In the absence of totally efficient scrubbers, some pollutants will exit the system in stack emissions. Chapter III provided background data against which the magnitude of particulate emissions from the proposed incinerator could be evaluated. A description of particulate fallout per unit acre resulting from incinerator operation was also given. It was concluded that the ultimate plant capacity of 25 mgd will result in particulate emissions representing an insignificant percent of total existing emissions for the City. Further, it was calculated that even under critical operational and meteorological conditions, particulate fallout per unit acre will be quite minor and have no effect on the surrounding resident population.

b) Noise

Construction noise is generated totally by the operation of construction equipment and vehicles. These noises are unavoidable but their adverse impacts will be moderated by construction specifications which will require that particularly noisy operations be carried out only during normal daylight working hours. Further, the high and well-drained nature of the plant site will not necessitate pile driving, the potentially noisiest construction operation.

Noise impact from construction vehicles using Monument Road, the primary access route, is expected to be minor since it is a secondary arterial which already bears a significant amount of traffic. Noise at the construction site itself will at times be noticed by the surrounding resident population but its impact is not expected to be significant due to the large buffer zone between the site and the nearest residents.

A minimal noise impact on the surrounding community would be realized from operation of the proposed facility. This impact has been described in detail in Chapter III.

c) Odor

The primary source of construction-related odor will be exhaust emissions of construction vehicles and equipment. Little impact is expected due to the already substantial amount of traffic on the primary access road and the extensive buffer zone between the construction site itself and surrounding residents. Nuisance odors associated with demucking operations will not be a problem since construction at the proposed site will not require demucking.

Operation of the controlled plant is expected to result in no noticeable nuisance odors off the plant site. Operational odor impact, as well as rationale and control systems, have been detailed in Chapter III.

2) Land

a) Physical and Chemical

(1) Topography

The 46-acre treatment plant site is essentially divided into a lower northern and a higher southern half separated by a ten to twelve foot embankment whose slope is, for the most part, in excess of eight percent. The facilities themselves will be constructed on the higher portion of the site and will require a minimum of grading and land surface alteration. The embankment will be affected only minimally and the lower northern portion will not be altered at all.

Effects of plant operation on topography center around visibility of the facilities. On-site studies to determine the visibility of the highest plant component--the 74-foot incinerator stack--have been described in Chapter III. In summary, observations have indicated that the incinerator stack will, for all practical purposes, not be visible by residents surrounding the Millcoe Road plant site.

(2) Soils

While cleared and under construction, the plant site will be subject to erosion by wind and water. Erosion by water will be minimized by the flat to moderately sloping terrain of the construction site while erosion by both wind and water will be minimized by the larger and inorganic soil particles prevalent at the site. Temporary soil erosion during construction, although an adverse environmental impact, is not expected to be a significant problem.

No long-term effects on land erosion are anticipated as a result of the operation of the proposed facilities. Disturbed areas at the plant and pump station sites will be graded and regrassed and all pipeline routes will be returned as closely as possible to a condition comparable to their preconstruction state.

b) Biological

(1) Terrestrial Vegetation

Primary impacts evolve from construction of the plant on the Millcoe Road site, installation of interceptors and effluent pipe, and system operation.

Approximately 25 acres of longleaf pine/turkey oak forest will be eliminated. Most of the pine has been timbered out. The dominant turkey oaks are mature and 20 to 30 feet in height. No unusually large or rare species of trees exist on the area to be cleared. Clearing, grubbing, and grading plans do not include the clearing of the low flatwoods on the northern half of the site. Further, expansion of the facilities to 25 mgd capacity can be accomplished within the initial clearing limits.

An estimated 95 percent of the interceptor sewer length is to be installed along existing roadway easement. Only two lines will measurably impact established natural vegetation; 4000 feet east of St. Johns Bluff Road on the Atlantic Boulevard line, and 5600 feet of the University of North Florida line. Both are presently planned to impact cypress swamp. These routings, however, can be slightly modified to impact less biologically sensitive terrain.

The effluent outfall line will impact a 50-foot wide corridor of low slash pine flatwoods from the plant site north to Fort Caroline Road. The interceptors and effluent line corridors along roadways will be returned to natural grade and seeded to minimize erosion and encourage natural vegetation.

(2) Terrestrial Animals

The sandhill habitat to be cleared for the treatment plant will permanently preclude its use by wildlife. Notably, bobwhite quail and doves utilize the good ground cover and forage of the sandhill. Two species appearing on the state list of threatened animals, the gopher tortoise and indigo black snake, could possibly be present on the site. Animals able to move will find suitable habitat adjacent to the site. An unquantifiable segment of the community will perish as a direct result of construction. During construction, the animals near the site will be temporarily disrupted.

Once the plant is in operation, surrounding wildlife habitats should be virtually unaffected by localized activity and noise from pumping stations and the plants. The quantity of naturally vegetated interceptor corridor lost to wildlife by the project is minimal and temporary.

3) Water-Land Interface

a) Physical and Chemical

The primary effects of project construction on the water-land interface will be to aquatic flora and fauna as discussed below. Operational effects to the interface areas, however, will be more far reaching in relation to both the physical and chemical and biologic aspects of these areas. Those interface areas which will receive the greatest direct benefit are the estuaries and coastal marshes. These marshes have, in many cases, been subjected to various man-made changes, such as the artificial introduction of nutrients, which have altered their natural condition. Such changes then influence the contiguous estuarine areas. These processes and induced changes have been described in more detail in Chapter II. However, by reducing or removing large biologic oxygen demand loadings from the water-land interface areas, the proposed project will directly contribute to an increase in water quality of these areas.

b) Biological

The most significant impact to the salt marsh is attendant to construction of the outfall line. 2.1 acres of salt marsh cordgrass will be destroyed in the crossings of Quarantine Island and Marian Island in Mill Cove. The invertebrate community associated with the marsh is expected to perish. Higher forms of marsh dwellers will seek adjacent marsh and be relatively unaffected.

A very small segment of marsh will be altered by the installation of the Villa Armada force main across upper Big Pottsburg Creek.

Freshwater swamp will not be affected by construction.

4) Water

a) Physical and Chemical

The primary effects to surface water bodies by construction activities are erosion and sedimentation. These effects have been described in Chapter III for both treatment plant and interceptor construction. In summary, however, erosion and sedimentation are expected to be significant short-term construction related impacts particularly in association with subaqueous outfall construction across Mill Cove.

Operational impacts to surface water quality will be caused by diversion of effluent flows from the tributaries and creation of a new municipal discharge to the St. Johns River. Effluent flow diversion from the tributaries will represent a major reduction of inflow in dry weather in many such cases where treated effluent is now a major part of dry weather inflow. However, implementation of the project will have overwhelmingly beneficial effects on tributary water quality by phasing out existing small treatment plants and terminating their effluent discharges.

Discharge of the Arlington-East effluent to the maintained shipping channel of the St. Johns River will affect water quality parameters in the vicinity of the discharge point. However, large available dilution factors, thorough mixing as afforded by strong tidal currents, and the ability of pollutants to exit the estuary on ebb tidal cycles, will assure minimal effect on water quality and maintenance of water quality standards.

Project implementation will not contribute to increased incidence of flooding. The plant site is not located in the flood plain of any stream and thus will not bring about any reduced hydraulic capacity. In addition, the effluent discharge is not significant in comparison with receiving stream flows and will not directly contribute to increased incidence of downstream flooding. Effluent flow will be 10.0 mgd initially and 25.0 mgd ultimately as compared with an average natural stream flow (net discharge) in the St. Johns River of some 5,880 cfs. Moreover, because of its open connection to the ocean, river stage in the lower St. Johns is almost totally a function of tide height rather than of stream flow.

Operation of the proposed facilities will not directly result in any groundwater contamination or quantity variations.

b) Biological

The greatest direct and long-range beneficial impact -- that of significantly reduced nutrient loadings -- will be experienced by the aquatic communities of the tributaries and Intracoastal Waterway.

(1) Aquatic Plants

Construction effects on aquatic plants will be insignificant from excavation of the outfall pipeline across shallow Mill Cove. Turbidity levels will increase around the subaqueous trench limiting light penetration to phytoplankton. No submerged estuarine grassbeds are known to exist along the outfall corridor.

Certain operational effects are unavoidable. The chlorinated effluent will inhibit or kill phytoplankton in the immediate discharge area. A potential for planktonic blooms exists in the periphery of the mixing zone. The occurrence of these two events is not expected since the freshwater effluent will be discharged at the bottom of the ship channel where phytoplanktonic activity is negligible and mixing potential is best.

(2) Aquatic Animals

Construction effects will result from excavation of interceptor and outfall pipeline in subaqueous areas. The outfall line across Mill Cove is the major area of aquatic impact. Similar but lesser impact will occur by traversing Big Pottsburg Creek for the Villa Armada force main. Because plans specify a The pipeline construction across Quarantine Island could necessitate breaking a spoil dike allowing contaminated dredged spoil to re-enter water courses. If this is the case, a realignment will be done away from active spoil sites. 14-foot deep trench, a huge quantity of spoil will be placed to either side of it. The benthic invertebrate community will be smothered under this spoil. Currents will carry suspended sediment an unknown distance from actual construction causing difficulty to filter-feeding mechanisms and gills. Shrimp and many smaller invertebrates are filter feeders. Clumps of oysters, also filter feeders, are abundant on the mud flats south of Quarantine Island. Those along the outfall line will perish. Such effects are not irreparable because affected areas should begin to recolonize soon after construction is terminated. Complete restoration will not occur, however, until a seasonal cycle has ended.

The chlorinated effluent will cause a localized kill of the animal segment of the plankton. Nektonic animals, particularly fish, will be attracted to the outfall plume but momentary contact with treated effluent will not be detrimental.

5) Sensitive Natural Areas

a) Mill Cove

The subaqueous area and peripheral marsh are productive segments of the estuarine system. They will receive short-term adverse impact from outfall installation.

b) Big Pottsburg Creek

The crossing of the Villa Armada force main will result in some short-term stress due to construction.

b. Man-Made Environment

1) Land Use

The site of the proposed plant is currently vacant of urban uses and will not cause the relocation of any people. The land surrounding the site is made up largely of single-family residential and vacant land. There are approximately 564 people living on 53 acres of single-family residential land within 3,000 feet of the proposed site.

The compatibility of the construction and operation of the proposed plant with the adjacent land uses will be determined primarily by the noise and odor impacts of the plant. There may be some short-term adverse construction noise noticeable in the surrounding neighborhoods. However, this noise will be limited to daytime working hours and should not cause significant disturbance.

The potential noise and odor impacts of plant operation are discussed in detail in the appropriate sections of Chapter III. The results of this analysis indicate that there will be no significant noise or odor impacts from the operation of the plant in the surrounding neighborhoods.

Despite the expected lack of substantive negative impacts in the existing neighborhoods, a short-term lowering of property values could occur if a significant number of area residents sell their homes in fear of anticipated adverse impacts. This type of panic selling could depress property values and potentially allow a deterioration of the neighborhood during this transition period. It is, however, expected that any decrease in property values will be only temporary. When the plant becomes operational, it will be clearly demonstrated that no significant noise and odor impact will occur. This will stabilize property values in the area at a level compatible with what they are now.

The construction of the 114-acre buffer zone adjacent to the plant site should have a long-term positive impact on residential property values. This land is projected for use as a passive recreational area for neighborhood residents. It will provide aesthetic enjoyment as well as a buffer from the treatment plant.

It is also important to remember that construction of the plant on this site will take up land that would otherwise be used for some form of residential construction. The 1990 Comprehensive Development Plan forecasts 624 people would be living in low and medium density residential development on the site if the plant is not built. Added to this would be similar development on the 114-acre buffer zone between the site and the surrounding community. The designation of this land for non-residential uses will provide a buffer from the expected extensive development of apartments along the Dames Point Freeway right-of-way. This will help maintain the character of the existing neighborhoods.

Some impact to property values might be expected on the vacant land immediately adjacent to the western side of the plant where no buffer is to be provided. However, a leg of the proposed Dames Point Freeway is planned to be constructed on the western and southern sides of the treatment plant site. This road will come within 300-foot of the plant site on its southwestern edge. The use of this land for highway construction will be very compatible with the treatment plant and should negate any lowering of property values which the treatment plant might otherwise cause.

2) Archeological, Cultural, Historical, and Recreational

Consultation with the State Historic Preservation Officer (see Appendix II) indicates that no historic properties on or eligible to be included on the National Register of Historic Places will be impacted by this project.

A search of the records of the Division of Archives, History, and Records Management of the Florida Department of State, and a preliminary survey by a staff archeologist of the same agency, indicates no known archeological sites present upon the plant site. A detailed archeological survey will be conducted on the plant site, interceptor lines and outfall line to verify the preliminary survey.

The proposed site is not located on land which is now being used or is projected to be used for parkland or other outdoor recreational activities. The City has purchased a 114-acre buffer between the plant site and the surrounding community which may be used as a passive recreational area. The project will also have a long-term beneficial impact upon water related recreational activities by helping the tributaries to meet body contact recreational water quality standards.

3) Transportation

During construction, traffic to and from construction sites will be induced by the need to move construction equipment, process equipment, and construction labor and materials to the sites and to remove debris from the sites. Traffic will enter the treatment plant site from Monument Road which is a local arterial route. Any objectionable traffic induced by construction will be temporary and will have very minor impact.

The operation of the treatment plant will generate some long-term heavy truck traffic. This traffic will result from the hauling of treatment chemicals (chlorine) to the plant site, traffic by septic tank trucks, and temporary portable toilet trucks to the treatment plant for discharge, traffic caused by screening and grit disposal, and traffic caused by the disposal of ash or sludge. The magnitude of such traffic is estimated as follows:

Traffic Sources	Round Trips Daily First Stage		Round Trips Daily Ultimate	
Chemical Delivery	0.20		0.20	
Ash Disposal (Sludge Disposal)	1.61	(10.00)	3.99	(24.00)
Grit Disposal	0.32		0.80	
Screenings Disposal	1.00		1.00	
Septic Tank Truck	8.94		13.04	
Portable Toilet Truck	3.00		4.30	
Total, Truck Round Trips	15.07	(23.46)	24.33	(44.34)
Total, One-Way Trips	30.14	(46.92)	48.66	(88.68)

The impact this traffic will have depends largely upon the type of roads over which it will travel. Traffic going to and from the chosen site will use Monument Road which is a local arterial route. The type of traffic generated by the operation of this plant should have minimum impact on a road of this type.

4) Resource Use

Construction of the project will cause a permanent and irrevocable commitment of resources in the form of materials used in construction. Treatment plant construction entails commitment of material resources in the form of cement, mineral aggregates, structural and reinforcing steel, pipe materials and valves manufactured process equipment and pumps, electrical equipment and wiring, and building construction materials. Similar materials, though in lesser quantities, are utilized in construction of the 32 pumping stations, while construction of the 245,000-foot length of pipeline will utilize piping, valves, concrete, and pavement replacement materials. Also, during construction, fuels and consumable supplies are required for operations of vehicles, equipment and machinery.

The treatment plant will incorporate mechanical equipment which during operation will utilize large amounts of electric energy. Small quantities of energy obtained by burning fuel oil will be expended in incineration. The operation of the pumping stations will require a significant consumption of electric energy. The transmission system for the chosen site will use 4,823,333 kwh of power annually at a cost of $248,000. The only chemical which will be used in significant quantities is chlorine used for treatment sewage effluent disinfection.

The total monetary resources used in system construction will be $48,559.307. Annual costs of system operation and maintenance will be $1,533,165. The total annualized cost over the design period of the project will be $5,864,949.

If this total cost was divided equally among the residents of the service area, it would come to $181.80 per equivalent household (3.22 persons/household).

5) Water Programs

The proposed project will have no significant impact upon the water supply system in the service area. None of the effluent will be used on land in any manner.

The project will have a long-term beneficial input on tributary streams by helping them meet water quality regulations through the elimination of discharges. The water quality of the St. Johns River will not be significantly affected by the effluent discharged from this project.

6) Taxes and Budgeting

The local share of the proposed project cost will be paid for entirely from user fees and, thus, will not require any tax increase.

Initial user fees will be based on the newly adopted water and sewer rates described in the Taxes and Budgeting Section of Chapter II. Any additional increases in these fees will be based upon future costs versus revenues for the entire City system.

7) Other Projects, Programs, and Efforts

The proposed outfall line across Mill Cove and Quarantine Island will be constructed so as to avoid any adverse impact to COE projects (see Appendix III). The pipeline will be buried sufficiently to avoid any possible future impacts related to the proposed small boat navigation channel in Mill Cove and planned excavation on Quarantine Island. The exact location of the outfall discharge point into the St. Johns River will be determined so as to avoid any impacts with COE, dredging operations and ship traffic in the navigation channels.

8) Sensitive Man-Made Areas

The proposed project will have no significant impact upon the sensitive man-made areas identified in Chapter II. The construction and operation of the project will not affect any cultural resources, any parklands, any heavily used traffic corridors, or any residential communities in the service area.

2. Secondary Impacts

a. Man-Made Environment

1) Demography and Economics

a) Population

The sizing and phasing of the proposed project is based upon the population forecast for the service area by the JAPB (see Figure 2-26). This forecast was made under the assumption that wastewater treatment would not be a constraint to development in the areas.

If this type of system was not put in, the population density which could be supported would be somewhat limited because of water quality and septic tank restrictions. However, the disposal of wastewater currently is a constraint to population growth in parts of the service area because of water quality and septic tank restrictions. Construction of this system will remove this constraint and allow growth to continue as it otherwise would.

Construction of the first phase of interceptors will allow population growth to continue west of Craig Field without being limited by the ban on additional discharges into the tributary stream of the St. Johns River.

Construction of the second phase will allow development to proceed in areas east and south of Craig Field which would otherwise be restricted because of limitations to septic tank development.

The total long-term effect of not putting in the system upon population growth is hard to quantify. The exact amount of acreage unsuitable for septic tank use is not known, and the degree of development which would occur using surface wastewater disposal into the St. Johns is also unclear. It is estimated, however, that not constructing the system could constrain the population increase to perhaps no more than 185,000. Therefore, the major secondary impacts of the project on population will be to allow the increment from 185,000 to 219,000 to settle in the area; and to allow the total population to distribute itself in an orderly manner based upon transportation lines, the location of community services, the location of shopping areas, etc., rather than being based upon the one limiting factor of wastewater disposal.

b) Economics

The construction of this project will provide the greatest economic benefit to major land developers in the service area. The project will remove wastewater treatment as a constraint to development and allow it to proceed as it otherwise would. The major land holders in the service area are as follows:

- Stockton, Whatley, and Davin
- Dan Trecnick

- Buck and Buck
- the Brent and Hodges families
- the Coppedge family

These land owners will realize significant economic benefits.

2) Land Use

Currently, about one-third of the net dry acres of land in the Arlington service area are developed. The 1990 Comprehensive Development Plan forecasts almost complete development of the area by 1990. (See Figure 2-29) The proposed wastewater treatment system was designed to serve the growth and development forecast in the plan.

The first part of the service area to be impacted by the project will be the area served by phase 1 (see Figure 3-1). Major impact to land use in this area will be an encouragement of growth of medium density residential and office development, particularly in the area north of Regency Square.

The second phase of interceptor construction will service areas to the east and south of Craig Airport. Much of this area is unsuitable for septic tank use (see Figure 2-10) and could not be extensively developed without the presence of a regional system. This area is projected for low density residential use with some conservation and preservation areas. The interceptor system was designed to service low density residential type of development. It could, however, support higher development densities and development in areas set aside for conservation and preservation because of the need to construct the system based upon the interceptor lines being one-half full at peak flow.

The major control measure the City has to direct growth in the pattern and density recommended in the Comprehensive Development Plan is its zoning ordinance. If future zoning decisions of the City government are based upon the land use plan, growth will not be excessive. However, possible changes in public office holders and in local priorities make future zoning decisions uncertain.

3) Archeological, Cultural, Historic, and Recreational Resources

The increased growth and development induced by the project may cause the distruction of some archeological and historical sites. This possibility is most significant along the southern share of the St. Johns River and along stream banks where most of these remains are located.

According to national standards, the service area now is deficient by 700 acres in public recreational facilities. The growth supported by this project will allow the population of the service area to more than double by the year 2002. This will mean a doubling of the need for parkland and other outdoor recreational facilities and a need for an additional 900 acres of recreational land. If these needs are not provided for, the demand on the already inadequate system will double.

4) Transportation

The population which the proposed system is being designed to serve will more than double the use of automobiles in the service area by the year 2002. This added demand will greatly increase congestion on the area's transportation facilities, especially on those facilities leading to the bridges crossing the St. Johns River. If the new bridges proposed by the JUANTS study are built, this demand will be somewhat dispersed. If they are not, the added demand will be focused on the Mathews and Hart Bridges and on the thoroughfares leading to them. The average daily travel on these bridges in 1974 was 44,900 on the Mathews Bridge and 23,000 on the Hart Bridge. Major traffic corridors and major overloaded thoroughfare segments are shown on Figures 2-32 and 2-33 in Chapter II.

5) Resource Use

The population which will be supported by this project will increase electric consumption in the area by approximately 450 MVA by the year 2002. This additional power demand will be met with a combination of additional transformers at existing substations and new substations. The ultimate size of substations usually range between 100 and 150 MVA. Each substation is made up of transformers which generally supply either 33 or 50 MVA of power. Enough reserve power is maintained at each station to operate with no loss of service if one of its transformers is out of service. No increase in electric rates is foreseen by JEA because of the construction of transformers and substations.

The need for a new generating station is based upon growth in the entire Jacksonville area. If power use increases throughout Jacksonville at its expected rate, a new 400 to 500 megawatt generating station may be necessary in the early 1980's. This facility could probably supply the City's increased power needs until the mid 1990's. This projected generating station may require a rate increase because of the need to sell bonds to finance it.

6) Water Programs

Demand for drinking water in the service area will more than double in the next twenty-five years. Water supply service will need to be extended throughout the service area as growth and development expand.

No major problems are foreseen in the availability of groundwater for use in the service area during the design period of the project. Salt water intrusion into the aquifer, however, could become a problem in the future. The proper location and spacing of wells will be necessary to preclude problems of this type from occurring.

7) Other Community Services and Facilities

a) General

The expected doubling of population in the service area in the next 25 years will cause great strain on the area's community services and facilities. If these services and facilities are not increased to keep pace with the added demand, the quality of public services will decrease significantly. The following discussion gives a general idea of what additional facilities and services will be required. A much more detailed and specific analysis is presented in the JAPB's Short Range Development Plan.

b) Schools and Libraries

There are currently 13 elementary schools, 3 junior high schools and 2 senior high schools in the district which have a capacity of 16,619 students. The expected 100 percent increase of population in the service area will approximately double the number of school age children. In turn, this will cause an approximate 100 percent increase in the demand for educational facilities in the Arlington area. This increased demand will be met through a combination of new facilities and the expansion of existing facilities which will, in essence, double the existing facilities and staff.

The one branch library now in the service area can adequately serve the projected population if the size of the book collection is increased. A branch library should have 2 to 2.5 books per capita. This will mean a need to increase the size of the collection by between 200,000 and 250,000 by the year 2002.

c) Public Safety

One new fire station is currently needed to serve the newly developing land around Regency Square. As the population of the service area continues to grow, additional equipment will be needed at existing stations and new stations may also be needed, particularly in the eastern section of the service area.

Police services will also have to be increased to serve the projected doubling of population. At this time, no precinct stations are projected for the area.

d) Solid Waste

The new landfill site located between Girvin Road and Greenfield Creek will serve the needs of the area in the 1980's. An additional site will then be needed to serve the long-term needs of the service area.

e) Health Facilities

Expansion of the two existing public health clinics and construction of one new clinic will be needed to service 1980 population. Additional expansions will be needed beyond these as the population of the service area continues to grow. By 2002 total space needs should be double what they are today.

8) Taxes and Budgeting

The cost of provision of the additional community services and facilities discussed in this Chapter will be substantial. As was shown in Chapter II, most of this cost will be born by the City. Generally speaking, the cost of the provision of services to a largely residential community such as Arlington is significantly greater than the increased revenue collected in additional taxes. However, the taxes generated in industrial areas such as that projected for Blount Island can be used to make up most of this deficit. Thus, at this time, it is difficult to tell whether increased taxes will be needed to pay for the governmental services needed by the expanded population of the service area.

b. Natural Environment

1) Atmosphere

a) Air Quality

In general, the overall air quality in Jacksonville is improving although particulate matter and photochemical oxidants still carry a priority classification of I and sulfur dioxide a classification of II. Much of the air quality information presently available for Jacksonville has been summarized in Chapter II. To assess the effects of projected significant growth and the potential for violation of national primary or secondary air standards, the EPA is developing an air quality model for the area. Until such time as this model is finished, little can be specifically predicted regarding future air quality of Jacksonville or the Arlington-East Service District. What can be said, however, is that with implementation of the proposed project, the population of Arlington will continue to grow at a rate faster than that of the City as a whole. By permitting this growth, the project will bring about the potential for a degree of change in air quality brought on by the functions and services attendant to the increased development of urban areas.

b) Noise

Secondary effects of the project on noise may be considered a direct function of human occupation and use. The major sources of noise in the Arlington-East area are aircraft and automobiles. The difference in noise levels and impact may be estimated to correspond to the amount and location of population growth induced by the project. The difference in population growth with the project as opposed to without it is estimated to be 25 percent. The general location of this growth regarding increases in overall noise levels is not expected to be significantly different with or without the project.

c) Odor

Changes in the human usage of land subjected to nuisance odors is the principal secondary effect of odor production. For example, a decrease in real estate values could come about should a neighborhood be subjected to a constant level, or frequent episodes, of nuisance odors. Due to the very high level of odor controls proposed for the Arlington-East plant, no such secondary effects are foreseeable as the result of odors.

An undoubtedly positive effect of the project on odors will be the decreased usage of package plants in close proximity to residential areas. These smaller plants have greater potential to adversely effect surrounding residents since odor controls are usually not included, overloadings are more common, breakdowns more frequent, and maintenance more difficult. Further, by decreasing the pressure for development of lands marginally suitable for septic tank operation, the project will decrease the incidence of septic tank malfunctions and associated odors.

2) Land

a) Physical and Chemical

(1) Topography

There are extensive areas in Arlington which are not suitable for development due to natural limitations on septic system operation. These areas, primarily in the eastern portion of the service district, will be more readily opened for development by the implementation of the proposed regional treatment system. As this occurs, areas which are now fairly wet or where the water table is very close to the surface could be partially or completely drained for development with the physical, chemical, and biologic effects which would accompany a change from a wet to a dry regime.

(2) Soils

Possible long-term secondary effects on soils are related to the previously discussed changes in drainage. Such soil changes may be physical (such as changes in plasticity or shrink-swell potential) and/or chemical and will themselves have the potential for causing such tertiary effects as influencing the kind and amount of vegetation that can live in the area.

b) Biological

Secondary impacts to the terrestrial biologic community will be caused by the increased land development expected as a result of the proposed project. The area of the proposed Dames Point Expressway west of the Millcoe Road site is planned for multi-family dwellings. This development will nearly eliminate natural areas of benefit to wildlife in the vicinity. The second phase interceptors -- Mt. Pleasant-Girvin, Atlanta Blvd., and Beach Blvd. will serve considerable areas that would have been potentially unsuitable for development due to septic system limitations. These areas are the most valuable to the animal communities because of their present remoteness to man.

As development progresses, those animals most sensitive to the presence of man will be excluded. Exclusion of a few top predators will ultimately affect the overall composition of the animal community. There will be a considerable loss of scenic beauty as naturally vegetated hardwood stands are sub-divided, although vegetation that is left remaining will be more accessible for viewing following development.

3) Water-Land Interface

Secondary effects of the project on the physical and chemical regime of the water-land interface are difficult to quantify. Some benefits will undoubtedly accrue, however, from the decreased use of less efficient package plants and septic systems in the service area. It is to be remembered that in the estuary of the St. Johns River, a primary threat to the marshes is the direct deposition of dredge spoil and excessive siltation due to dredge and fill operation and runoff of solids. The project will have no effect on lessening the need for these operations.

Long-term adverse secondary effects are certain to occur as the result of increased usage of salt and freshwater marshlands by expanding populations in the area. Past development in Florida has severely encroached on saltwater wetlands. Some continued stress will be placed on these areas but hopefully better environmental awareness will limit destruction of these resources.

More people in the area will increase the demand for open area access, causing more roads to traverse marshland. Wetlands will receive increased urban runoff containing harmful biocides. Cypress swamps will become less suitable wildlife habitats with closer proximity to development. Animal diversity will ultimately decrease.

Development will entail filling and drainage alterations in low areas. This will ultimately be adverse to the vegetation requiring a wet habitat as well as animals which are acutely dependent upon freshwater swamps.

4) Water

a) Physical and Chemical

Implementation of the proposed project will indirectly cause an increase in urban runoff as a result of the forecasted growth in Arlington. The identification and characterization of this runoff is difficult. It is known, however, that urban storm water runoff commonly contains significant quantities of biologic and carbonaceous oxygen demand, suspended and dissolved solids, coliform bacteria, and chlorides. In the areas of Arlington for which significant growth is forecasted, the effects of these pollutants on surface waters will not approach the severity of those caused by runoff from, for example, a more centralized urban area. However, a minor amount of groundwater contamination is possible from induced runoff since storm sewering will not be extensive and since the soil types and high groundwater table will probably combine to assure relatively easy access to the shallow water aquifer.

Secondary effects on groundwater quantity are also not easily quantified. The general decline in the potentiometric surface and the increase of chlorides in the Floridan aquifer in recent years has been documented in Chapter II. These problems are caused primarily by a current rate of groundwater withdrawal in excess of the rate of aquifer recharge. By permitting growth to increase in Arlington at a faster rate than would otherwise occur, the proposed project may indirectly cause an increased demand for groundwater withdrawal.

The project will have at least one indirect and beneficial effect on the quality of the shallow water aquifer in that it will decrease pressure for installation of septic systems in areas only marginally suitable for their operation. The incidence of septic system malfunction with subsequent pollution of the shallow water aquifer will thus be decreased.

b) Biological

A long-term benefit to estuarine biota, especially in the creeks tributary to the St. Johns, should be realized. Removal of domestic wastes from them will enhance diversity to the ultimate benefit to commercially important fisheries.

The recreational and commercial use of aquatic resources in and surrounding the district will increase with more people. Attendant to this will be increased use of aquatic resources. Unfortunately, detrimental urban runoff will enter area surface waters. If water quality is not maintained, these stress factors can become severe and result in physiological changes in many organisms and a community shift towards pollution tolerant dominants.

d. Sensitive Areas

1) Cypress Swamps East of Craig Airport

Long-term developmental pressures will alter the wildlife community of this area and could seriously jeapardize its function as a water retention and recharge area. The sensitive cypress swamp areas are much larger than shown on the map of future land use (Figure 2-29).

2) Saltmarsh Surrounding the Service District

Attendant to increased population in the service district will be increased recreational use of the extensive estuarine marshes in Duval County. Increased proximity of man to wetlands near the Intracoastal Waterway will affect migratory habits of waterfowl as well as the terrestrial and aquatic animal species. Preservation of salt marshes will ensure long-term direct economic benefits.

3) Live Oak Hammock Areas Surrounding Ft. Caroline Park

This cover type is the least abundant of the dominant terrestrial arboristic cover types within the service district (refer to Figure 2-11). Its existence is the result of a long successional process; restablishment would take a considerable amount of time. This area could potentially be of great value as a public park.

4) Big and Little Pottsburg Creeks

The removal of waste treatment plant effluents from these receiving waters will have a beneficial result to this segment of the estuary. An accelerated rate of entrophication is of no benefit to man or the animal community in the long term.

VI. Adverse Impacts Which Cannot Be Avoided and Available Mitigative Measures

A. Adverse Impacts

1) Minor construction dust.

2) Minor construction vehicle and equipment exhaust emissions.

3) Emission of minor quantities of particulate and gaseous pollutants to the atmosphere as a result of operation of the multiple hearth sludge disposal incinerator.

4) Construction noise generated by vehicles and equipment.

5) Minor operational noise.

6) Odor caused by construction vehicle and equipment exhaust emissions.

7) Minor operational odors.

8) Grading and land surface alteration at the treatment plant site.

9) Minor aesthetic impact of the facilities.

10) Minor soil erosion by wind and water during construction and operation.

11) Commitment of 46.98 acres of land for the treatment plant site with subsequent loss of approximately half this acreage as wildlife habitat. In addition, some wildlife habitat will be at least temporarily disturbed along the interceptor corridors during the period of construction.

12) Some disruption of wildlife habitat surrounding the plant site during the period of construction.

13) Temporary disturbance of two acres of Mill Cove salt marsh by outfall line construction.

14) Slight water quality degradation in a small mixing zone at the point of discharge in the St. Johns River.

15) Some impact on the aquatic animal community by sedimentation and turbidity as a result of disturbance of bottom sediments in Mill Cove and Big Pottsburg Creek during the period of construction.

16) Possible panic selling before plant goes into operation.

17) Potential archeological impacts.

18) Impacts to transportation facilities from construction and operation.

19) Commitment of resources in construction and operation.

20) Impact to preservation and conservation areas from increased development pressure.

21) Increased usage of recreational facilities.

22) Increased usage of transportation facilities.

23) Increased use of other community services and facilities.

24) Possible increase in tax rates to fund necessary community services.

25) Slight changes in air quality brought on by increased development.

26) Increased potential for development of presently sparsely populated areas of the service district with concomitant impact to terrestrial biota.

27) Increased potential for urban impact (i.e., usage) of wetland areas in and surrounding the service district.

28) Probable increase in urban runoff as developed areas expand.

29) Decrease in the potentiometric level and increase in the chloride content of the Floridan aquifer as a result of increased demand for groundwater.

B. Mitigative Measures to Adverse Impacts

This section discusses measures capable, or potentially capable, of mitigating the unavoidable adverse impacts previously noted. It includes not only those measures proposed to be taken but also those which are less likely to be taken as, for example, in areas where statutory authority does not exist. The distinction between measures actually planned and those recommended is apparent in the discussion. To facilitate cross-referencing, the order of presentation corresponds directly to that of the adverse impacts listing.

1) Dust generated during construction will be minimized by the spreading of calcium chloride as needed on disturbed earth areas as a control measure.

2) Minor exhaust emissions from construction vehicles and equipment at the plant site can be reduced only marginally by such means as limiting unattended idling. The impact of emissions from vehicles going to and from construction sites, however, may be lessened by requiring these vehicles to use less populated and more heavily traveled routes.

3) Further reduction of projected particulate and gaseous pollutants which will be emitted to the atmosphere as a result of incinerator operation is not possible with current technology. A precooler, scrubber, and other appurtenant facilities will assure that these emissions are well within the requirements of the Florida Department of Pollution Control and the Environmental Protection Agency.

4) Adverse impacts of construction noise generated by vehicles and equipment will be mitigated by requiring that particularly noisy operations be carried out only during normal daylight working hours.

5) Operational noise control measures have been described in Chapter III. These represent the most effective means of mitigating foreseeable operational noises. However, the requirement of a followup investigation on noise levels and the taking of feasible corrective actions will provide an excellent post

construction control strategy should some noise source be overlooked in initial control efforts.

6) Minor odor caused by construction vehicle and equipment exhaust emissions can be reduced only marginally by such means as limiting unattended idling of machines.

7) Operational odor control measures have been detailed in Chapter III. The most effective means available under current technology will be used to eliminate operational nuisance odors. Should equipment failure, operator error, or maintenance oversight cause a highly unlikely odor episode, however, several previously described backup systems will be used to prevent noticeable odors from leaving the treatment plant site.

8) There are no practical measures available to mitigate a certain degree of grading and land surface alteration at the treatment plant site. These are unavoidable engineering requirements. Attendant effects will be minimized, however, by confining this grading to the southern half of the plant site.

9) Aesthetic impact of the treatment plant will be minimized by leaving intact the vegetative buffer zone between the plant site and nearest residents.

10) To reduce soil erosion during the period of construction, the contractor will be required to spread calcium chloride on disturbed areas as required (see also (1) above). Available measures to minimize erosion by water during construction include containment on site by temporary berms and/or ditches and the chipping and spreading of cleared vegetation on disturbed areas. Required erosion control measures after completion of construction will consist of regrading and grassing disturbed areas as soon as practicable.

11) There are no measures available to mitigate the actual loss of approximately half of the 46.98-acre plant site as undisturbed wildlife habitat. Disturbed areas along the interceptor corridors, however, will be returned as closely as is practicable to their preconstruction condition. In addition, a trained forester will walk all naturally vegetated interceptor corridors to determine if any rare or exceptionally large trees will be impacted. Any such specimens encountered will be marked for preservation

on the plans and specifications. Results of this survey will be included in the final environmental impact statement. Finally, should any sensitive natural areas be encountered along proposed interceptor corridors, rerouting through a less sensitive area will be investigated and discussed in the final impact statement.

12) Disruption of wildlife habitat surrounding the plant site during the period of construction will be mitigated by leaving intact the previously discussed vegetative buffer zone.

13) Decreasing the amount of salt marsh which will be disturbed by outfall line construction could be accomplished by rerouting the line to avoid Marian Island in Mill Cove. Reducing the degree of disturbance to the salt marsh by outfall line construction can be accomplished by not placing spoil on adjacent marsh grass. In this context, progressive backfilling as construction proceeds will facilitate restoration and revegetation. In addition, progressive backfilling in lieu of piling spoil alongside the trench and backfilling later would undoubtedly aid the circulation of water in Mill Cove, particularly in the very shallow areas.

14) The use of turbidity curtains can help lessen the impact of construction activities on the benthic animal communities of Mill Cove and Big Pottsburg Creek by helping to contain suspended sediments.

15) Announcement of the construction of the treatment plant could lead to some panic selling of homes in the surrounding residential neighborhoods. This panic effect could be reduced to a minimum through an educational program on the part of the City. Local officials could address neighborhood organizations and civic clubs to explain the operation of the plant and the effects it will, and will not, have. Also, knowledgeable local officials should make themselves available as much as possible at their offices to answer specific questions which residents might have.

16) At present there are no known significant archeological sites endangered by the project. In order to insure that no culturally significant sites are destroyed, a detailed surface survey of the plant site, outfall line, and interceptor lines will be conducted by the Division of

Archives, History, and Records Management of the Florida Department of State prior to the issuance of the final EIS. If any sites of significance are located, possible rerouting to avoid artifacts or recovery of these resources will be investigated and discussed in the final EIS.

17) Heavy construction and operation vehicles coming to the plant site should operate during non-peak daylight hours to minimize impacts of traffic congestion and noise, respectively.

18) The use of material resources in plant construction is being limited by the use of the alternative with the smallest configuration of interceptor lines and pumping stations. The chosen alternative will also require the smallest use of electric power of the twelve alternatives considered. Use of resources in the operation of the incinerator can be eliminated if an acceptable site can be found for the land spreading of sludge.

19) The Jacksonville Zoning Ordinance should be used to protect from development those lands set aside for preservation and conservation in the 1990 Comprehensive Development Plan. This ordinance is the most effective regulatory means now available to protect these lands.

Other means which could be used include direct purchase and/or purchase of a development easement on the land by the City, and a special tax incentive program to encourage no development on the land. These programs would all provide some sort of financial relief to the property owners for not allowing development on their land.

20) The projected population increase for the service area will more than double the use of parkland and other outdoor recreational facilities by the year 2002. To meet this demand, the City should accelerate a program of purchasing land for future recreational use in the service area. The Short Range Development Plan of the JAPB identifies several specific areas which could be acquired for this purpose.

21) The projected population increase for the service area will more than double the use of the area's transportation facilities by the year 2002. The JUANTS Study has identified specific corridors which are projected to be overloaded. The City should continue its efforts to

identify specific strategies to meet these problems and begin to implement them. Highway, bus, and rapid rail alternatives should all be considered.

22) The projected population increase for the service area will more than double the demand for other community services and facilities. To help meet this demand, new facilities and services such as those recommended in the Short Range Development Plan should be instituted and planning of this type should continue.

23) The increased public services and facilities which will be needed in Arlington may require an increase in taxes. The best way to avoid this increase is to institute a program of advanced planning and implementation. This program should consist of identifying future needs, projecting specific solutions, budgeting for the cost of the solutions, and implementing the recommended program. The Short Range Development Plan of the JAPB incorporates this type of planning. The successful implementation of such a program will greatly increase the ability of the city government to effectively service expected growth at the lowest cost possible.

24) The greatest potential for future changes in air quality brought on by increased development will be from transportation sources. Decreases in vehicle usage should be encouraged to minimize these effects.

25) Adherence to the Jacksonville Area Planning Board's 1990 Comprehensive Development Plan will aid in maintaining orderly development at densities compatible with terrestrial biota. In particular, the preservation of low hardwood and cypress swamps will provide habitat for future wildlife.

26) Developmental setback regulations in combination with beneficial use by the citizenry should be encouraged to provide for the preservation of wetland areas.

27) Ordinances to control increases in urban runoff may be instituted as a mitigative measure to control such increases attributable to urbanization.

28) Further localized decreases in the potentiometric level of the Floridan aquifer can be mitigated by decentralizing the withdrawal points of major water users.

VII. Public, Federal, State, and Local Governments Comments and Participations

The participation of the Federal, State, and local governments and interested citizens and groups in the review of the proposed action is of the utmost importance. This chapter lists comments made at a public meeting, November 14, 1974, also, written public, local, State and Federal comments, and describes the citizens committee involvement in the project. Responses are given to each substantive comment made but are not repeated once given.

A. Public Meeting, November 14, 1974

On November 14, 1974, the EPA held a public hearing in the Jacksonville City Hall to solicit comments on the proposed Arlington-East Wastewater Treatment project. A synopsis of the comments of each speaker at the hearing are presented below, together with responses to each comment based upon information presented in this Environmental Impact Statement. Responses are not presented to comments that have been previously answered.

Comment 1 - George Spohrer, Jr. - A regional facility of this magnitude cannot be a good neighbor to a residential community. The potential impacts of noise and odor should be considered more important than cost savings.

Response: A detailed study of the effects of odor and noise from similar plants was conducted as a part of this EIS. The results of this study indicated that, if additional control measures were incorporated into plant design, no significant adverse impacts to the surrounding residential communities will occur. The project was altered to include these recommended controls. Details of the study are given in the noise and odor sections of Chapter III.

Comment 2 - Bette Soldwedel - Attacked in detail, the ranking system used for alternative analysis in the assessment statement. Felt much more emphasis should have been given to environmental criteria. Consider potential impacts to quality of life and property values to be severe. Indicated effects of raw sewage overflows could be significant.

Response - The criteria and ranking system used in this EIS are completely different from those used in the Assessment Statement. The criteria developed by the EPA for the environmental ranking of alternatives does not include relative cost differences among the various alternatives. The details of the environmental evaluation of alternatives is presented in Chapter III.

Potential impacts of the plant to quality of life and property values are directly related to the noise, odor, and visual impacts. Detailed discussion of these impacts are presented in Chapter III.

The chance of a raw or partially treated sewage overflow is highly unlikely. A system component breakdown at the plant would cause a by-pass of that component and result in a lesser degree of treatment, not an overflow. Raw sewage is pressurized in the force main underground. A construction accident or a road cave-in is a very remote possibility. Force main pumping stations and the treatment plant have auxiliary power systems to prevent a total system breakdown.

Comment 3 - Robert Adams - Feels further noise and odor study is needed. Requests dye survey to study effects of tital current on effluent disposal at the proposed location.

A Dye Study would be frustrated by the very complex hydrologic phenomena of the lower St. Johns River. At best, such a study would have to be carried out over a long period of time to account for the interactions of these phenomena. In the event any valid conclusions were able to be drawn at all, they would most certainly be of an academic nature since excellent dilution and dispersion is already known to be assured by the huge volumes of water and rapid currents in this area (refer to Chapter II). Further, significantly faster average speed of these currents on the ebb tide than on the incoming tide will facilitate transport of the dispersed effluent to the ocean.

Comment 4 - William Seigh - Challenged cost analysis in the assessment statement. Indicated costs for sites other than Millcoe Road site were developed too quickly. Questioned validity of the section in the Assessment Statement discussing property values. Stated that the one mgd Grove Park facility is not comparable with a 10 mgd regional facility.

Response: The location of the proposed site in the center of service area population leads to the cheapest possible system costs. The extent of the added costs for each of the other proposed alternatives was not a factor in the conclusion of this EIS. The EPA agrees that impacts from the one mgd Grove Park facility are not comparable with impacts from the proposed 10 mgd facility. The long-term impact on land values will be directly related to primary impacts from the proposed plant.

Comment 5 - Helen O'Quinn - The plant will cause changes in the existing character of the neighborhood. Fears visual pollution.

Response: Previously discussed.

Comment 6 - David Porter - Expressed concern about possible negative impacts of air emissions, specifically oxides of nitrogen and sulfur. Also wants material balance done on incinerator. Expressed concern about defoliation caused by stack emissions.

Response: The air quality impacts analysis presented in Chapters III and V indicate that no significant adverse impacts will occur because of the operation of the incinerator. Previous experience with similar facilities indicates that emissions will be well within air quality standards. Therefore, it is felt that a complex material balance would be a time-consuming academic exercise.

Comment 7 - Don Brewer, Jr. - Questioned the validity of Millcoe Road as the population center of the service area. Believes General Waterworks plants will never be tied into system. Feels plants should be located farther east. Dislied rating scale used in Assessment Statement.

Response: The current and projected population densities of the service area both show the center of population to be well west of Craig Field (see Figures 2-25 and 2-27). The city expects to include the Monterey plant owned by General Waterworks into the proposed system. Projected time of aquisition is 1980.

Comment 8 - Robert Hulsey - Indicated he will move out of the area if the plant is put at the Millcoe Road site. Feels noise and odor impacts will be significant.

Response: Previously discussed.

Comment 9 - W. Colvillé - Feels impacts to population should be given top priority. Fears noise and odor impacts to residential communities.

Response: Previously discussed.

Comment 10 - David K. Evans - Feels the cost of the system is inflationary. Feels the upgrading of existing plants should be evaluated.

Response: The upgrading of existing plants is not a feasible means of waste treatment since these facilities discharge into the tributary streams which cannot take any additional volume of wastewater (See Water Quality section of Chapter II). Also, the cost of one regional system using economics of scale is less than the cost of several small plants with duplicating facilities.

Comment 11 - Charles Mann - Doesn't feel that a sewage treatment plant is compatible with a residential community.

Response: Previously discussed.

Comment 12 - Reese Cruse - Does not like outfall crossing of Mill Cove and discharge into St. Johns River. Advocates ocean outfall discharge.

Response: Long-term adverse environmental impacts to Mill Cove are minimal. Certain short term effects from construction are unavoidable but several mitigative steps can be taken (refer to Chapter VI). An ocean outfall is considered prohibitively expensive due to the long distance to a suitable point of discharge. (Refer to Water Quality Management Plan for Duval County.)

Comment 13 - Frederick Irving - Noise, odor, and visual impacts need to be studied carefully. No location is perfect. A plant needs to be built somewhere as quickly as possible.

Response: Previously discussed.

Comment 14 - Charles Harris - Questions desirability of Mill Cove crossing. Problems with increased siltation, with trench material, with possible COE dredging, and with possible redesign of Quarantine Island. Also questioned possible damage to outfall pipe from shipping in the St. Johns channel.

Response: Increased siltation with result during construction but can be reasonably contained. The pipe will be laid and the trench backfilled. With minor design modifications, the Corps of Engineers foresees no problem with the proposed outfall across Quarantine Island.

B. Additional Comments on Written Communication Received by EPA

Several letters commenting on the project have been received by EPA from individual citizens and from State and Federal agencies. A summary of the comments of each letter is presented below together with responses to each comment based upon information presented in the EIS. Citizen letters which raised issues which were discussed in Section A of this Chapter are not presented.

1. Public

Comment 1 - Mrs. Robert Werder - Believes the plant will affect the wildlife, especially birds, which frequent her property. Indicated that siting a treatment plant near residential neighborhoods is establishing a precedent no neighborhood could accept.

Response: Plant construction activity will remove wildlife from the plant site to surrounding areas. This might disrupt daily feeding patterns of birds around Holly Oaks. However, normal plant operation will not affect behavior of birds in the Holly Oaks area. See Terrestrial Animals Sections of Chapter V for more detail.

Each proposed waste treatment plant is environmentally evaluated separately.

Comment 2 - Mr. James O. Buck - Indicated that if a plant site east of Craig Field were chosen, this outfall could be to the Intracoastal Waterway or north to the St. Johns River.

Response: Outfall discharge to the St. Johns is considered best because it has a greater flow to better meet water quality standards. Less naturally vegetated area, especially wetlands, would be traversed with discharge north to the St. Johns River.

Comment 3 - Mr. Leslie C. Fowler - Believes undesirable animal pests, especially noxious bugs would infest the area of the waste treatment plant.

Response: A modern treatment facility run by professional operators is the most sanitary means of disposal of waste.

2. Federal Agencies

Comment 1 - U. S. Fish and Wildlife Service - Points were made concerning the adverse impacts resultant to EPA's proposed action to have the outfall pipe cross Mill Cove and its contiguous marsh.

Response: Restoration of marsh destroyed in construction is addressed under Chapter VI, adverse impacts and mitigative actions. Plans to restore original soils, contour, and mechanically replant marsh grass are specified.

Comment 2 - Corps of Engineers - Comments concerned the use of Quarantine Island as a point of discharge into the main shipping channel. Interference with periodic dredging activities and a potential hazard to navigation by the effluent discharge are also pertinent issues involving the proposed action.

Response: Latest communication with the COE indicates that with minor modifications in the proposed action no problems are foreseen. The depth at which the pipeline will be placed should preclude interference with continued use of Quarantine Island for dredge spoil disposal nor interference with navigation by pipeline or discharge.

3. State Agencies

Comment 1 - Florida Department of Natural Resources - Comments addressed the environmental desirability of alternate sites and questioned whether outfall effluent could enter Mill Cove.

Response: Answers to these questions pertinent to the proposed action are presented in a letter from the engineering firm, Flood and Associates, Appendix . The Department of Natural Resources comments were based solely on generalized maps and were only to be used in a preliminary evaluation.

Comment 2 - Florida Department of State Division of Archives, History and Records Management - A preliminary list of archeological and historical sites located near the project alternatives was presented. A professional archeological and historical survey of the chosen system was recommended.

Response: A professional archeological and historical survey of the chosen system will be done and the results presented in the final EIS.

C. Citizens Committee Impact

EPA, in order to increase the level of public involvement in the Arlington-East wastewater treatment project, organized a committee to provide input into the analysis of alternatives. This committee was selected to involve those most likely to be affected by constructing a sewage treatment plant at the proposed Millcoe Road site, representatives of the City of Jacksonville and some additional citizens. Input from this committee was used to weight the environmental categories and to help identify impacts from the project.

Three meetings were held on October 9, October 21, and November 4, 1975. The first meeting was used to describe the alternative analysis system that would be used, and to generally describe the environmental criteria being proposed. The committee members were asked to indicate the relative importance to his or her quality of life of each environmental category. An arbitrary scale of 0-10 was used where 0 indicates a category of no importance and 10 indicates a category of maximum importance. These rankings were added for each rater and the total divided into each individual score to give a percent importance of that category in relation to the rater's total environment. The combined average committee weightings are given in Table 3-19.

At the second meeting a discussion of each alternative and that alternative's impact was given. Rating sheets were handed out and each committee member was asked to rate each alternative in each category. These ratings are summarized in Table 7-1.

At the third meeting, all previously performed ratings were presented to the committee. The results are given in Tables 7-2 through 7-5. Mr. Tom Brewer suggested that the committee vote on recommending that alternative number 2, the Dunes Area site, be considered the most acceptable site

TABLE 7-1

TOTAL RANKING

	1q	1b	2q	2b	3	4	5	6	7	8	9	10	11	12	inc.	1.S.	N.A.
CITY GROUP	510.35	514.07	490.45	494.17	470.96	462.56	448.36	448.36	442.51	442.51	439.58	433.43	472.80	452.91	475.40	494.80	275.83
AFFECTED GROUP	125.38	127.42	352.02	352.02	370.81	299.54	836.32	838.34	754.50	746.53	269.00	229.12	684.08	592.70	285.39	408.31	415.92
OTHERS	441.36	449.96	478.59	504.06	404.03	416.31	478.48	477.20	445.55	451.46	437.93	403.76	415.97	420.27	471.15	485.16	435.57
TOTAL	348.22	353.08	436.77	446.92	411.28	387.82	597.67	597.93	555.02	554.28	378.06	349.85	527.78	491.17	406.02	460.46	382.91
RANKING	15	13	8	7	9	10	2	1	4	3	12	14	5	6			11

TABLE 7-2

AFFECTED GROUP

	1q	1b	2q	2b	3	4	5	6	7	8	9	10	11	12	inc.	l.S.	N.A.
Charles Morgan	80.70	80.70	330.70	330.70	394.25	275.10	827.40	827.40	767.80	767.80	242.05	183.75	687.90	551.45	266.65	396.35	361.73
Dr. Bette Soldwedel	80.70	80.70	413.15	413.15	355.45	289.50	854.50	854.50	805.20	805.20	261.30	226.90	686.50	712.15	229.55	301.65	428.80
Robert Wilkins	80.70	80.70	335.55	335.55	402.60	289.50	817.30	827.40	767.80	727.95	306.85	183.75	687.90	940.10	263.25	391.95	424.10
David Evans	98.7	98.7	332.00	332.00	372.75	212.30	828.90	828.90	777.90	777.90	256.15	190.45	725.10	547.00	258.65	436.35	476.20
Del Revels	200.90	211.10	348.70	348.70	329.50	431.30	853.50	853.50	653.80	653.80	278.65	360.75	633.00	612.80	408.85	515.25	388.80
Total	125.38	127.42	352.02	352.02	370.81	299.54	836.32	838.34	754.50	746.53	269.00	229.12	684.08	592.70	285.39	408.31	415.92
Ranking	14-15	14-15	9-10	9-10	8	11	2	1	3	4	12	13	5	6			7

TABLE 7-3

CITY GROUP

	1q	1b	2q	2b	3	4	5	6	7	8	9	10	11	12	inc.	1.S.	N.A.
Herb Underwood	534.10	544.30	503.50	513.70	503.50	503.50	442.75	442.75	469.80	469.80	428.20	442.20	522.05	482.50	483.05	599.35	42.6
C. C. Holbrook	592.00	597.50	561.70	567.20	525.65	526.55	531.55	531.55	500.85	500.85	530.75	519.55	522.45	500.85	492.50	471.60	266.50
Ed Baker	460.15	460.15	447.05	447.05	414.05	395.89	397.15	397.15	385.25	385.25	377.05	369.95	415.25	399.15	456.50	477.75	415.05
Al Hammack	455.15	454.35	449.55	448.75	440.65	424.30	422.00	422.00	414.16	414.16	422.35	402.05	431.45	429.15	469.55	430.50	379.20
Don Brewer	N O R	E S P O	N S E														
Total	510.35	514.07	490.45	494.17	470.96	462.56	448.36	448.36	442.51	442.51	439.58	433.43	472.80	452.91	475.40	494.80	279.83
Ranking	2	1	4	3	6	7	9-10	9-10	11-12	11-12	13	14	5	8			15

TABLE 7-4

OTHERS

	1q	1b	2q	2b	3	4	5	6	7	8	9	10	11	12	inc.	1.S.	N.A.
Ted Pappas	445.15	444.35	425.45	424.65	414.35	426.10	398.70	406.50	413.20	402.80	420.65	420.65	418.15	417.35	469.55	430.70	351.60
Jack Merrion	441.80	463.00	458.55	479.75	413.95	417.00	437.60	437.60	364.63	364.63	354.75	377.10	330.25	345.70	----	---	423.10
Mrs. Charles Platt	387.90	387.90	456.05	456.05	381.95	363.28	561.35	561.35	472.20	472.20	392.40	312.90	436.25	399.90	460.60	564.15	429.15
John Powers	526.50	533.0	549.15	565.65	474.20	546.10	601.95	601.95	584.55	569.75	614.95	519.45	601.75	518.50	478.20	461.20	487.00
Thomas Brewer	405.45	421.55	503.75	519.85	335.70	329.10	392.80	378.60	393.20	447.95	406.90	388.60	290.95	419.90	476.25	484.60	487.00
Total	441.36	449.96	478.59	504.04	404.03	416.31	478.48	477.20	445.99	451.46	437.93	403.74	415.47	420.27	471.15	485.16	435.57
Ranking	8	6	2	1	14	12	3	4	7	5	9	15	13	11			10

TABLE 7-5

AVERAGE OF TOTAL SITE RANKINGS

	1q	1b	2q	2b	3	4	5	6	7	8	9	10	11	12	N.A.
Ted Pappas	15	14	12	11	6	13	2	4	5	3	10	9	8	7	1
Jack Merrion	12	14	13	15	7	8	10.5	10.5	4.5	4.5	3	6	1	2	9
Mrs. Charles Platt	5.5	5.5	10.5	10.5	4	3	14.5	14.5	12.5	12.5	7	1	9	2	8
Del Revels	1	2	5.5	5.5	4	9	14.5	14.5	12.5	12.5	3	7	11	10	8
Herb Underwood	14	15	10	12	10	10	4.5	4.5	6.5	6.5	2	3	13	8	1
C. C. Holbrook	14	15	12	13	7	8	10.5	10.5	3	3	9	5	6	3	1
Ed Baker	14.5	14.5	12.5	12.5	9	3	6.5	6.5	4.5	4.5	2	1	11	8	10
Al Hammack	15	14	13	12	11	8	5.5	5.5	3.5	3.5	7	2	10	9	1
Charles Morgan	1.5	1.5	6.5	6.5	9	5	14.5	14.5	12.5	12.5	4	3	11	10	8
Dr. Bette Soldwedel	1.5	1.5	7.5	7.5	6	5	14.5	14.5	12.5	12.5	4	3	10	11	9
Robert Wilkins	1.5	1.5	6.5	6.5	8	4	14	15	13	12	5	3	11	10	9
David Evans	1.5	1.5	6.5	6.5	8	4	14.5	14.5	12.5	12.5	5	3	11	10	9
Tom Brewer	8	11	14	15	3	2	6	4	7	12	9	5	1	10	13
John Powers	5	6	8	9	1	7	13.5	13.5	11	10	15	4	12	3	2
Don Brewer															
Total	110	117	137.5	142.5	93	89	145.5	146.5	120.5	121.5	85	55	125	103	89
Rankings	9	8	4	3	11	12-13	2	1	7	6	14	15	5	10	12-13

considering both environmental and monetary aspects of the project. The vote was as follows:

1. Herb Underwood NO
2. C. C. Holbrook No
3. Ed Baker No
4. Al Hammack No
5. Don Brewer Yes
6. Charles Morgan Yes
7. Bette Soldwedel Yes
8. Robert Wilkins Yes
9. Dave Evans Yes
10. Mrs. Charles Platt Yes
11. Thomas Brewer Yes
12. Jack Merrion Yes
13. Del Revels Yes
14. Ted Pappas No
15. John Powers No

The results of the vote were published in the Jacksonville Times Union November 5, 1975, Page B-1 (Appendix IX).

It should be noted that this committee was not a representative sampling of citizens in the Arlington-East area since there were no citizens on the committee that lived close to the Dunes Area Site or any of the other alternative sites.

The weightings of the committee for each environmental category were used to perform the EPA alternative analysis. The ratings given by committee members were fully considered prior to giving the impact ratings for each alternative. The scores given by the citizens group indicate a fear that there will be adverse effects on the Holly Oaks community due to construction and operation of the proposed sewage treatment plant. The ratings prepared by EPA indicate the knowledge that the plant will not produce offensive odors, noise or be visually offensive to the surrounding community (see Table 7-6).

TABLE 7-6

Monetary Costs and Environmental Effects Ranking

System, STP Location	Plant Cost	Project Cost	Annual Cost Per Household	City Rating	HollyOaks Rating	Others Rating	Average Rating	Average Ranking	EIS Ratings	EIS Br. Ranking	City Ranking	HollyOaks Ranking	Others Ranking
MONETARY COSTS				**ENVIRONMENTAL EFFECTS**									
1.a. Millcoe Road (Quarantine)	$34,373,206	$48,559,307	$181.81	510.35	125.38	441.36	348.22	15	480.35	6	2	14-15	8
1.b. Millcoe Road (Blount)	37,032,984	51,219,085	189.75	514.07	127.42	449.96	353.08	13	490.30	2	1	14-15	6
2.a. Dunes Area (Quarantine)	36,780,183	50,615,077	187.04	490.45	352.02	478.59	436.77	8	479.24	7	4	9-10	2
2.b. Dunes Area (Blount)	39,440,031	53,274,925	194.95	494.17	352.02	504.06	446.92	7	489.19	3	3	9-10	1
3. Dames Point/ Ft. Caroline	33,242,115	51,364,776	197.17	470.96	370.81	404.03	411.28	9	476.06	8	6	8	14
4. N. of Craig Field	35,895,000	56,308,903	209.00	462.56	299.54	416.31	387.82	10	473.40	10	7	11	12
5. E. of Craig, Sys."A"	35,883,702	62,699,047	231.58	448.36	836.32	478.48	597.67	2	481.60	5	9-10	2	3
6. E. of Craig, Sys."B"	35,883,702	57,887,620	216.20	448.36	838.34	477.20	597.93	1	486.00	4	9-10	1	4
7. Inside E. Craig, (Sys. "A")	37,592,000	63,709,227	235.42	442.51	754.50	445.55	555.02	4	442.00	13	11-12	3	7
8. Inside E. Craig, (Sys. "B")	37,592,000	58,363,620	215.36	442.51	746.53	451.46	554.28	3	447.00	12	11-12	4	5
9. Beacon Hills	36,621,384	64,971,606	243.67	439.58	269.00	437.93	378.06	12	455.40	11	13	12	9
10. Spanish Point	35,326,358	62,707,688	235.71	433.43	229.12	403.76	349.85	14	405.70	14	14	13	15
11. Quarantine Island	34,245,873	56,772,182	215.25	472.80	684.08	415.97	527.78	5	474.90	9	5	5	13
12. Southside Craig Field	38,094,179	55,749,995	203.53	452.91	592.70	420.27	491.17	6	492.40	1	8	6	11
13. NO ACTION				275.83	415.92	435.57	382.91	11	375.80	15	15	7	10

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Appendix I

Additional Ambient Noise Information
Developed by
Environmental Science and Engineering, Inc.

Sound waves propagate outdoors from source to receptor through an atmosphere which has highly variable acoustic properties. Turbulence, temperature and wind gradients, viscous and molecular absorption, and reflection from the earth's surface vary the attenuation and refraction of sound waves and consequently affect the amplitude of the sound level perceived at a receptor.

The ESE survey team observed several municipal, commercial, and natural events and activities in the Jacksonville area which have the potential to generate noise impacting the Holly Oaks community. These exisitng sources of noise include a variety of vehicular traffic on major highways, local arterials, and residential streets, aircraft noise associated with Craig Municipal Airport, Jacksonville International Airport, and the U.S. Navy air stations in the area, and urban noise contributed by air conditioning, lawn mowers, street lights, and transformers. Animal noise, particularly noticeable in residential areas, included sounds contributed by pets, and a variety of birds, frogs, and insects. Recreational noise from school playgrounds and several parks was also noted.

The predominate aircraft noise is due to single and multi-engine planes and helicopters during landings and takeoffs from Craig Field, located approximately one mile from Holly Oaks. Spot readings at 15 locations in the Holly Oaks area produced short-term sound pressure level readings in excess of 80 dBA for short periods of time due to these aircraft operations. This source of noise was not significantly attenuated by barriers, trees, and ground plantings.

Heaviest vehicle traffic noise was observed on roads to the west and south of the Holly Oaks area during daylight hours. However, Monument Road and Merrill Road have heavy passenger vehicle traffic until midnight. In addition, Monument Road is subject to heavy tank truck traffic servicing the Dunes area sludge farming operations. Between four and six tank trucks per hour were observed arriving at the sludge landfill. During quieter periods on Fort Caroline Road, Monument Road traffic noise becomes more noticeable, and at night, U.S. 90 (Arlington Expressway) vehicle traffic becomes distinctly audible. Averages of dBA spot readings during daylight hours with and without aircraft noise included indicate traffic and aircraft noise have approximately equal impact on average noise levels in Holly Oaks community although the intensity of aircraft noise is much higher than traffic noise.

Residential air conditioning, electrical transformers and street lights represent relatively steady-state ongoing noise sources. Spot sound-pressure level averages excluding aircraft during night hours ranged from 42 dBA to 52 dBA when the above sources dominated background noise levels. In addition to vehicle and aircraft noise, lawn mowers have a significant short term impact on residential noise levels.

Animal noise observed by the field survey team included pets, birds, frog and insect noise. Bird noise decreases markedly after sundown, and frog and insect noise sources declined rapidly to very low levels in the early morning hours. Except for dogs, which may cause local annoying sound pressure levels, animal noise cannot be considered a significant or objectionable noise source.

None of the industries listed in Section V of Volume 1 was observed to have a significant noise impact on the Holly Oaks community. The Fort Caroline Road area near Mill Cove also experiences a noise impact from powerboats that could not be estimated in the course of the field survey.

Site Specific Background Noise Survey Results

The 14 sites chosen for background noise level spot readings are presented in Figure V-1. At least 20 discreet dBA sound pressure level readings, taken at 15 second intervals, were performed both at night (2200 to 0700 hrs.) and during the day (0700 to 2200 hrs.). The spot sound pressure level readings are summarized in Table V-1. Weighted dBA background levels during the day are significantly affected by traffic noise because of the proximity of monitoring sites to local arterials and residential streets. Weighted dBA day noise levels ranged from 43 to 66 dBA. Night monitoring at the same sites produced weighted noise levels between 35 and 54 dBA. Sites F, G, I, and L produced higher night weighted levels than their day weighted levels, due to traffic influences at the time of the spot readings.

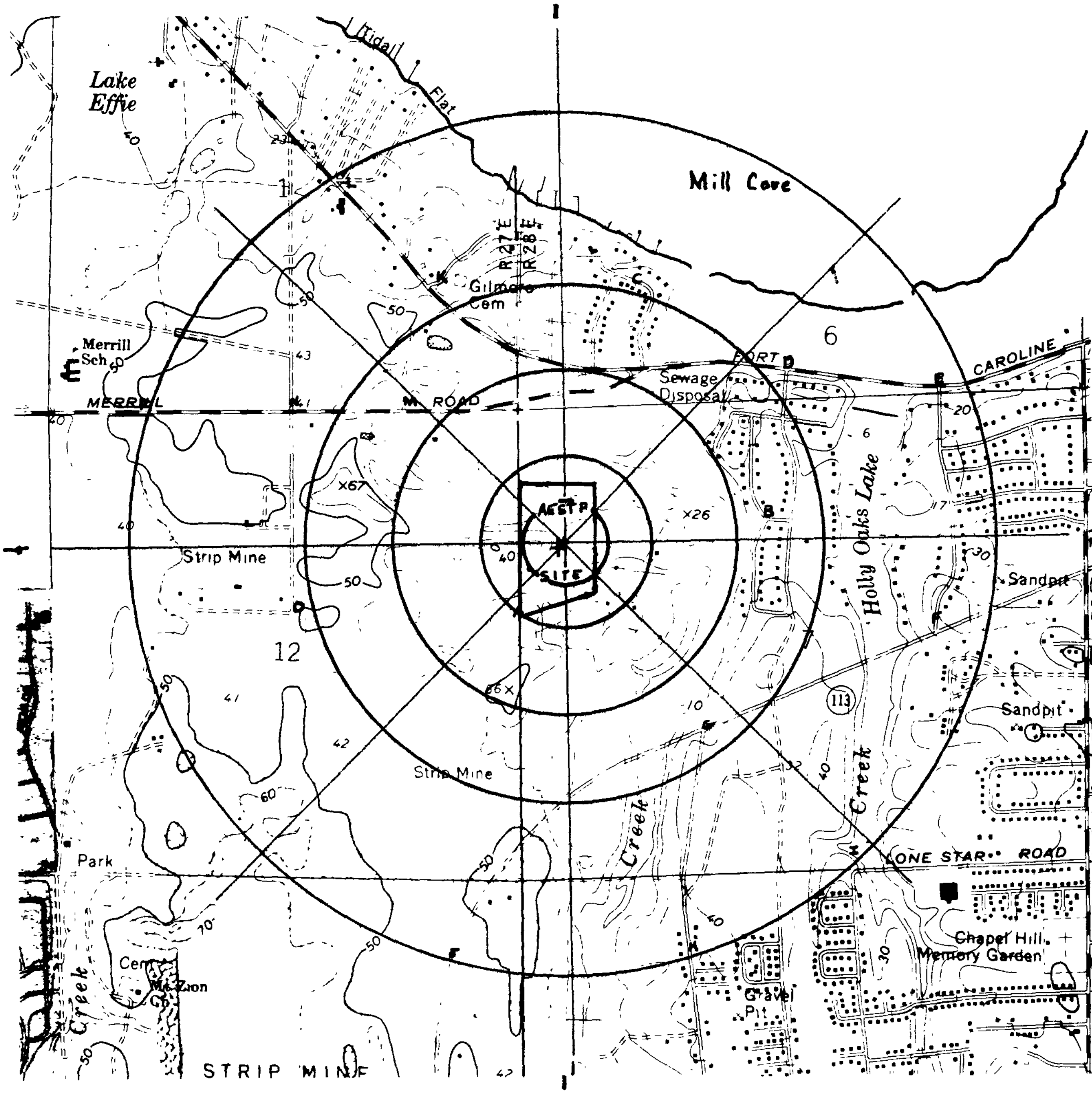
Sound pressure levels monitored at sites A, B, and C over a 24 hour period are summarized in Table V-2 and Figures V-2, 3, and 4. These figures present the frequency of occurrence of the sound pressure levels recorded, and include histograms showing the percent occurrence of 3-dB ranges for both day and night.

Noise levels that were exceeded 10, 50, and 90 percent of the time are plotted by day and night and designated L_{10}, L_{50}, and L_{90}. To quantify environmental noise in a manner that correlates well with various modes of human response, equivalent A-weighted sound pressure levels were calculated for day and night periods and designated as Ld_{eq} and Ln_{eq} in dBA. Since the primary interest for evaluating environmental noise for residential and similar land use is a 24-hour period, a Day-Night Equivalent Level, designated $L_{d/n}$, was calculated for each of the sites. A 10 db weighting is applied to nighttime noise levels in calculating this level. Table V-2 presents the observed and calculated equivalent sound levels in tabular form.

The envelope of minimum and maximum noise levels observed at sites A, B, C were plotted against time and are graphically presented in Figures V-5, 6, and 7. Day, night, and 24-hour equivalent weighted noise levels are superimposed on these plots.

FIGURE V-1

AESTP NOISE MONITORING SITES



Scale 1 in. = 1758 ft

TABLE V-1

SPOT READINGS
AT SELECTED SITES SURROUNDING THE AESTP
(Sound Pressure Levels - dBA)

	Day			Night		
Site	Minimum	Maximum	Weighted Background[1]	Minimum	Maximum	Weighted Background[2]
D	39	80	66	43	47	45
E	43	62	56	50	51	51
F	38	63	55	52	56	55
G	38	58	51	41	60	54
H	41	62	55	42	45	44
I	42	51	47	49	50	50
J	49	60	56	45	50	48
K	39	46	44	40	43	42
L	38	44	42	45	46	46
M	39	44	42	--	--	--
N	47	60	56	41	43	42
O	38	46	43	--	--	--
P	42	60	54	34	36	35
Q	46	65	58	--	--	--

[1]Based on 40 readings.
[2]Based on 20 readings.

TABLE V-2

AESTP TWENTY-FOUR HOUR BACKGROUND NOISE SUMMARY

BACKGROUND NOISE LEVEL (dBA)	SITE A Day	SITE A Night	SITE B Day	SITE B Night	SITE C Day	SITE C Night
L_{10}	49	50	54	52	59	53
L_{50}	44	43	47	48	49	48
L_{90}	38	37	41	40	43	41
L_{deq}	46	--	51	--	53	--
L_{neq}	--	44	--	48	--	48
$L_{d/n}$	51		55		56	

FIGURE V-2

AESTP BACKGROUND NOISE
FREQUENCY DISTRIBUTION
SITE A

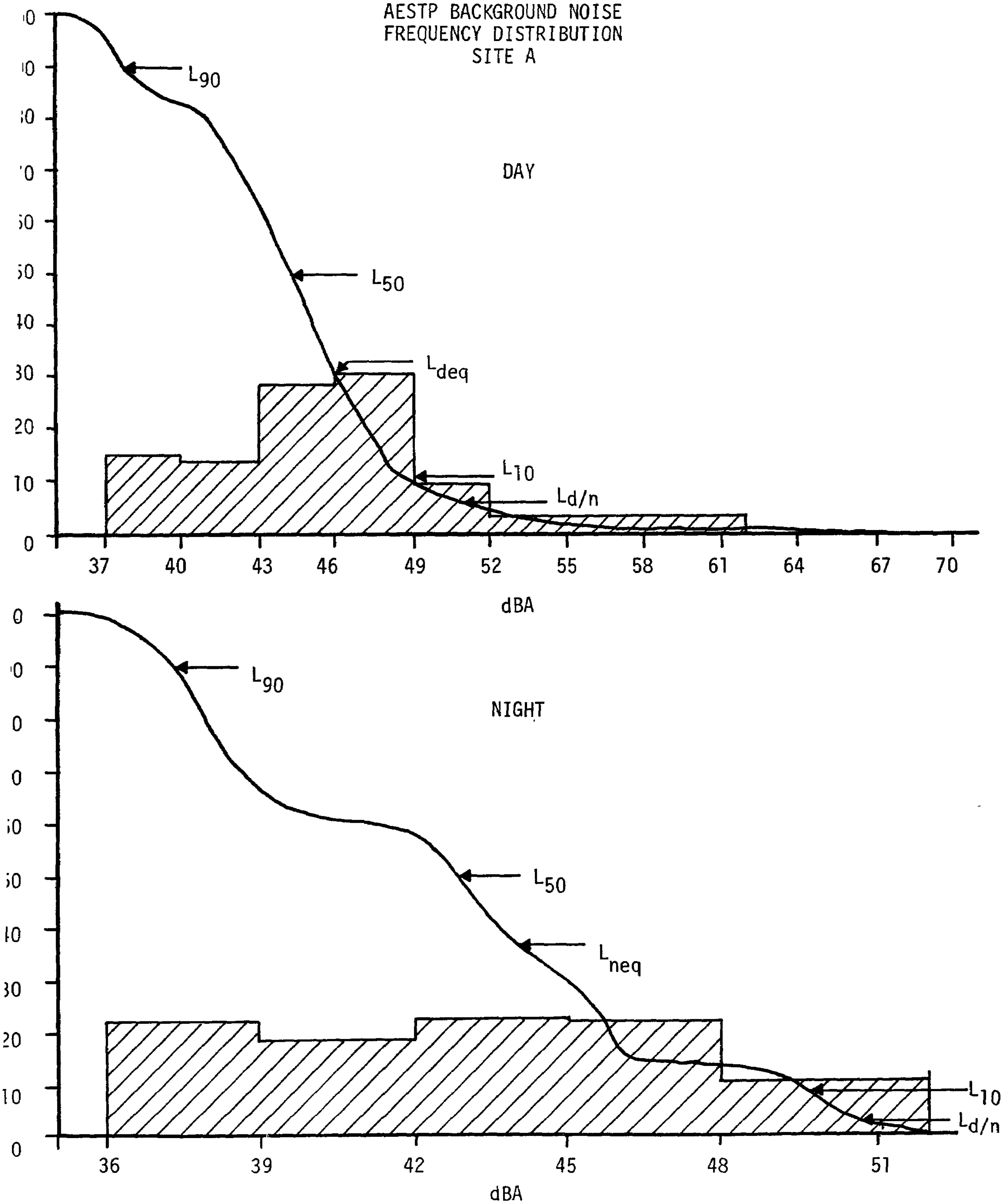


FIGURE V-3

AESTP BACKGROUND NOISE
FREQUENCY DISTRIBUTION
SITE B

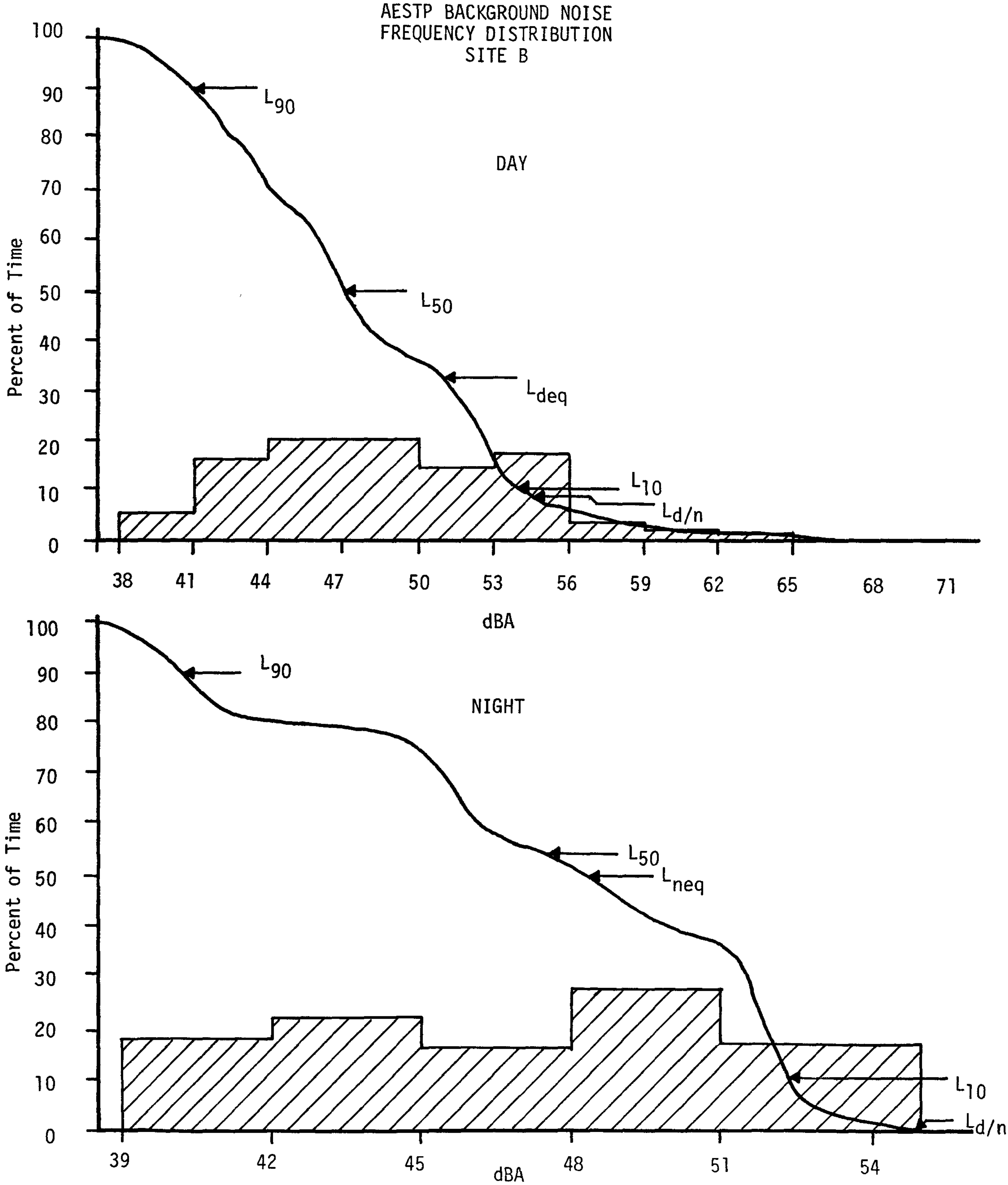


FIGURE V-4

AESTP BACKGROUND NOISE
FREQUENCY DISTRIBUTION
SITE C

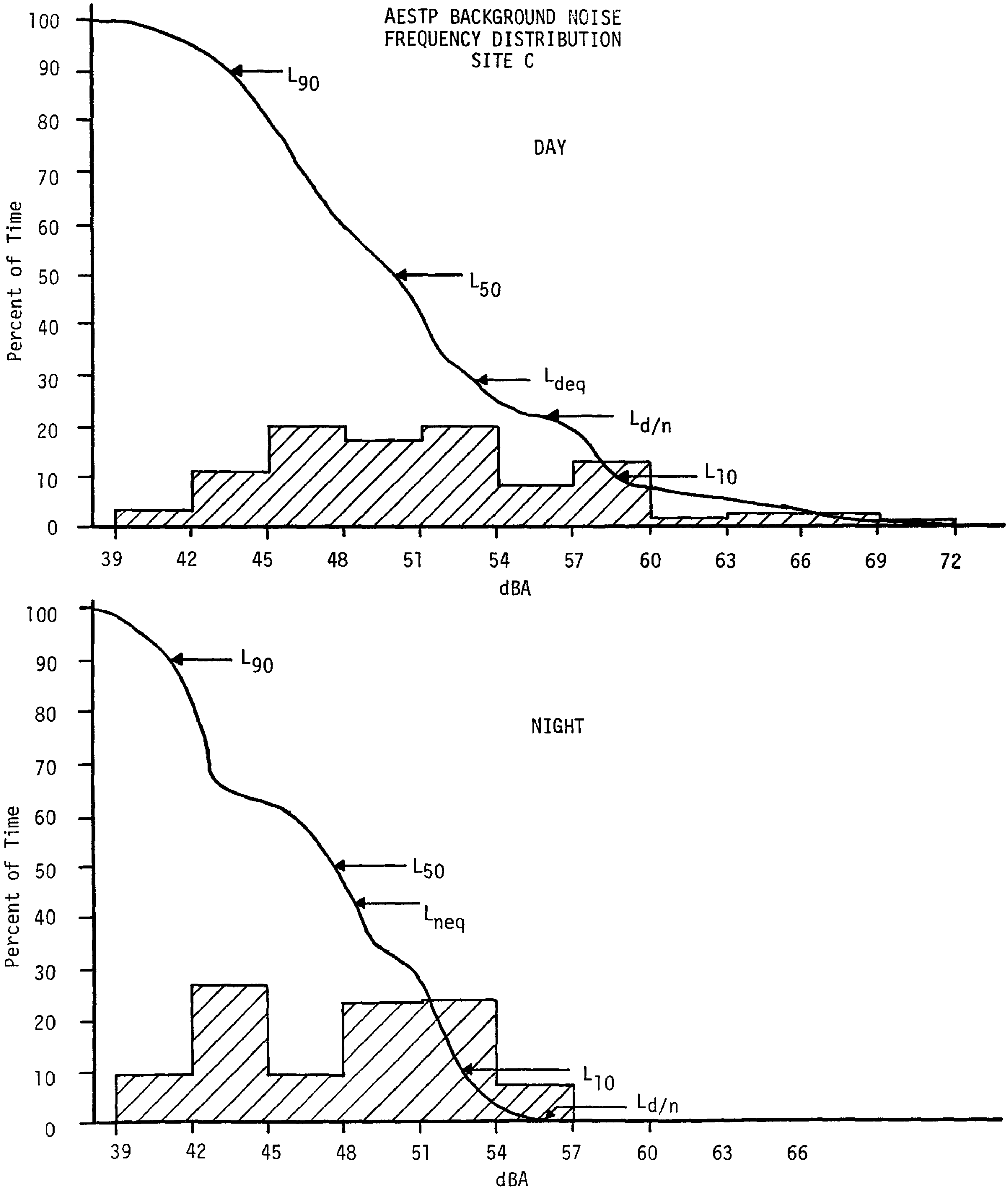


FIGURE V-5

TWENTY-FOUR HOUR SOUND PRESSURE LEVELS
SITE A

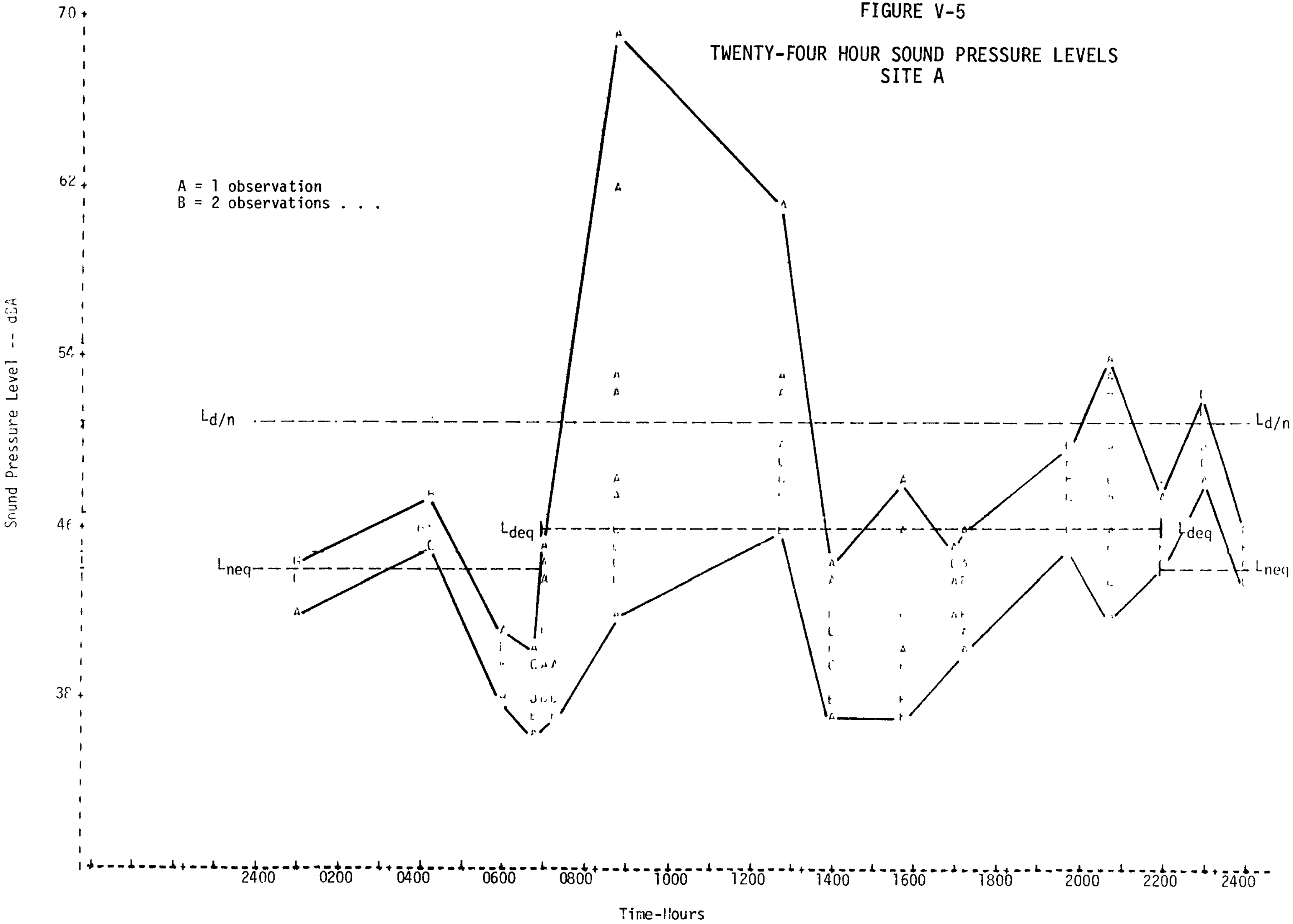


FIGURE V-6

TWENTY-FOUR HOUR SOUND PRESSURE LEVELS
SITE B

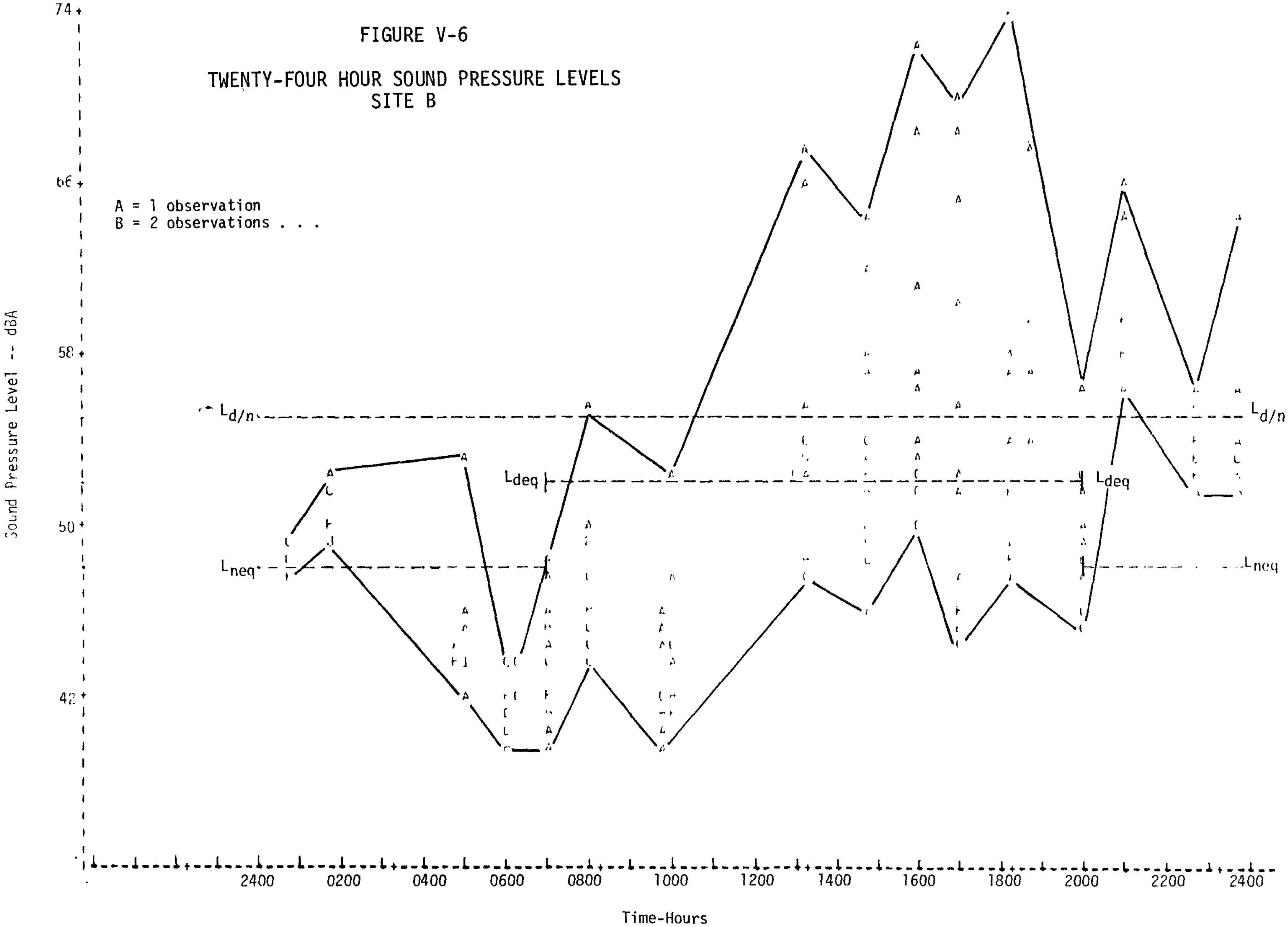
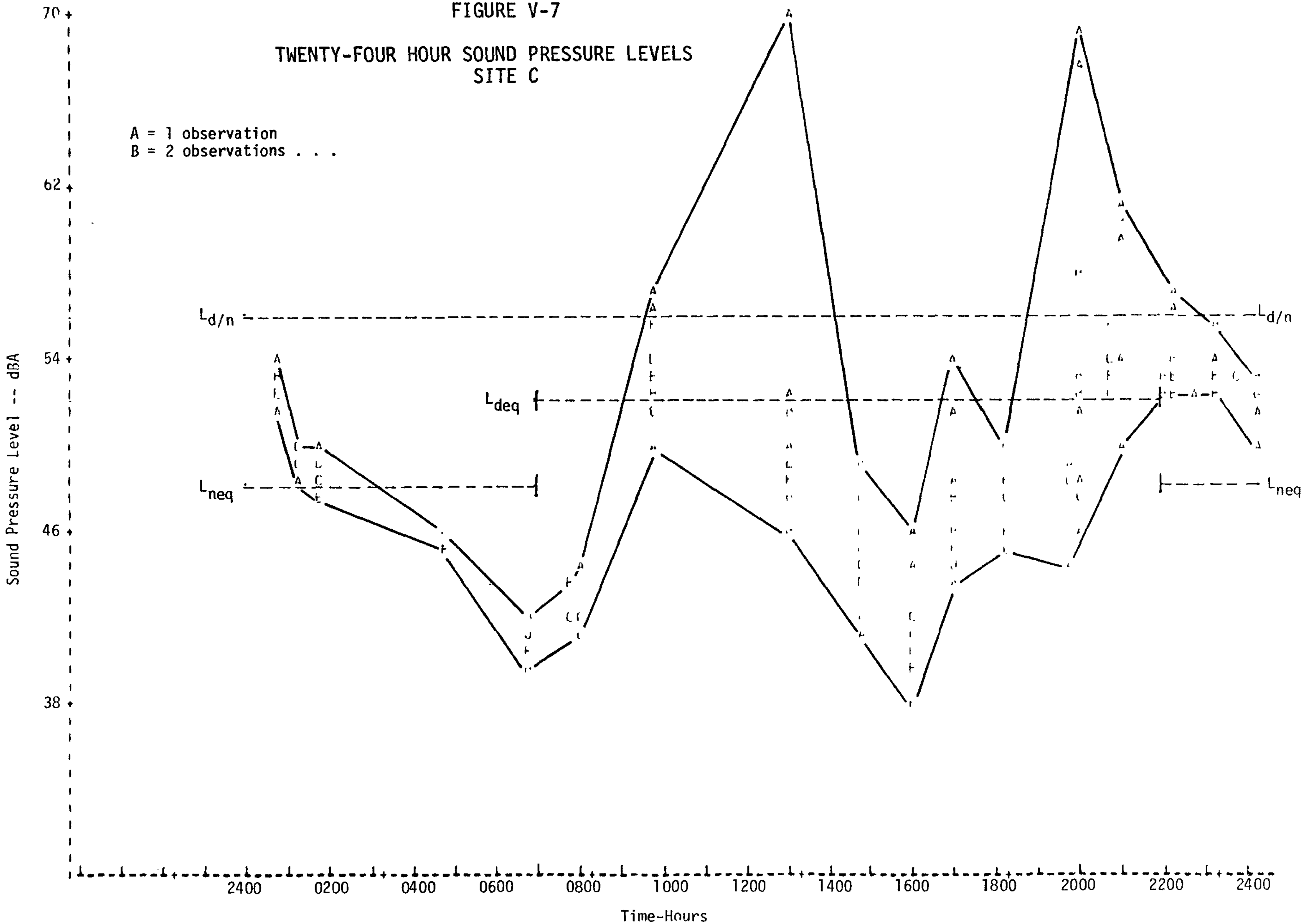


FIGURE V-7

TWENTY-FOUR HOUR SOUND PRESSURE LEVELS
SITE C



Appendix II

STATE OF FLORIDA

Department of State

THE CAPITOL
TALLAHASSEE 32304

BRUCE A. SMATHERS
SECRETARY OF STATE

June 10, 1975

ROBERT WILLIAMS, DIRECTOR
DIVISION OF ARCHIVES, HISTORY, AND RECORDS MANAGEMENT
(904) 488-1480

IN REPLY REFER TO:

Mr. Robert C. Cooper
Environmental Planner
U. S. Environmental Protection Agency
1421 Peachtree St. N.E.
Atlanta, Georgia 30309

Re: Arlington Wastewater Management Facility, Jacksonville, Florida, Duval County.

Dear Mr. Cooper:

We have reviewed the above project for possible impact on arhcaeological, historical, and National Register properties, and have the following comments.

Seven sites are recorded within the service district boundary in locations which indicate impact by one or more of the proposed alternates. These locations are shown on the enclosed maps. It can be seen that all alternates seem to endanger sites, numbers 9, 10, and 11 more significantly than the others.

This information is based on recorded sites only, and there is little doubt that additional sites exist in areas which have never been surveyed. The present assessment, then, should be considered preliminary in nature. After alternatives have been narrowed to one or several likely plans, the proposed transmission routes and pumping station locations should be subjected to a professional archaeological and historical survey in order to adequately assess project impact. We would be pleased to prepare a proposal and estimated budget for the project, or the work could be done by any other professional archaeologist in the State. In the latter case we request that the survey effort be coordinated with this office to insure the adequacy of the work and the mitigation of impact.

The opportunity to comment is appreciated.

Sincerely,

James J Miller
for: L. Ross Morrell
State Archaeologist & Chief
Bureau of Historic Sites & Properties

LRM/Msh

SAJEE 15 July 1975

United States Environmental
Protection Agency
ATTN: Mr. Robert B. Howard, EIS Branch
Region IV
1421 Peachtree Street, N. E.
Atlanta, GA 30309

Dear Mr. Howard:

This is in reply to your letter dated 27 May 1975 concerning alternative site selection for the proposed Arlington East Wastewater Facilities in Jacksonville, Florida. In view of the preliminary nature of the alternative analysis and lack of some engineering data, we offer the following comments based upon the assumption that the outfall pipeline extends into the St. Johns River Navigation Channel. We foresee some possible problems with each alternative that will necessitate further coordination.

<u>Alternatives 1, 2, 3, and 11</u> - The pipeline as depicted in referenced letter, transects Mill Cove and Quarantine Island with outfall into the St. Johns River ship channel. Below we have listed pertinent aspects to be considered for plans involving Mill Cove and Quarantine Island crossings.

a. The Jacksonville Harbor - Mill Cove Model Study, which is underway at this time, may determine that modifications to Quarantine Island are necessary to promote increased circulation of water through Mill Cove.

b. Quarantine Island has been created through the deposition of dredged materials from the Jacksonville Harbor ship channel. Pipelines considered under the alternatives would cross the island where this District maintains a perpetual disposal easement. The island is designated as a permanent maintemande disposal area for use by the Corps of Engineers in maintenance dredging of the Federal Jacksonville Harbor deep draft navigation project. Acceptable upland disposal areas in this area are scarce; Quarantine Island is presently being operated as an environmentally acceptable upland disposal site. Since excavation by heavy equipment will be done in the future on the island to build and raise retention dikes, the pipeline crossing would have to be buried suitably to prevent damage.

c. Alternate 11 would appear contrary to Quarantine Island's designated purpose by preventing usage as a perpetual disposal area and the ultimate planned development of the area into a public recreational site.

d. Concerning the Mill Cove crossing, it should be noted that a small boat navigation channel along the south side of the cove is being studied for possible Federal authorization. The pipeline would need to be buried to provide for at least a 12-foot deep by 100-foot wide channel should it be authorized and constructed. The pipeline in this case should be at least 6 feet below the channel to avoid damage to the pipe by dredging operations.

St. Johns River Outfall Discharge - All alternatives have effluent discharge into the St. Johns River. The following points should be considered:

a. The outfall pipeline should not protrude into the present Federal Jacksonville Harbor navigation channel or planned enlargement.

b. Congress has authorized the Corps of Engineers to study the feasibility of providing a 45-foot deep channel in Jacksonville Harbor.

c. A turning basin requested by the Jacksonville Port Authority is currently under study and if authorized will be located near the westerly end of Blount Island. If the turning basin is provided, the outfall could interfere with ships maneuvering in the basin if the outfall were to be located in or near the main ship channel. Extension of the outfall pipeline into the channel would be a hazard to ships and also could be damaged by dredges working in the area.

d. Any outfall discharges into the main ship channel could create cross-currents that could become a hazard to navigation.

e. Rather than constructing a submerged outfall which could interfere with shipping, channel maintenance or channel deepening, it may be advantageous to construct an outfall structure located at or near shore, utilizing a spillway or other methods to disperse the effluent. Such a structure may be more economical than laying pipe underwater to depths as great as 50 feet. Data obtained for the Jacksonville Harbor - Mill Cove Model Study indicates that adequate mixing would occur if the effluent were discharged at or near the surface, close to shore. Velocity measurements in the vicinity of the area of interest, collected at depths of 3 feet during June 1974, had a mean flood tide velocity of 2.26 f.p.s. and a mean ebb tide velocity of 1.90 f.p.s. During November 1974, a mean flood tide velocity of 2.30 f.p.s. and a mean ebb tide velocity of 2.62 f.p.s. were observed. These velocities should be sufficient to provide adequate mixing and dispersal.

f. Information is not provided on solids loadings and removal efficiencies for the proposed sewage treatment facility. Emission of substantial quantities of solids could cause a continuous shoaling problem in the navigation channel, requiring costly maintenance dredging.

Other specific comments center upon the requirement for a Department of the Army permit to construct an outfall structure in navigable waters. The sewage treatment plant outfall lines discharging into the St. Johns River that are being considered would require a DA permit and each site would have to be evaluated on the specific merits of that location. Since we have not at this time received a permit application giving the details of the outfall and proposed routing, our comments on the various alternatives could only be given in general terms. We suggest that Alternatives 4 through 10 would have more likelihood of obtaining a permit without undue objection since those plans involve a minimum amount of underwater disturbance. Alternative 11 would have to be analyzed to determine its effect upon plans for disposal of dredged material on Quarantine Island and future recreational development. Alternative 11 also involves a crossing of the eastern entrance channel from Mill Cove into the Dames Point - Fulton Cut-off.

We trust these points will be of value in alternative selection. Upon project designation it must be realized that a full public interest review of the outfall location would have to be made by issuance of a public notice and review of all comments received thereon, including our complete evaluation of the proposed work in detail.

Sincerely yours,

JAMES L. GARLAND
Chief, Engineering Division

Appendix IV

State of Florida

DEPARTMENT OF NATURAL RESOURCES

HARMON W. SHIELDS
Executive Director

CROWN BUILDING / 202 BLOUNT STREET / TALLAHASSEE 32304

June 25, 1975

Mr. Robert B. Howard
EIS Branch
United States Environmental
Protection Agency
Region IV
1421 Peachtree Street, N.E.
Atlanta, Georgia 30309

Dear Mr. Howard:

This will respond to your letter of May 27, 1975, enclosing information on the proposed Arlington East Wastewater Facilities in Jacksonville, Florida.

Pursuant to your request, comments on the proposal are provided as follows:

Coastal Coordinating Council Staff

1. The staff recommends against Alternates 1, 2 and 3. These alternates have in common a proposed outfall in or quite close to Mill Cove. At present, Mill Cove is suffering serious sedimentation problems due to constrictions at either end caused by continuous maintenance spoiling associated with the adjacent ship channel. Navigation charts less than 10 years old indicate depths of greater than 15 feet throughout the Cove while the actual existing depth probably does not exceed minus 6 feet except in isolated spots. The staff is, therefore, concerned about additional sediment build up in the Cove as well as possible pollution problems associated with the extremely poor circulation of the Cove if these alternates were implemented.

2. The staff recommends against Alternates 5, 6, 7 and 8. According to the Coastal Zone Management Atlas of 1972, these alternates would necessitate significant modification of a large freshwater swamp immediately east of Craig Airfield. Because of the water retention, filtration, recharge, and wildlife habitat functions of large swamps, it appears that the environmental trade-offs involved in destroying the integrity of this habitat could override the benefits of an integrated sewage system for this area of Jacksonville.

3. The staff recommends against Alternates 9, 10 and 11. Again, the Coastal Zone Management Atlas indicates that in all cases the treatment plant itself would be located in the hurricane flood zone. The amount of investment necessary to protect such a large public work does not seem to be warranted.

In summary, the Coastal Coordinating Council staff recommends Alternate No. 4. The plant itself would be located adjacent to Craig Airfield, outside the hurricane flood zone. It is the staff's view that the two uses would be most compatible and the plant itself is amply removed from the hurricane flood zone to be safe with a minimum of land site preparation. Moreover, the attendant pump stations, force mains, and laterals skirt the previously mentioned freshwater swamp and the outfall is well east of Mill Cove, thereby insuring adequate flushing.

Division of Interior Resources Staff

The actual outfall sites selected in the proposals differ very little with respect to water quantity effects. Cost factors and system efficiencies will enter into consideration here. Without further information pertaining to expected environmental impacts, it is difficult to make any recommendation. The staff prefers to see the prepared environmental impact statement before making final comment.

Mr. Robert B. Howard
Page Three
June 25, 1975

The use of a larger diameter outfall pipe (48") would reduce discharge velocities for the expected flows. This would appear to be a desirable factor. Other comments will be directed to specific items in the impact statement.

Sincerely,

James G. Smith
Administrative Assistant

JGS:rt

FLOOD & ASSOCIATES, INC.
Consulting Engineers

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OFFICES
JACKSONVILLE
ATLANTA
PENSACOLA

July 16, 1975

Mr. Joe H. Hyatt, P.E.
Deputy Director
Department of Public Works
City Hall
220 East Bay Street
Jacksonville, Florida 32202

Re: Environmental Assessment Statement
Wastewater Management Facilities
Arlington East District
Comments of Department of Natural Resources

Dear Mr. Hyatt:

We refer to your letter of July 1, 1975, requesting that we provide you with written responses to comment made relative to the subject in a letter from the Florida Department of Natural Resources to the E.I.S. Branch of the U.S. Environmental Protection Agency dated June 25, 1975, a copy of which you forwarded to us. We have reviewed said letter and are providing our responses herein; format is a comment - response format. In general, we agree with your observation that the comments must be based on limited and somewhat narrow data. Specific comments and responses are as follows:

Coastal Coordinating Council Staff
Comment:
"1. The staff recommends against Alternates 1, 2 and 3. These alternates have in common a proposed outfall in or quite close to Mill Cove. At present, Mill Cove is suffering serious sedimentation problems due to constrictions at either end caused by continuous maintenance spoiling associated with the adjacent ship channel. Navigation charts less than 10 years old indicate depths of greater than 15 feet throughout the Cove while the actual existing depth probably does not exceed minus 6 feet except in isolated spots. The staff is, therefore, concerned about additional

- continued -

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ediment build up in the Cove as well as possible pollution problems associated
/ith the extremely poor circulation of the Cove if these alternates were implemented."

esponse:
leither Alternative No. 1, 2 nor 3, proposes a point of discharge in Mill Cove; under
ll three alternatives, the outfall would discharge in the main shipping channel of
ıe St. Johns River on the opposite (north) side of Quarantine Island from Mill Cove.

'he possibility that outfall construction or operations would materially contribute
ɔ the "constrictions" at either end of Mill Cove is considered non-existent. The
utfall construction would be located 2000 feet, more or less, west of the eastern
ntrance and several miles from the western entrance to Mill Cove. Further,
edimentation attributable to the outfall would be limited to the period during and
nmediately following construction and would be limited solely to resettling of
xisting local sediments suspended during construction. The outfall's construction
nd continuing operations will not introduce additional solids directly into Mill Cove.

/ithin the River channel proper, introduction of effluent suspended solids will be
nly a negligible incremental increase over existing background turbidity. At
ssumed critical conditions: (1) plant effluent flow rate of 25 MGD (ultimate design
.ow); (2) effluent suspended solids concentration of 20 mg/l; (3) average river flow
qual to freshwater inflow rate of 5,360 MGD; the additional increment to natural
ackground turbidity is 0.09 mg/l.

omment:
2. The staff recommends against Alternates 5, 6, 7 and 8. According to the
oastal Zone Management Atlas of 1972, these alternates would necessitate significant
ıodification of a large freshwater swamp immediately east of Craig Airfield. Because
f the water retention, filtration, recharge, and wildlife habitat functions of large
wamps, it appears that the environmental trade-offs involved in destroying the
ıtegrity of this habitat could override the benefits of an integrated sewage system for
ıis area of Jacksonville."

esponse:
lternative No. 5 is totally out of place in the grouping included in this comment;
onstruction of neither the plant, tributary major force mains, nor the plant outfall
ould encroach at all into Cedar Swamp nor Possum Head Swamp, the wetland area
long the eastern edge of Craig Field to which the comment alludes. Rather, under
lternative No. 5, construction would be confined to a fairly high, well drained
idge along an existing electric power transmission line east of Possum Head Swamp.

- continued -

The quantification "significant" as applied to "modification of a large freshwater swamp" in the comment is somewhat nebulous and ill-defined. Under Alternatives Nos. 7 and 8, the modification would be somewhat more "significant" in that the plant site (46 acres more or less) and a 5,500$^{+}_{-}$ L.F. pipeline crossing would be constructed in the wetland area (if clearing were limited to 50-foot width, some 6.3 acres would be cleared for pipeline construction). Under Alternative No. 6, the plant site is on high ground east of the swamp, with only the pipeline crossing (6.3 acres impacted area as above) being constructed in the wetland area.

It is thought the allegation that such construction would "override the benefits of an integrated sewage system for this area of Jacksonville" is totally false and erroneous for Alternative No. 5, is a gross overstatement for Alternative No. 6, and is questionable for Alternatives Nos. 7 and 8.

Comment:
"3. The staff recommends against Alternates 9, 10 and 11. Again, the Coastal Zone Management Atlas indicates that in all cases the treatment plant itself would be located in the hurricane flood zone. The amount of investment necessary to protect such a large public work does not seem to be warranted."

Response:
Plant sites under all three alternatives are located adjacent to shorelines and/or edges of tidal marshes; thus, all would be essentially unprotected from hurricane winds. Sites under Alternatives 9 and 11 also are totally low ground (elevations less than 10 feet M.S.L.) such that conceivably they might be flooded by maximum hurricane tides. The ground surface elevations on the Spanish Point site (Alternative No. 10), however, vary from about 10 feet to more than 40 feet M.S.L. It would be feasible to locate plant structures near the western (higher) end of the site and do a moderate amount of earthwork and grading on-site to protect a plant on this site from hurricane flooding.

Comment:
"In summary, the Coastal Coordinating Council staff recommends Alternate No. 4. The plant itself would be located adjacent to Craig Airfield, outside the hurricane flood zone. It is the staff's view that the two uses would be most compatible and the plant itself is amply removed from the hurricane flood zone to be safe with a minimum of land site preparation. Moreover, the attendant pump stations, force mains, and laterals skirt the previously mentioned freshwater swamp and the outfall is well east of Mill Cove, thereby insuring adequate flushing."

Response:
The southern portion of the plant site (1/3 to 1/2 of total area) is located in a freshwater swamp (so indicated by U.S.G.S. 1:24,000 quadrangle map and verified by

- continued -

site inspections in which cypress, gum, and bay - all typical freshwater swamp species - were observed to be the dominant vegetation). The endorsement of this site by this comment is totally at variance with comment No. 2 above.

The summary comment, too, appears totally to ignore socio-economic and cultural factors. The Environmental Assessment Statement (Table No. 4-2 and Figure 4-2) shows that construction on the Derringer Road site (Alternative No. 4) would have fourth most severe impacts on nearby future populations among all alternatives considered. This conclusion is based on Area Planning Board population and land use projections and by equating severity of socio-economic and cultural impacts to resident population-proximity figures.

Already, in the past two to three years, major developments of multi-family housing have been constructed along Monument Road immediately adjacent to the northern end of the plant site under Alternative No. 4.

<u>Division of Interior Resources Staff</u>
<u>Comment:</u>
"The actual outfall sites selected in the proposals differ very little with respect to water quantity effects. Cost factors and system efficiencies will enter into consideration here. Without further information pertaining to expected environmental impacts, it is difficult to make any recommendation. The staff prefers to see the prepared environmental impact statement before making final comment."

<u>Response:</u>
The alternatives differ not at all in regard to water quantity effects, if it may be assumed that the District system's service area and population will be the same regardless of the plant site chosen. With regard to water quality effects, the differences, if any, among alternatives should be negligible in that the same treatment process sequence will be employed prior to effluent discharge regardless of where the plant is located. The only possible variable with regard to water quality would seem to be the exact point of effluent discharge. The point of discharge, in all cases is the maintained shipping channel of the St. Johns River, depth 34 to 38 feet, total River width less than 2000 feet. Alternatives Nos. 1, 2, 3 and 11 would result in effluent discharge some 2000 feet west of the eastern entrance of Mill Cove while the remaining Alternatives would result in effluent discharge some 6,000 to 9,000 feet east of said entrance. Water quality effects, thus, would be dependent primarily on any differences in localized mixing-dispersal patterns in proximity to specific points of discharge. No detailed information is readily available to us on such patterns, but, overall, mixing-dispersal is not thought to vary markedly.

- continued -

Comment:
"The use of a larger diameter outfall pipe (48") would reduce discharge velocities for the expected flows. This would appear to be a desirable factor. Other comments will be directed to specific items in the impact statement."

Response:
Two alternatives, Nos. 9 and 11, (Beacon Hills and Quarantine Island sites) would provide for a 60-inch gravity outfall. All other alternatives provide a 48-inch effluent force main. The exact reason for the commentator's request for a larger outfall is not clearly understood. At the smaller diameter (48"), ultimate average daily effluent flow rate of 25 MGD, and extreme short-term peak flow rate of 200% of average daily flow rate, exit velocity from a 48" pipe is 6.16 f.p.s. (3.65 knots). Inasmuch as this velocity is very similar to prevalent tidal current velocities in the vicinity of the point of discharge, the rationale for the comment is unclear.

Summary:
In summary, as you are aware, several of the sites discussed herein were propounded by parties other than the Department of Public Works and its consultants, notably the public-at-large and E.P.A. The Environmental Assessment Statement attempted honestly, on the basis of best available information, to assess both assets and liabilities, positive and negative attributes of each site. It is thought that the E.A.S. addressed those valid weaknesses of each alternative as are noted in the foregoing comments. However, as was noted in your transmittal letter of July 1, we would agree that certain of the comments were based on less than fullest and best available information. These comments have been refuted in our responses thereto.

Should you have questions or desire additional discussions of any of the points made herein, please do not hesitate to contact us.

Very truly yours,

FLOOD & ASSOCIATES, INC.
Consulting Engineers

Robert L. Bates, Jr., P.E.
Project Manager

RLBjr/le

State of Florida

DEPARTMENT OF NATURAL RESOURCES

HARMON W. SHIELDS
Executive Director

CROWN BUILDING / 202 BLOUNT STREET / TALLAHASSEE 32304

REUBIN O'D. ASKEW
Governor
BRUCE A. SMATHERS
Secretary of State
ROBERT L. SHEVIN
Attorney General
GERALD A. LEWIS
Comptroller
PHILIP F. ASHLER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

August 22, 1975

Mr. Robert B. Howard
EIS Branch
U.S. Environmental Protection Agency
Region IV
1421 Peachtree Street, N.E.
Atlanta, Georgia 30309

Dear Mr. Howard:

This will respond to your July 24 letter concerning comments submitted by the Department on the proposed Arlington-East Wastewater Facilities in Jacksonville, Florida.

Original comments provided your office by our letter of June 25, 1975, were made based on information indicated on charts provided by you and on staff's general knowledge of the area concerned. These should have been considered purely preliminary comments subject to change based on the case made by the Environmental Impact Statement. As you are no doubt aware, the Department is not staffed to make special studies of each matter presented for review. We do try to comment on items when requested to do so by other agencies however.

From reading the consultant's letter, it appears that he is under the impression that our staff had access to the Environmental Assessment Statement during our review. In fact, as you are aware, our staff had eleven generalized maps of the area in question with which appeared to us to be concept designs of the various alternatives. Primary tools used by our staff in our review were USGS quadrangles, soils information, 1973/74 infra-red and black and white aerial photographs, and the Coastal Zone Management Atlas of 1972. Given

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RECREATION AND PARKS • RESOURCE MANAGEMENT

more detailed information on the various alternatives, we may have reached different conclusions and provided different comments.

If you are interested in further discussion on the project, our staff would be available to meet with you and the Jacksonville Department of Public Works consulting engineers at your convenience in our offices in Tallahassee, Florida. Please advise whether or not such a meeting is desired.

Sincerely,

James G. Smith
Administrative Assistant

JGS:rt

FLORIDA GAME AND FRESH WATER FISH COMMISSION

HOWARD ODOM, Chairman, Marianna | OGDEN M. PHIPPS, Vice Chairman, Miami | E. P. "Sonny" BURNETT, Tampa | O. L. PEACOCK, JR., Ft. Pierce | JAMES B. WINDHAM, Jacksonville

DR. O. E. FRYE, JR., Director
H. E. WALLACE, Assistant Director

WILDLIFE RESEARCH PROJECTS
4005 S. Main Street
Gainesville, Florida 32601
Phone: (904) 376-6481

October 15, 1975

Mr. Theodore Bisterfeld
United States Environmental Protection Agency
1421 Peachtree St., N.E.
Atlanta, GA 30309

Dear Mr. Bisterfeld:

Your letter of 24 September to Major Martin has been referred to this office. A cursory examination of the site as indicated on your map showing that the area enclosed in red would certainly contain alligators, Indigo Snakes, fox squirrels and at least in the Southern portions of the area the possibility of Black Bear. Portions of the area are unpopulated enough by humans to occasionally harbour various migratory species which could be considered threatened. If further information is required, please advise.

Sincerely,

James A. Powell
Wildlife Biologist

JAP/vg
cc: Martin

Appendix VIII

United States Department of the Interior
FISH AND WILDLIFE SERVICE
17 EXECUTIVE PARK DRIVE, N. E.
ATLANTA, GEORGIA 30329

JUL 15 1975

Regional Administrator
Environmental Protection Agency
1421 Peachtree Street, NE., Suite 300
Atlanta, Georgia 30309

Dear Sir:

In response to a May 27, 1975, letter from Mr. Robert B. Howard of your Environmental Impact Statement Branch, the Fish and Wildlife Service has reviewed the proposed alternative plant sites and outfall locations for the Arlington-East Service District, Wastewater Treatment Facilities, Jacksonville, Duval County, Florida. We offer the following comments concerning this project.

According to the above letter and attachments, 11 alternative treatment plant sites and outfall line routings are under consideration. The proposed treatment facilities will provide secondary treatment for a 10 MGD flow of sewage, with an ultimate flow of 25 MGD by 2002.

Biologists from our Vero Beach, Florida, field office visited the project area on June 11 and 12, 1975. Because of the general nature of the maps supplied, the precise location of plant and outfall facilities was often difficult to determine. Consequently our comments are based on observations of areas which our biologists believe to approximate facility sites. We will be glad to provide more specific additional comments when precise plans are formulated.

Treatment plant site alternatives 1, 3, 5, and 6 are located in upland areas vegetated predominately by scrub oak communities with scattered pines. Alternative site 2 is located in an old mine area where little vegetation currently exists. Alternatives 4, 7, and 8 appear to be in lower areas, subject to frequent or periodic inundation and vegetated by water-tolerant tree species including cypress and bay. Alternative 10 is a dune area of extreme relief bounded by salt marsh. Dune ridge vegetation is predominately live oak, magnolia, and cabbage palm with lower areas dominated by wax myrtle and palmetto. Alternative site 9, northeast of the Beacon Hills subdivision, is a lower dune area vegetated by wax myrtle, other shrub species, and scattered red cedar. An existing

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sewage treatment facility occupies portions of this location. Alternative site 11 is located on the east end of Quarantine Island. The higher elevations of Quarantine Island are forested, sloping to dune communities, then to a narrow mud flat on the north side of the island along Dame Point Cutoff, and to quite broad salt marsh bordering Mill Cove on the south.

Alternative plans 1, 2, 3, and 11 propose construction of the outfall line or transmission lines across Mill Cove to Quarantine Island with the outfall point in Dame Point Cutoff. Alternatives 4, 5, 6, 7, 8, and 10 appear to entail construction of the outfall line entirely in upland areas reaching the St. Johns River main channel just east of Shipyard Creek. The outfall for alternative 9 would traverse a short upland route to an outlet point in the St. Johns River approximately 1 mile east of Shipyard Creek.

Obviously, the construction of the treatment plant in any area which involves removal of existing vegetation will have some adverse effect on wildlife resources utilizing the area. Based on treatment plant site location alone, alternative 2 appears to be the least damaging, since little or no vegetation is present in this area. Alternatives 1, 3, 5, and 6 located in the oak pine vegetation would provide the next-least-damaging treatment plant sites.

Although alternatives 1, 2, and 3 are among the least damaging treatment plant sites, we are concerned about the effects of outfall line construction across Mill Cove and Quarantine Island that would be involved in these alternatives. These concerns would also hold true for alternative 11. The salt marshes along the south side of Quarantine Island are productive and provide habitat and feeding areas for many fish and wildlife species. Telephone conversations with personnel of the city of Jacksonville, Department of Public Works indicate that the installation of outfall pipe across these marshes may require the use of a barge, which would require dredging a channel 30 to 40 feet wide into some of the marsh areas. This dredging and spoil removal would result in the destruction of several thousand square feet of productive marsh. However, we believe that the adverse effects of any construction would not be permanent if surface contours in the marsh and bay are restored to preproject conditions after completion of work. Restoration of marsh areas could be hastened by the replanting of marsh grasses.

We do not favor to the selection of alternatives 4, 7, or 8 since they appear to involve construction in freshwater swamp areas. These areas provide high quality wildlife habitat and assimilate nutrients from upland runoff. We also recommend against selection of alternative 10, because of the uniqueness and esthetic values of the hardwood-vegetated dune area.

Alternative 9 is located in a dune area. However, because of previous modification of portions of this area, construction impact would be reduced. Some portions of alternative 9 appear to be subject to flooding by extreme high water conditions and may therefore require filling.

We believe the treatment plant site, as proposed in alternative 11, is inadvisable because of the multiple pipeline crossings of Mill Cove and salt marsh. Crossing these areas would require extensive filling to elevate the pipeline above flood levels. We also understand that portions of Quarantine Island are being considered for recreational use. Although this area of the St. Johns River is highly developed, treatment plant siting on Quarantine Island would detract from a quality recreational experience and may reduce the land available for recreation.

In summary, we believe that the least biologically damaging alternative would involve construction of the treatment plant at the unvegetated strip mine area or, secondly, on one of the sites vegetated by the scrub oak-pine community. The least damaging outfall line route would be along an entirely upland alignment to the St. Johns River. If construction across Mill Cove and associated salt marsh is considered, construction plans and cost calculations should include restoration of preproject contours in all areas and replanting of marsh vegetation to minimize adverse effects.

We hope that these comments are helpful in project planning and construction. Thank you for soliciting our comments during the early stages of planning.

Sincerely yours,

Kenneth E. Black

Regional Director

AREA NORTH OF REGENCY SQUARE

Dunes Favored for Sewage Plant

By BILL MIDDLETON, Times-Union Staff Writer

A citizens committee is recommending as the most acceptable site for an Arlington East sewage treatment plant the dunes area north of Regency Square.

The Arlington East Assistance Committee voted 9 to 4 at a meeting Tuesday night at City Hall to suggest the site to the Environmental Protection Agency over 11 other possible sites for the plant.

"The ultimate decision will rest in the hands of EPA," said Bob Howard. "A public hearing will be held in January and a decision will be proposed at that time." Howard is the head of the Environmental Impact Statement branch of the federal Environmental Protection Agency's Atlanta office.

The committee includes five city officials, five representatives of the Holly Oaks area and five other Duval citizens. The committee members completed rating sheets on which each member gave a weighting on a scale of one to 10 the importance of environmental factors and the positive or negative impact of each factor on each proposed site.

The factors ranking highest included air quality, 8.35; odor, 7.0; water quality, 8.5; water supply, 7.1 and land use, 6.9.

Howard said the total project cost of the dunes area plant is estimated at $50,615.077.

Estimated costs of the other sites ranged from a low of $48,559,307 for the Millcoe Road site, to a high of $64,971,606 for the Beacon Hills site.

The sites under consideration include Millcoe Road, Dame Point-Fort Caroline, north of Craig Field, east of Craig Field, system A; east of Craig Field, system B; inside east boundary of Craig Field, system A; inside the east boundary of Craig Field, system B; Beacon Hills, Spanish Point, Quarantine Island and Southside Craig Field.

APPENDIX X

PLANT SPECIES OF THE ARLINGTON-EAST DISTRICT

Relative Abundance: A = Abundant C = Common U = Uncommon O = Occasional	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
-FERNS-							
Boston Fern *Nephrolepis exaltat*			U	C			
Cinnamon Fern *Osmunda cinnamonea*			U	C	C		
Royal Fern *Osmunda regalis*				C			
Resurrection Fern *Polypodium polypodioides*			U	C			
Bracken Fern *Pteridium aquilinum*	A	A					
Wood Fern *Thelypteris normalis*				C	C		
Chain Fern *Woodwardia virginica*			U	C	C		
-VINES-							
Cat-claw Vine *Bignonia unguis-cati*			C	C			
Japanese Honeysuckle *Lonicera japonica*			U	C			
Virginia Creeper *Parthenocissus quinquefolia*			C				
Poison-Ivey *Rhus radicans*			C	C			
Catbrier *Smilax sp.*			C	C	C		
Summer Grape *Vitis aestivalis*			U	U			
Muscadine Vine *Vitis rotundifolia*			C	C			
-HERBACEOUS-							
Alligator Weed *Alternanthera philoxeroides*				U	U		
Jack-in-the-pulpit *Arisaema triphyllum*			U	C			
Wire Grass *Aristida stricta*		A	C				
Treadsoftly *Cnidoscolus stimulosus*		C	U				

APPENDIX X

PLANT SPECIES OF THE ARLINGTON-EAST DISTRICT

Relative Abundance: A = Abundant C = Common U = Uncommon O = Occasional	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
White-top Sedge *Dichromena sp.*				C		
Sundew *Drosera brevifolia*				U		
Pipewort *Eriocaulon sp.*					C	
Marsh Pennywort *Hydrocotyle umbellata*				U		
Rush *Juncus sp.*				U		C
Bog Moss *Mayaca aubletii*					A	
Maiden-cane *Panicum hemitomon*		C				
Arrow Arum *Peltandra sagittaefolia*				C		
Pickerel-weed *Pontederia cordata*					C	
Mermaid-weed *Proserpinaca sp.*				U	U	
Beak Rush *Rynchospora sp.*					C	
Duck Potato *Sagittaria sp.*				U		
Hooded Pitcher Plant *Sarracenia minor*				O	O	
Lizard-tail *Saururus cornuus*				C		
Spanish-moss *Tillandsia uspeoides*	C	C	U	C	C	
Bladderwort *Utricularia sp.*				C	A	
Seven-lobed Violet *Viola septemloba*				U		
-TREES & SHRUBS-						
Box Elder *Acer negundo*			U	C	C	
Red Maple *Acer Rubrum*			U	C	C	
Red Buckeye *Aesculus pavia*			O	C	U	

APPENDIX X

PLANT SPECIES OF THE ARLINGTON-EAST DISTRICT

Relative Abundance:

A = Abundant
C = Common
U = Uncommon
O = Occasional

(Continued)

Species	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Devil's Walking Stick *Aralia spinosa*			O			
Red Chokeberry *Aronia arbutifolia*		O	U	U		
Pawpaw *Asimina sp.*		C	U			
Saltbush *Baccharis halimifolia*				U	C	C
American Hornbean *Carpinus caroliniana*			U	O		
Pignut Hickory *Carya glabra*			C	C		
Mockernut Hickory *Carya tomentosa*			C			
Sugarberry *Celtis laevigata*			U	U		
Buttonbush *Cephalanthus occidentalis*				C	U	
Rosemary *Ceratiola ericoides*		C	O			
Gopher Apple *Chrysobalanus oblongifolius*		U				
Flowering Dogwood *Cornus florida*			U			
Florida Dogwood *Dornus foemina*			U			
Haw *Crataegus sp.*			U	U		
Persimmon *Diospyros virginiana*		C	C			
Ash *Fraxious sp.*				C		
Loblolly Bay *Gordonia lasianthus*				C	C	
St. John's Wort *Hypericum sp.*					O	
Large Gallberry *Ilex coriacea*		U	U			
American Holly *Ilex opaca*	U		U			
Virginia Willow *Itea virginica*				A		
Southern Red Cedar *Juniperus silicicola*	U		U	U		

APPENDIX X

PLANT SPECIES OF THE ARLINGTON-EAST DISTRICT

Relative Abundance:

A = Abundant
C = Common
U = Uncommon
O = Occasional

(Continued)

	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Sweetgum *Liquidambar styraciflua*	O		C	C		
Staggerbush *Lyonia ferruginea*	U	U	C			
Fetterbush *Lyonia lucida*			C		U	
Magnolia *Magnolia grandiflora*			C	U	C	
Sweet Bay *Magnolia virginiana*	U		U		C	
Red Mulberry *Morus rubra*				U		
Wax Myrtle *Myrica cerifera*				U	O	
Black Tupelo *Nyssa sylvatica*				C	O	
Wild Olive *Osmanthus americana*			U			
Redbay *Persea borbonia*				C	U	
Slash Pine *Pinus elliottii*		C	A	C	O	
Spruce Pine Pinus glabra			U	U		
Longleaf Pine *Pinus palustris*		C	U			
Chickasaw Plum *Prunus angustifolia*		U				
Black Cherry *Prunus serotina*		U	U			
Chapman Oak *Quercus chapmanii*		C				
Bluejack Oak *Quercus incana*		C				
Turkey Oak *Quercus laevis*		A				
Laurel Oak *Quercus laurifolia*		C	U	C	U	
Water Oak *Quercus nigra*	U		U			
Live Oak *Quercus virginiana*	A	C				
Winged Sumac *Rhus copallina*		C	C	C		

APPENDIX X

PLANT SPECIES OF THE ARLINGTON-EAST DISTRICT

Relative Abundance: A = Abundant C = Common U = Uncommon O = Occasional	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
Blackberry *Rubus sp.*			C			
Blue Stem Palmetto *Sabal minor*				U		
Cabbage Palm *Sabal palmetto*	A			U		
Coastal Plain Willow *Salix caroliniana*				U		
Elderberry *Sambucus simpsonii*				U		
Sassafras *Sassafras albidum*			U			
Saw-palmetto *Serenoa repens*			C	U		
Pond Cypress *Taxodium ascendens*					A	
Bald Cypress *Taxodium distichum*					A	
Basswood *Tilia caroliniana*				U		
American Elm *Ulmus americana*			U	U		
Blueberry *Vaccinium sp.*					O	

APPENDIX XI (a)

AMPHIBIANS OF THE ARLINGTON-EAST DISTRICT

AMPHIBIANS:	Hammock	Longleaf-Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Greater Siren *Siren lacertina*				X	X	
Lesser Siren *Siren intermedia*				X	X	
Dwarf Siren *Pseudobranchus striatus*				X	X	
Amphiuma *Amphiuma means*				X	X	
Flatwoods Salamander *Ambystoma cingulatum*			X	X	X	
Mole Salamander *Ambystoma talpoideum*			X	X	X	
Tiger Salamander *Ambystoma tigrinum*				X	X	
Central Newt *Notophthalmus viridescens*				X	X	
Striped Newt *Notophthalmus perstriatus*			X	X	X	
Dusky Salamander *Desmognathus Fuscus*			X	X	X	
Slimy Salamander *Plethodon glutinosus*			X	X	X	
Mud Salamander *Pseudotriton montanus*			X	X	X	
Dwarf Salamander *Manculus quadridigitatus*				X	X	
Spadefoot Toad *Scaphiopus holbrooki*	X	X				
Southern Toad *Bufo terrestris*	X	X	X	X	X	
Oak Toad *Bufo quercicus*		X	X	X	X	
Southern Cricket Frog *Bufo quercicus*				X	X	
Green Treefrog *Hyla cinerea*			X	X	X	
Spring Peeper *Hyla crucifer*			X	X	X	
Piney Wood Treefrog *Hyla femoralis*			X			
Least Treefrog *Hyla ocularis*			X	X	X	

APPENDIX XI (a)

AMPHIBIANS OF THE ARLINGTON-EAST DISTRICT

AMPHIBIANS:	Hammock	Longleaf-Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
Squirrel Treefrog *Hyla squirella*		X	X	X	X	
Gray Treefrog *Hyla versicolor*	X	X	X	X	X	
Barking Treefrog *Hyla gratiosa*	X	X	X	X	X	
Chorus Frog *Pseudacris nigrita*			X	X	X	
Easter Narrow-mouth Toad *Gastrophryne carolinensis*		X	X	X	X	
Gopher Frog *Rana areolata*		X				
Bullfrog *Rana catesbeiana*					X	
Bronze Frog *Rana clamitans*		X				
Pig Frog *Rana grylio*					X	
River Frog *Rana heckscheri*				X	X	
Southern Leopard Frog *Rana sphenocephala*				X	X	

APPENDIX XI (b)

REPTILES OF THE ARLINGTON-EAST DISTRICT

REPTILES:	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
St Ue American Alligator *Alligator mississippiensis*				X		X
Snapping Tortoise *Chelydra serpentina*					X	
St Gopher Tortoise *Gopherus polyphemus*	X	X				
Stinkpot *Sternothaerus odoratus*					X	
Mud Turtle *Kinosternon bauri*					X	
Box Turtle *Terrapene carolina*		X	X			
Diamondback Terrapin *Malaclemmys terrapin*						X
Yellow-bellied Turtle *Pseudemys scripta*				X	X	
Florida Cooter *Pseudemys floridana*				X	X	
Chicken Turtle *Deirochelys reticularia*				X	X	
Florida Softshell *Amyda ferox*				X	X	
American Chaemeleon *Anolis carolinensis*	X	X	X	X	X	
Six-lined Racerunner *Cnimidophorus sexlineatus*	X	X	X			
Ground Skink *Lygosoma laterale*	X	X	X	X	X	
Red-tailed Skink *Eumeces egregius*	X	X	X	X	X	
Five-lined Skink *Eumeces inexpectatus*	X	X	X			
Slender Glass Lizard *Ophisaurus attenuatus*		X	X			
Island Glass Lizard *Ophisaurus compressus*	X	X	X			
Eastern Glass Lizard *Ophisaurus ventralis*			X	X	X	
Eastern Fence Lizard *Sceloporus undulatus*	X	X	X			
Green Water Snake *Natrix cyclopion*	X			X		
Broad-headed Skink *Eumeces laticeps*	X	X	X			

APPENDIX XI (b)

REPTILES OF THE ARLINGTON-EAST DISTRICT

REPTILES:	Hammock	Longleaf-Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
Red-bellied Water Snake *Natrix erythroquster*				X	X	
Glossy Water Snake *Natrix rigida*				X	X	
Florida Water Snake *Natrix sipedon pictiventris*				X	X	
Brown Water Snake *Natrix taxispilota*				X	X	
Black Swamp Snake *Seminatrix pygaea*				X	X	
Brown Snake *Storeria dekayi*	X	X	X	X	X	
Red-bellied Snake *Storeria occipitomaculata*		X	X			
Eastern Garter Snake *Thamnophis sirtalis*			X	X	X	
Southern Ribbon Snake *Thamnophis sauritus*			X	X	X	
Rough Earth Snake *Haldea striatula*			X	X	X	
Smooth Earth Snake *Haldea valeriae*			X	X	X	
Striped Swamp Snake *Liodytes alleni*				X	X	
Eastern Hognose Snake *Heterodon platyrhinos*	X	X				
Southern Hognose Snake *Heterodon simus*	X	X	X	X	X	
Ringneck Snake *Diadophis punctatus*			X	X	X	
Mud Snake *Farancia abacura*				X	X	
Black Racer *Coluber constrictor*	X	X	X			
Coachwhip *Masticophis flagellum*	X	X				
Rough Green Snake *Opheodrys aestivalis*	X			X	X	
St Indigo Snake *Drymarchon corais*	X	X	X	X	X	

APPENDIX XI (b)

REPTILES OF THE ARLINGTON-EAST DISTRICT

REPTILES:	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
Corn Snake *Elaphe guttata guttata*	X	X	X	X	X	
Yellow Rat Snake *Elaphe obsoleta quadrivittata*			X	X	X	
Pine Snake Pituophis melanoleucas		X				
Eastern Kingsnake *Lampropeltis getulus*			X	X	X	
Scarlet Kingsnake *Lampropeltis doliata*			X	X	X	
Mole Snake *Lampropelti calligaster*	X	X	X	X	X	
Scarlet Snake Cemophora coccinea			X			
Crowned Snake *Tantilla coronata*	X	X	X	X	X	
Coral Snake *Micrurus fulvius*	X	X	X	X	X	
Cottonmouth *Ancistrodon piscivorus*				X	X	X
Pygmy Rattlesnake *Sistrurus miliarfus*		X	X		X	
Eastern Diamondback *Crotalus adamanteus*	X	X	X	X	X	

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

PR = Permanent Resident
SR = Summer Resident
WR = Winter Resident
T = Transient

Abundance:

C = Common
FC = Fairly Common
U = Uncommon
R = Rare

Species	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
Common Loon Gavia immer	WR	U						X	
Red-throated Loon Gavia stellata	WR	U						X	
Horned Grebe Podiceps auritus	WR	FC						X	
Pied-billed Grebe Podilymbus podiceps	PR	FC						X	
St Ue Brown Pelican Pelecanus occidentalis	PR	C						X	
Gannet Morus bassanus	WR	C						X	
Double-crested Cormorant Phalacrocorax auritus	PR	C						X	
Anhinga Anhinga anhinga	PR	C				X	X	X	
Mallard Anas platyrhynchos	WR	U						X	
Pintail Anas acuta	WR	U						X	
Gadwall Anas strepera	WR	U						X	
American Widgeon Mareca americana	WR	U						X	
Shoveller Spatula clypeata	WR	U						X	
Blue-winged Teal Anas discors	WR	FC						X	
Green-winged Teal Anas carolinensis	WA	U						X	
Wood Duck Aix sponsa	PR	R				X	X		
Redhead Aythya americana	WR	R						X	
Canvasback Aythya valisineria	WR	R						X	
Ring-necked Duck Aythya collaris	WR	U						X	
Greater Scaup Aythya marila	WR	R						X	

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

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	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)								
Lesser Scaup *Aythya affinis*	WR	C						X
Common Goldeneye *Bucephala clangula*	WR	R					X	X
Bufflehead *Bucephala albeola*	WR	U						X
Ruddy Duck *Oxyura jamaicensis*	WR	FC						X
Red-breasted Merganser *Mergus serrator*	WR	C						X
Hooded Merganser *Lophodytes cucullatus*	WR	U						X
Turkey Vulture *Cathartes aura*	PR	C		X	X			X
Black Vulture *Coragyps atratus*	PR	FC		X	X			X
Cooper's Hawk *Accipiter cooperii*	PR	U		X	X			
Sharp-shinned Hawk *Accipiter striatus*	WR	U		X	X			
Marsh Hawk *Circus cyaneus*	WR	FC						X
Red-tailed Hawk *Buteo jamaicensis*	PR	U		X	X			
Red-shouldered Hawk *Buteo lineatus*	PR	U		X	X			
Osprey *Pandion haliaetus*	PR	C						X
Sparrow Hawk *Falco sparverius*	WR	C		X	X			
Bobwhite *Colinus virginianus*	PR	R		X	X			
Common Egret *Casmerodius albus*	PR	C				X	X	X
Snowy Egret *Leucophoyx thula*	PR	C				X	X	X
Cattle Egret *Bubulcus ibis*	SR	C						X
Great Blue Heron *Ardea herodias*	PR	FC				X	X	X

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

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(Continued)	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
Louisiana Heron *Hydranassa tricolor*	PR	C				X	X	X	
Little Blue Heron *Florida caerulea*	PR	C				X	X	X	
Green Heron *Butorides virescens*	PR	C				X	X	X	
Black-crowned Night Heron *Nycticorax nycticorax*	PR	C				X	X	X	
Yellow-crowned Night Heron *Nyctanassa violacea*	PR	FC				X	X	X	
American Bittern *Botaurus lentiginosus*	WR	R						X	
Least Bittern *Ixobrychus exilis*	SR	FC						X	
Wood Ibis (Stork) *Mycteria americana*	PR	C				X	X	X	
White Ibis *Eudocimus albus*	SR	FC				X	X	X	
Virginia Rail *Rallus limicola*	WR	U						X	
Sora *Porzana carolina*	WR	U						X	
Clapper Rail *Rallus longirostris*	PR	C						X	
King Rail *Rallus elegans*	PR	U					X	X	
Common Gallinule *Gallinula chloropus*	PR	FC						X	
American Coot *Fulica americana*	PR	U						X	
American Oyster Catcher *Haematopus palliatus*	PR	U						X	
American Avocet *Recurvirostra americana*	T	R						X	
Black-necked Stilt *Himantopus mexicanus*	SR	U						X	
Piping Plover *Charadrius melodus*	WR	U						X	
Wilson's Plover *Charadrius wilsonia*	SR	U						X	

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

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(Continued)	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
Killdeer Charadrius vociferus	PR	FC	X					X	
Whimbrel Numenius phaeopus	T	U						X	
Spotted Sandpiper Actitis macularia	WR	U						X	
Greater Yellowlegs Totanus melanoleucus	WR	U						X	
Lesser Yellowlegs Totanus flavipes	WR	U						X	
Stilt Sandpiper Micropalama himantopus	T	R						X	
Short-billed Dowitcher Limnodromus griseus	WR	FC						X	
Ruddy Turnstone Arenaria interpres	PR	FC						X	
Pectoral Sandpiper Erolia melanotos	T	R						X	
Knot Calidris canutus	T	U						X	
White-rumped Sandpiper Erolia fuscicollis	T	R						X	
Common Snipe Capella gallinago	WR	FC						X	
Great Black-backed Gull Larus marinus	PR	FC						X	
Herring Gull Larus argentatus	PR	FC						X	
Ring-billed Gull Larus argentatus	PR	U						X	
Laughing Gull Larus atricilla	PR	C						X	
Bonaparte's Gull Larus philadelphia	WR	FC						X	
Least Tern Sterna albifrons	SR	C						X	
Common Tern Sterna hirundo	WR	U						X	
Forster's Tern Sterna forsteri	WR	C						X	

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

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Abundance:

C = Common
FC = Fairly Common
U = Uncommon
R = Rare

(Continued)	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Sandwich Tern Thalasseus sandvicensis	T	C						X
Gull-billed Tern Gelochelidon nilotica	SR	FC						X
Caspian Tern Hydroprogne caspia	WR	FC						X
Black Tern Chlidonias niger	T	C						X
Black Skimmer Rynchops nigra	PR	C						X
Mourning Dove Xenaidura macroura	PR	FC	X	X	X			
Ground Dove Columbigallina passerina	PR	FC	X	X	X			
Yellow-billed Cuckoo Coccyzus americanus	SR	FC		X	X	X		
Screech Owl Otus asio	PR				X		X	
Great Horned Owl Bubo virginianus	PR	U	X	X	X	X	X	
Barred Owl Strix varia	PR	FC	X		X	X		
Chuck-will's-widow Caprimulgus carolinensis	SR	FC		X	X			
Whip-poor-will Caprimulgus vociferus	WR	U		X	X			
Common Nighthawk Chordeiles minor	SR	C	X	X	X			
Yellow-shafted Flicker Colaptes auratus	PR	C		X	X	X		
Red-bellied Woodpecker Centurus carolinus	PR	C		X	X	X		
Yellow-bellied Sapsucker Sphyrapicus varius	WR	C			X	X	X	
Downy Woodpecker Dendrocopos pubescens	PR	FC		X	X	X		
Eastern Kingbird Tyrannus tyrannus	SR	U		X	X			
Western Kingbird Tyrannus verticalis	WR	R		X	X			

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

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T = Transient

Abundance:

C = Common
FC = Fairly Common
U = Uncommon
R = Rare

	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
(Continued)									
Blue-gray Gnatcatcher *Polioptila caerulea*	PR	FC						X	
Golden-crowned Kinglet *Regulus satrapa*	WR	R		X	X				
Ruby-crowned Kinglet *Regulus calendula*	WR	C		X	X				
Water Pipit *Anthus spinoletta*	WR	FC						X	
Cedar Waxwing *Bombcilla cedrorum*	WR	C			X	X	X		
Loggerhead Shrike *Lanius ludovicianus*	PR	C		X	X				
Starling *Sturnus vulgaris*	PR	C			X				
White-eyed Vireo *Vireo flavifrons*	PR	C		X		X			
Black and White Warbler *Mniotilta varia*	WR	U				X	X		
Worm-eating Warbler *Helmitheros vermivorus*	T	U			X				
Orange-crowned Warbler *Vermivora celata*	WR	U				X	X		
Cape May Warbler *Dendroica tigrina*	T	U			X				
Myrtle Warbler *Dendroica coronata*	WR	C		X	X				
Black-throated Blue Warbler *Dendroica caerulescens*	T	U			X				
Yellow-throated Warbler *Dendroica dominica*	PR	U			X	X			
Blackpoll Warbler *Dendroica striata*	T	U			X				
Pine Warbler *Dendroica pinus*	T	U	X	X	X	X	X		
Prairie Warbler *Dendroica discolor*	T	FC	X	X	X	X	X		
Palm Warbler *Dendroica palmarum*	WR	C				X	X		
Ovenbird *Seirus aurocapillus*	T	U			X				
Red-eyed Vireo *Vireo Olivaceus*	WR	U				X	X		

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

PR = Permanent Resident
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T = Transient

Abundance:

C = Common
FC = Fairly Common
U = Uncommon
R = Rare

(Continued)

	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Great Crested Flycatcher *Myianrchus crinitus*	SR	FC			X	X	X	
Eastern Phoebe *Sayornis phoebe*	WR	C	X	X	X			
Eastern Wood Pewee *Contopus virens*	SR	U			X	X		
Barn Swallow *Hirundo rustica*	T	C			X			
Tree Swallow *Iridoprocne bicolor*	WR	C	X			X	X	X
Purple Martin *Progne subis*	SR	FC		X	X			
Blue Jay *Cyanocitta cristata*	PR	C	X	X	X	X	X	
Common Crow *Corvus brachyrhynchos*	PR	C	X	X	X			X
Fish Crow *Corvus ossifragus*	PR	C	X	X	X			X
Carolina Chickadee *Parus carolinensis*	PR	FC			X			
Tufted Titmous *Parus bicolor*	PR1	FC				X	X	
House Wren *Troglodytes aedon*	WR	FC			X			
Carolina Wren *Thryothorus ludovicianus*	PR	C			X	X		
Long-billed Marsh Wren *Telmatodytes palustris*	PR	C						X
Short-billed Marsh Wren *Cistothorus platensis*	WR	FC						X
Mockingbird *Mimus polyglottos*	PR		X	X	X	X	X	
Catbird *Dumetella carolinensis*	WR	C	X	X	X	X	X	
Brown Thrasher *Toxostoma rufum*	PR	FC	X		X	X	X	
Robin *Turdus migratorius*	WR	C		X	X			
Hermit Thrush *Hylocichla guttata*	WR	FC			X	X		

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence: PR = Permanent Resident; SR = Summer Resident; WR = Winter Resident; T = Transient. Abundance: C = Common; FC = Fairly Common; U = Uncommon; R = Rare	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)								
Northern Waterthrush <u>Seiurus noveboracensis</u>	T	U				X	X	
Louisiana Waterthrush <u>Seiurus motacilla</u>	T	U				X	X	
Yellowthroat <u>Geothlypis trichas</u>	PR	C			X	X		
American Redstart <u>Setophaga ruticilla</u>	T	FC				X	X	
House Sparrow <u>Passer domesticus</u>	PR	U	X		X			X
Bobolink <u>Dolichonyx oryzivorus</u>	T	U			X			X
Eastern Meadowlark <u>Sturnella magna</u>	PR	FC			X			
Red-winged Blackbird <u>Agelaius phoeniceus</u>	PR	C					X	X
Boat-tailed Grackle <u>Cassidix mexicanus</u>	PR	C			X	X	X	X
Common Grackle <u>Quiscalus quiscula</u>	PR	U						
Summer Tanager <u>Pirnaga rubra</u>	SR	C		X				
Cardinal <u>Richmondena cardinalis</u>	PR	C			X	X	X	
Indigo Bunting <u>Passerina cyanea</u>	T	FC			X			
Painted Bunting <u>Passerina ciris</u>	SR				X			
Pine Siskin <u>Spinus pinus</u>	WR	R			X			
American Goldfinch <u>Spinus tristis</u>	WR	C			X			
Rufous-sides Towhee <u>Pipilo erythrophthalmus</u>	PR	C	X	X	X	X	X	
Savannah Sparrow <u>Passerculus sandwichensis</u>	WR	FC			X			
Sharp-tailed sparrow <u>Ammospiza caudacuta</u>	WR	FC						X
Vesper Sparrow <u>Pooecetes gramineus</u>	WR	U			X			

APPENDIX XI (c)

BIRDS OF THE ARLINGTON-EAST DISTRICT

Season of Occurence:

PR = Permanent Resident
SR = Summer Resident
WR = Winter Resident
T = Transient

Abundance:

C = Common
FC = Fairly Common
U = Uncommon
R = Rare

(Continued)	Season of Occurrence	Abundance	Hammock	Longleaf Pine/ Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh	
Slate-colored Junco *Junco hyemalis*	WR	U		X	X				
Field Sparrow *Spizella pusilla*	WR	U			X				
White-throated Sparrow *Zonotrichia albicollis*	WR	C		X					
Chipping Sparrow *Spizella passerina*	WR	U			X				
Swamp Sparrow *Melospiza georgiana*	WR	C				X	X		
Song Sparrow *Melospiza melodia*	WR	FC			X				
Purple Finch *Carpodacus purpureus*	WR	U		X					

APPENDIX XI (d)

MAMMALS OF THE ARLINGTON-EAST DISTRICT

MAMMALS:	Hammock	Longleaf-Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
(Continued)						
Cotton Mouse *Peromyscus gossypinus*		X				
St Florida Mouse *Peromyscus floridanus*		X				
Eastern Woodrat *Neotoma floridana*		X	X		X	
Rice Rat *Oryzomys palustris*				X	X	X
Cotton Rat *Sigmodon hispidus*		X	X	X	X	X
Norway Rat *Rattus norvegicus*	FOUND IN ASSOCIATION WITH HUMAN HABITATION					
Black Rat *Rattus ratfus*						
House Mouse *Mus musculus*						
Cottontail *Sylvilagus floridanus*	X	X	X	X	X	
Marsh Rabbit *Sylvilagus palustris*			X	X	X	
Feral Hog *Sus scrofa* x *Sus vittatus*			X	X	X	

St -State threatened list
Ue -U.S. endangered list

APPENDIX XI (d)

MAMMALS OF THE ARLINGTON-EAST DISTRICT

MAMMALS:	Hammock	Longleaf-Turkey Oak	Slash Pine Flatwoods	Hardwood Swamp	Cypress Stand	Salt Marsh
Opossum *Didelphis marsupialis*	X	X	X	X	X	
Nine-banded Armadillo *Dasypus novemcinctus*	X	X	X	X	X	
Southeastern Shrew *Sorex longirostris*		X	X	X	X	
Eastern Mole *Scalopus aquaticus*	X	X	X			
Least Shrew *Cryptotis parva*		X	X			X
Shorttail Shrew *Blarina brevicauda*	X	X	X			
Bats	Several species all habitats					
Whitetail Deer *Odocoileus virginianus*	X	X	X	X	X	
River Otter *Lutra canadensis*				X		X
Longtail Weasel *Mustela frenata*				X		
Raccoon *Procyon lotor*			X	X	X	X
Spotted Skunk *Spilogale putorius*	X	X	X	X	X	
Striped Skunk *Mephitis mephitis*		X	X	X		
Bobcat *Lynx rufus*	X	X	X	X	X	
Gray Fox *Uracyon cinereoargenteus*	X	X	X	X	X	
Gray Squirrel *Sciurus carolinensis*	X	X	X	X	X	
St Fox Squirrel *Sciurus niger*	X	X	X			
Flying Squirrel *Glaucomys volans*			X	X	X	
Southeastern Pocket Gopher *Geomys pinetis*		X				
Eastern Harvest Mouse *Reithrodontomys humulis*			X	X	X	
Oldfield Mouse *Peromyscus plionotus*		X				