APPLICATION FOR CERTIFICATION OF PROPOSED ELECTRICAL POWER GENERATING PLANT SITE

Prepared for

Metropolitan Dade County

by

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

With Technical Assistance From:

Resource Recovery (Dade County), Inc.

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Architects - Engineers - Planners, Inc.

Equitable Environmental Health, Inc.

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E. R. Hendrickson, Ph.D., P.E. - Chairman of the Board

July, 1977

ACKNOWLEDGEMENTS

Special consideration is extended to Dean Kohlhepp, resident engineer for Resource Recovery (Dade County), Inc. whose technical expertise of the process was of considerable value for the preparation of this application.

Tony Sobrino, P.E. of the Metropolitan Dade County Environmental Resource Management (MDCERM) was especially helpful and cooperative for obtaining information on the solid waste problems of Dade County and coordinating information gathering efforts. Technical assistance was also provided by Dr. R. Holm, Robert Kalafel and Don Arnold of MDCERM in the area of ecology.

Major project participants from Environmental Science and Engineering, Inc. whose special expertise contributed to the technical aspects of the application were:

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J. R. Newman, Ph.D. - Terrestrial Ecology
G. W. McRae - Noise Survey
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The continued efforts of Ann Sides and Lucinda Merritt of ESE were responsible for the final production of the application.

Other technical assistance was provided from Jim King of the Audubon Society and Allen Serper, P.E. Equitable Environmental Health, Inc.

PERTINENT APPLICANT INFORMATION

Applicant's Official Name: Metropolitan Dade County

Address: 73 West Flagler Street, Miami Florida 33130
Official Headquarters: 73 West Flagler St., Miami, Fla.

Name and Title of Business Head: County Manager

Name, Title and Address of Official Representative Responsible for obtaining certification:

Colin Morrissey, Director
Department of Environmental Resources Management
909 S.E. 1st Avenue, Miami, Florida 33131

Site Location: County - Dade Nearest Incorporated City - Medley

Latitude and Longitude: 25° 50' 7", 80° 21' 27"
UTM Coordinates: Section 17 - 564300 meters East
2857600 meters North

Name Plate Generating Capacity of Proposed Facility: 77 megawatts

Remarks:

Metropolitan Dade County does not operate, maintain or construct facilities for the purpose of electric generation. Neither does Metropolitan Dade County distribute electrical energy generated at facilities operated by others. The primary purpose of the proposed generating facility is to abate the solid waste problems associated with a large urban area.

Professional Engineer Submitting Application:

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Florida Registration Number 14996

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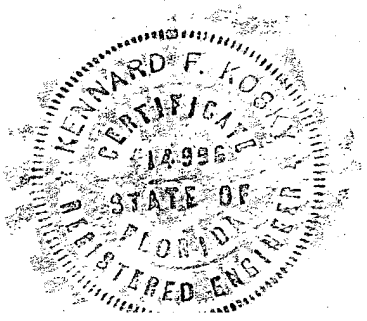

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1.0 PURPOSE OF
PROPOSED FACILITY

1.0 PURPOSE OF THE PROPOSED FACILITY AND ASSOCIATED TRANSMISSION

The disposal of Dade County's municipal and commercial refuse must be performed in an environmentally acceptable manner. One method, which includes the recovery of resources material and energy, has economic advantages. In addition, such a method reduces the volume of material remaining to be disposed of to three percent or less of the original. This material is relatively inert and can be landfilled.

Generation of steam and electricity from the combustible fraction of solid waste is a viable form of energy conversion. Transmitting the electrical energy developed directly into a utility grid provides a desirable way of utilizing this energy.

The concept of a resource recovery facility is that a major portion of the electrical energy developed can be delivered during peaking hours of electrical demand. The amount of energy thus transmitted essentially reduces the amount of oil and gas needed to meet this demand.

The proposed Metropolitan Dade County Resource Recovery Plant will dispose of garbage and trash and recover useful materials and energy, eliminate the need for conventional landfill and its generation of leachate, and substantially reduce the cost of disposal of solid waste materials; thus, it will be of significant benefit to the county.

Using a "wet" pulping system, the resource recovery facility will separate all combustible material in the refuse, and produce a homogeneous fuel of uniform heat content. The fuel, which is similar to bark, is conveyed pneumatically directly to a cyclone discharging to a live bottom bin feeding the boiler by means of a swept air spout. Exit air from the cyclone discharges into the fuel storage building, which supplies the boiler forced draft fans.

Fuel in excess of the boiler demand is conveyed to a fuel storage building for later use in high demand periods during the week. Thus, the boiler loading can be flexible. For example, the boilers and turbine generation can all be operated at capacity during the 7:00 A.M.--11:00 P.M. hours of high demand. During the 11:00 P.M.--7:00 A.M. low demand period, the system can be operated at a lower level.

Four identical steam generating bark boilers equipped with electrostatic precipitators are used for combustion of the fuel. Two turbine-generators, one per pair of boilers, will have a total output capacity of 77,000 KW. The system will be inter-connected with Florida Power and Light Company's adjoining network. The boilers are equipped with auxiliary oil burners and are capable of generating steam at full capacity on oil. These will normally be used only on start-up. No oil will be used as auxiliary fuel, however, under normal conditions.

Non-combustible materials will be separated into usable components. At rated annual processing capacity of 936,000 tons, the Plant will recover materials in annual amounts of:

Aluminum	7,020 tons
Other Non-Ferrous	4,680 tons
Glass	37,440 tons
Ferrous	65,520 tons
Fuel	514,800 tons

Electricity--MWH/Yr.--440,000 to 520,000

As noted above, the facility may operate at maximum capacity during peaking hours. It will directly reduce the need of the fossil fuel derived electricity required during these periods. However, all fuel input and output must balance out on a weekly basis.

Since the proposed facility is not a prime generating source in the Florida Power and Light system, this application does not address itself to Parts 1.1 through 1.3.

2.0 THE SITE

2.0 THE SITE

2.1 SITE LOCATION AND LAYOUT

Presented as Figure 2-1 is the site location relative to the State of Florida, Dade County, and major municipalities. The site location of the Resource Recovery Facility, which includes plant perimeter, utility property, abutting and adjacent properties, is presented in a detailed topographical map, Figure 2-2.

The site is located within 160 acres of the Northeast Quarter of Section 17, Township 53 South, and Range 40 East in Dade County. At present, the property is undeveloped, as are adjacent areas to the west, north, and south. In addition to the site, Metropolitan Dade County owns adjacent Section 16, which is used as a solid waste landfill (Northwest 58th Street landfill).

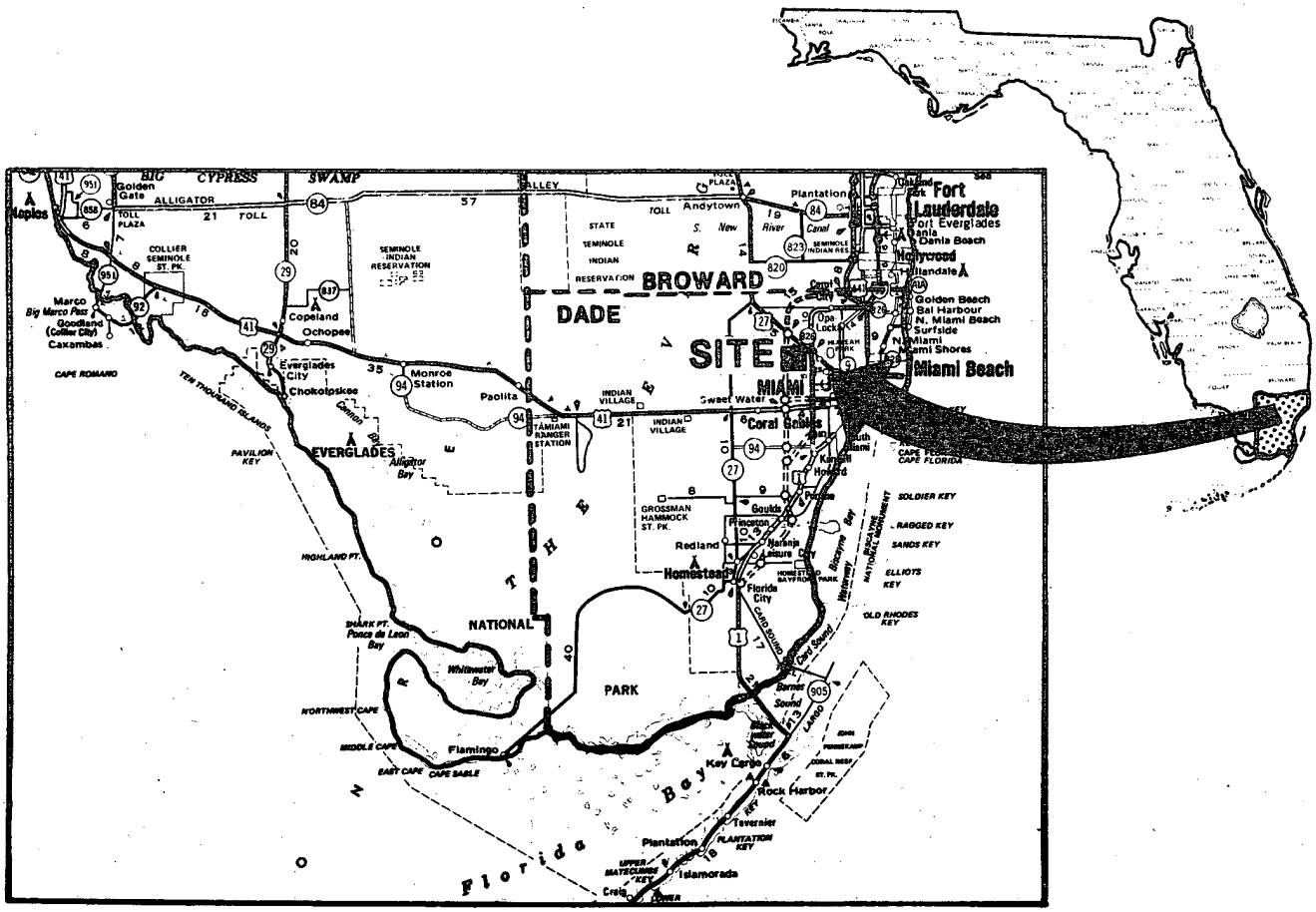
2.2 REGIONAL DEMOGRAPHY, LAND AND WATER USE

Dade County, the most densely populated of all Florida counties, includes the City of Miami and 26 surrounding municipalities. The 1970 census lists a population of 1,200,000 in Dade County. By 1976, the population had increased by 14 percent to an estimated 1,449,300.

More than 50 percent of the population live within the incorporated areas of the county, which are concentrated along the eastern coastline. The western portion of the county is sparsely populated and comprised of swampy wetlands, while the southwestern areas are predominantly agricultural.

The immediate study area for the proposed Resource Recovery facility site is depicted in Figure 2-3, which consists of a five-mile radius (50,240 acres) centered on the site. Included in the study area are portions of the incorporated areas of Hialeah, Hialeah Gardens, Medley and Miami Springs and of unincorporated areas from the county. The total populations of these incorporated areas from the 1970 Census are also shown (Table 2-1); however, only portions of these areas lie within the five-mile radius. A breakdown of the 1970 population in the individual census tracts comprising the study, provided by the Research Division of the Metropolitan Dade County Planning Department, yields an estimated total population for the study area of 108,447 persons. Based on population growth rates for the incorporated areas and the county, determined by comparing 1976 Florida population estimates (Bureau of Economic and Business Research, University of Florida) and 1970 Census data, it is estimated that approximately 128,000 persons presently reside within the study area.

RESOURCE RECOVERY SITE LOCATION



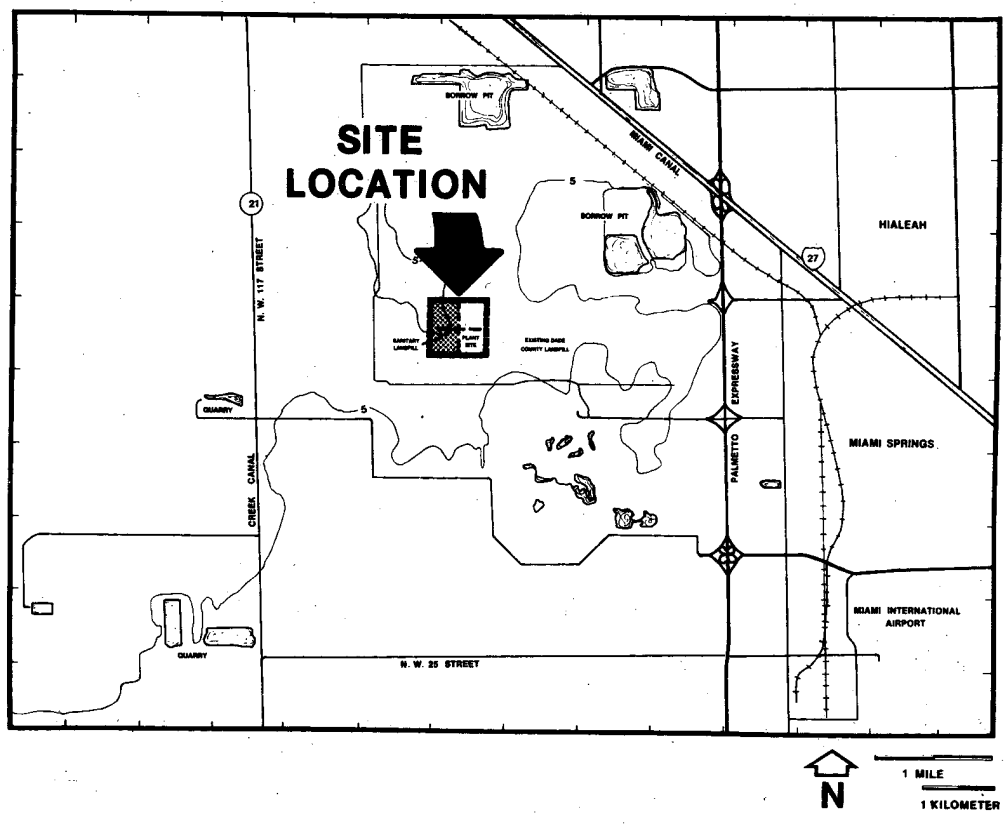


FIGURE 2-1

TOPOGRAPHIC MAP

FIGURE 2-2

Table 2-1. Estimates of Dade County Population by Municipality.

	April 1 1970 (census)	July 1 1976 (est.)	Total change 1970-1976	Percent change 1970-1976
FLORIDA	6,791,418	8,551,814	1,760,396	25.9
DADE COUNTY	1,267,792	1,449,300	181,508	14.3
Bal Harbour	2,038	2,155	117	5.7
Bay Harbor Islands	4,619	4,709	90	1.9
Biscayne Park	2,717	2,642	-75	-2.8
Coral Gables	42,494	42,284	-210	-0.5
El Portal	2,068	2,084	16	0.8
Florida City	5,133	5,181	48	0.9
Golden Beach	849	875	26	3.1
Hialeah*	102,452	126,125	23,673	23.1
Hialeah Gardens*	492	1,002	510	103.7
Homestead	13,674	20,351	6,677	48.8
Indian Creek Village	82	89	7	8.5
Islandia	8	8	0	0.0
Medley*	351	557	206	58.7
Miami	334,859	343,977	9,118	2.7
Miami Beach	87,072	88,850	1,778	2.0
Miami Shores	9,425	9,026	-399	-4.2
Miami Springs*	13,279	12,722	-557	-4.2
North Bay	4,831	4,389	-442	-9.1
North Miami	34,767	43,544	8,777	25.2
North Miami Beach	30,544	35,736	5,192	17.0
Opa-Locka	11,902	13,782	1,880	15.8
Pennsuco	74	51	-23	-31.0
South Miami	11,780	11,365	-415	-3.5
Surfside	3,614	3,673	59	1.6
Sweetwater	3,357	6,655	3,298	98.2
Virginia Gardens	2,524	2,447	-77	-3.0
West Miami	5,494	5,589	95	1.7
Unincorporated*	537,293	659,432	122,139	22.7

* The five-mile study area encompasses portions of these municipalities

Source: FLORIDA ESTIMATES OF POPULATION, DIVISION OF POPULATION STUDIES, BUREAU OF ECONOMIC AND BUSINESS RESEARCH, UNIVERSITY OF FLORIDA July 1, 1976.

The major concentrations of population in the study area are located in the vicinity of the City of Hialeah, approximately 3.5 miles to the northeast of the proposed site, and in the City of Miami Springs, approximately 3.5 miles southeast of the site. These residential areas consist mainly of single-family units and duplexes, with a few multi-family complexes and nominal acreage devoted to mobile home parks.

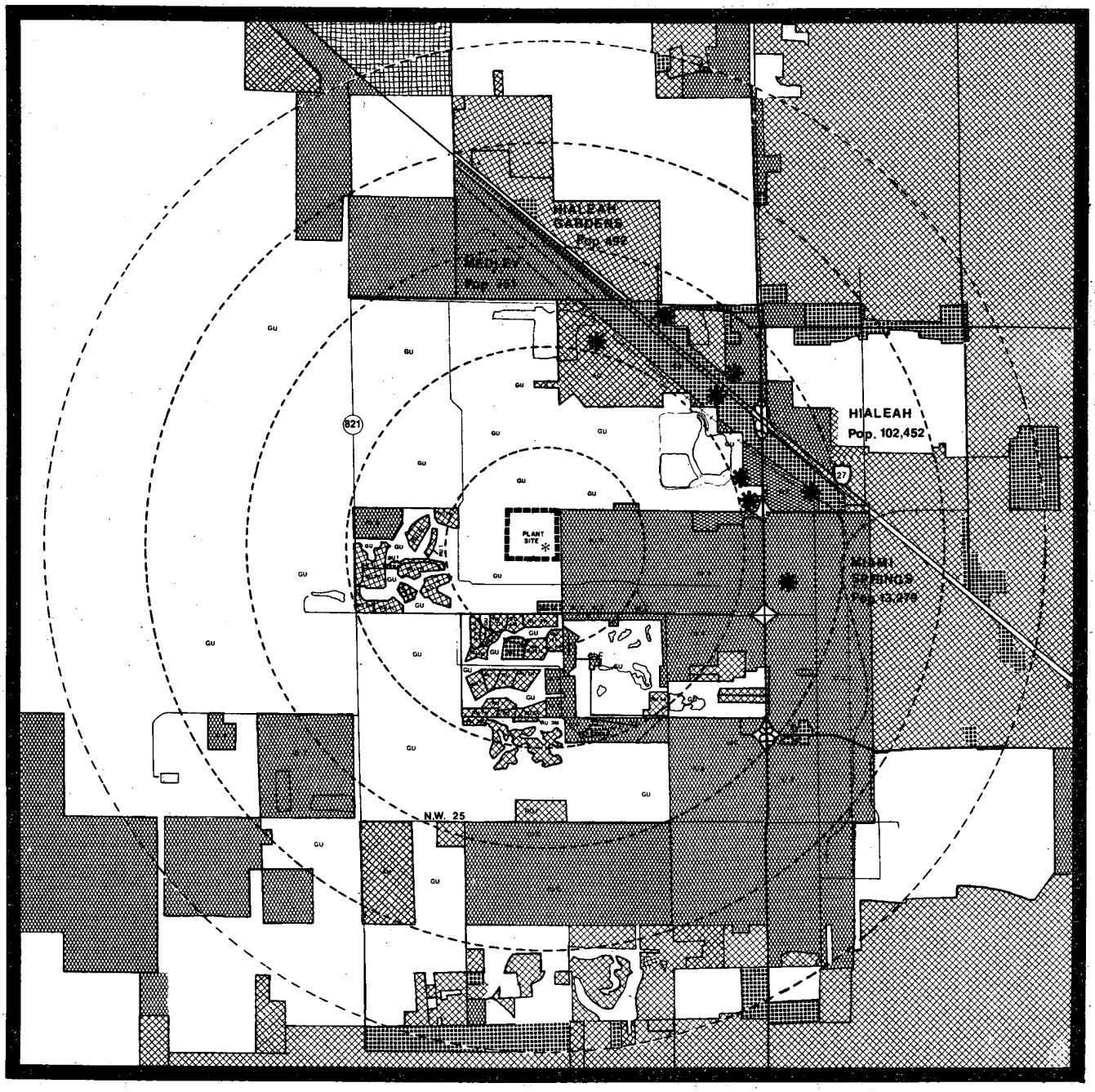
As shown in Figure 2-3, the proposed site is currently zoned GU (General Use), as are all peripheral lands within a one-mile radius with two exceptions. A 1280-acre area, bordering the eastern property line of the site, is zoned IU-3 (Industrial Unlimited Manufacturing) and is presently used by the county as a sanitary landfill. This is to be phased out upon completion of the solid waste recovery facility. The second exception is located approximately one-half mile to the south of the site, where approximately 74 acres have been zoned residential, ranging from single family to high density multi-family. This land, in addition to approximately 293 acres located one mile west of the site and 157 acres one mile to the south, also zoned for residential use (Figure 2-4), belongs to the Doral Country Club. Although legal covenants restrict development of the land until 1985, the acreage has been committed to residential use at that time in the form of a planned resort community.

Present land use within a one-mile radius of the site is limited to agriculture (approximately 78 acres) and industry, both mining (approximately 379 acres) and light industry (approximately 43 acres). A substantial portion (1402 acres) within this one-mile radius is as yet undeveloped and about 109 acres are surface water. Within two miles of the site, 6350 acres of the 8064 total are undeveloped with the remainder in urban development, industry, agriculture and surface water.

Beyond the two-mile radius to the east are the urbanized areas of Hialeah and Miami Springs, or approximately 5339 acres in urban development. Lands to the south are predominantly agricultural and undeveloped, with more undeveloped acreage to the west.

The adopted 2000 Metropolitan Development Pattern for Dade County (Figure 2-5) indicates agricultural and undeveloped lands to the south and west giving way to urban development. Undeveloped areas to the southeast are planned to be converted to industrial use with urban development of Hialeah and Miami Springs expanding to the north. It should be noted at this point that the Metropolitan Development Pattern is a general guideline for development adopted in 1975. More recently, as is evidenced by the present land use (Figure 2-6), the development trend in the vicinity of the plant site has been the conversion of agricultural lands to industrial uses, concentrating industry in one area. Construction of a solid waste disposal facility at the selected site appears to be in keeping with the present trend of development.

CURRENT ZONING: RESOURCE RECOVERY STUDY AREA (5 MILE RADIUS)



DADE COUNTY CODE

- INDUSTRIAL
- RESIDENTIAL
- AU (Agriculture)
- GU (General Use District)
- COMMERCIAL or BUSINESS
- ✱ SITE OF AIRBORNE EMISSIONS

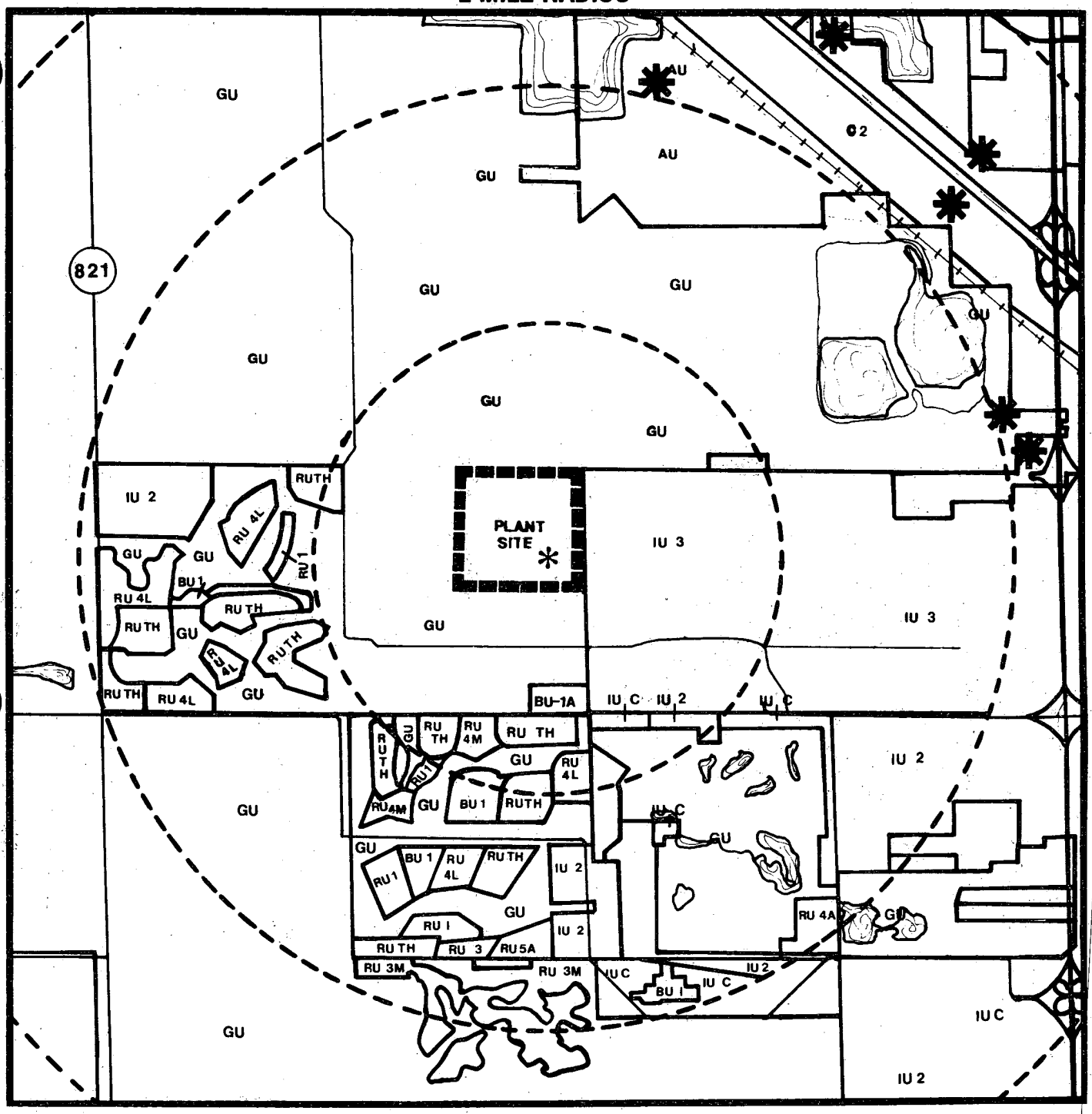
N

SCALE IN MILES 0 1

SOURCE: METROPOLITAN DADE COUNTY PLANNING DEPT. UPDATE 1977.

FIGURE 2-3

CURRENT ZONING: RESOURCE RECOVERY AREA
2 MILE RADIUS



DADE COUNTY CODE

AU	Agricultural District
GU	General Use District
RU	Residental District
IU C	Industrial District, Conditional
IU 2	Industrial, Unlimited Manufacturing District
IU 3	Industrial Heavy Manufacturing District
BU 1	Neighborhood Business District
BU 2	Special Business District
BU1A	Limited Business District

N

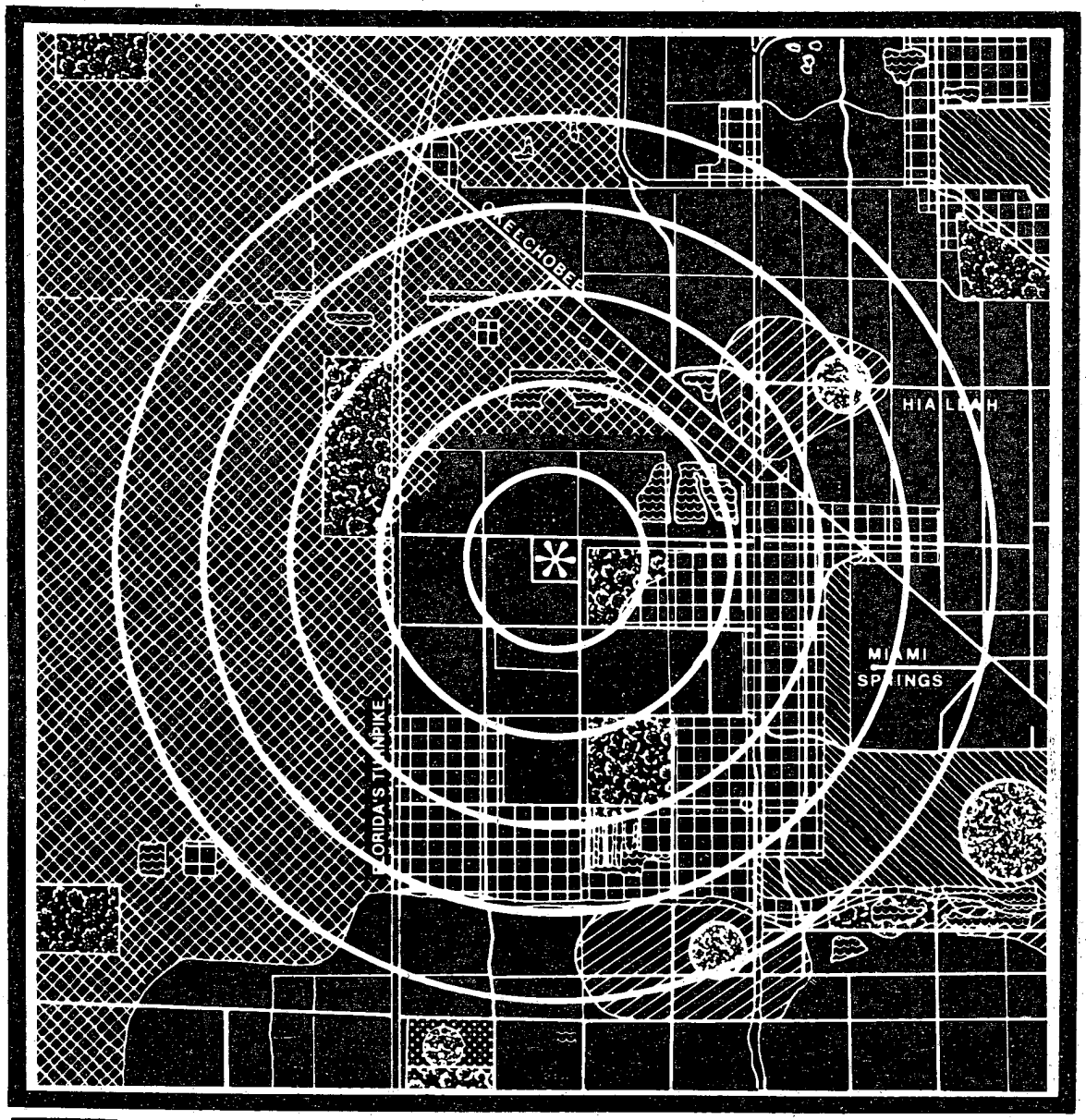
SCALE IN MILES 0 — 1

SOURCE: METROPOLITAN DADE COUNTY PLANNING DEPT. UPDATE 1977.

✱ Site of Airborne Emissions

FIGURE 2-4

PROJECTED LAND USE: RESOURCE RECOVERY AREA



INDUSTRIAL AND BUSINESS TRANSPORTATION

URBAN DEVELOPMENT

INTENSIVE URBAN DEVELOPMENT

TERMINAL

PARKS AND RECREATION

INSTITUTIONAL

WATER

AGRICULTURE AND OPEN LAND

N

SCALE IN MILES 0 1 2

ACTIVITY CENTERS

REGIONAL

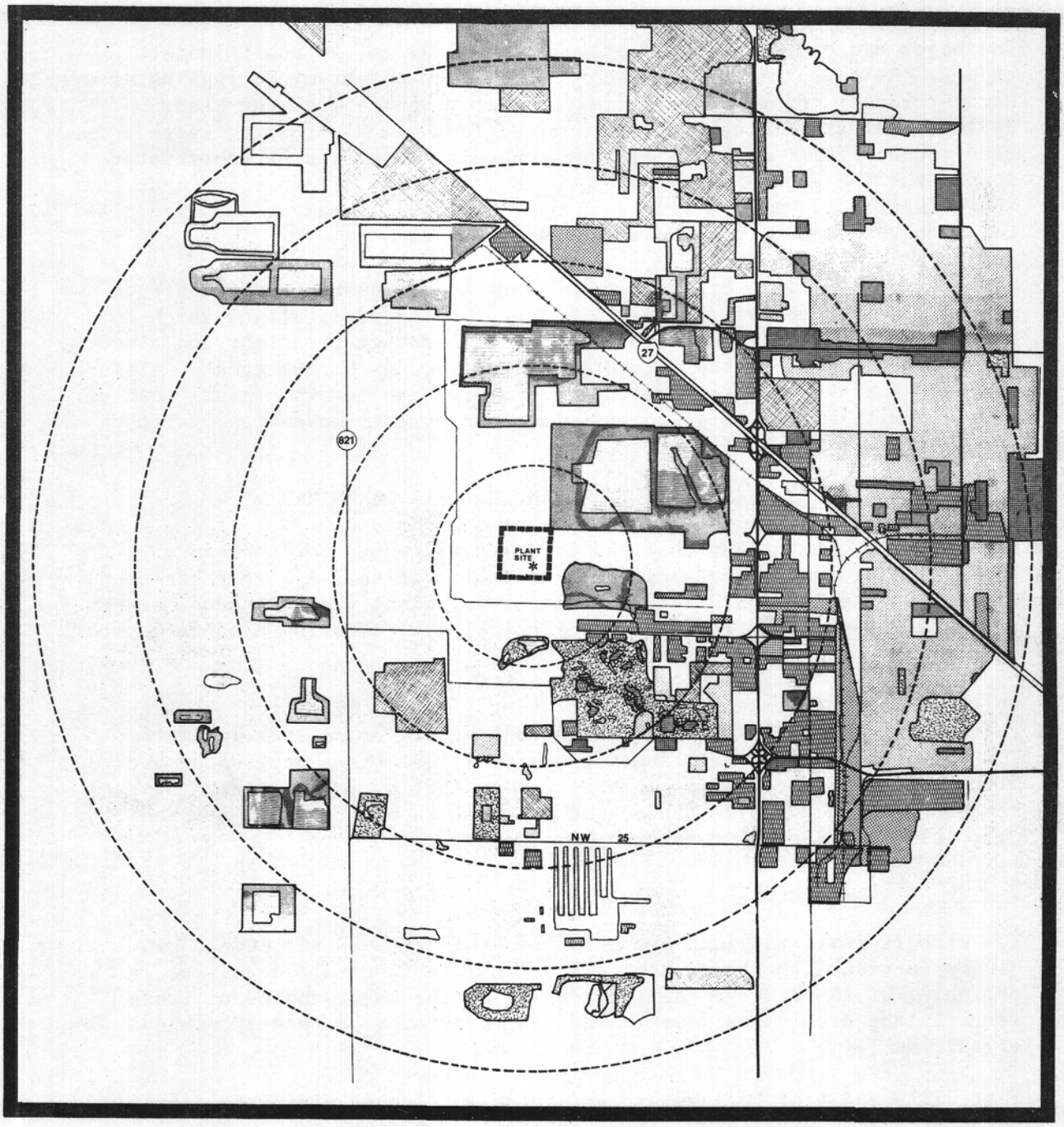
SUB-METROPOLITAN

METROPOLITAN

SOURCE: METROPOLITAN DADE COUNTY PLANNING DEPARTMENT, MARCH, 1975

FIGURE 2-5

PRESENT LAND USE: RESOURCE RECOVERY STUDY AREA



COMMERCIAL/TOURIST
HEAVY INDUSTRY
LIGHT INDUSTRY
RESIDENTIAL
TRANSPORTATION, COMMUNICATION & UTILITY
INSTITUTIONAL
PARK & RECREATION
AGRICULTURE
UNDEVELOPED
WATER

N
SCALE IN MILES
0 1

SOURCE: METROPOLITAN DADE COUNTY PLANNING DEPT. UPDATE 1977.

FIGURE 2-6

The major use of water in the area (Figure 2-5) is the public water supply. At the present time the area includes the Miami Springs Water Company--upper and lower well fields. Water source from the Miami Springs well field, located 2 to 3 miles from the plant site, is the Biscayne Aquifer. The well field is one of the major sources of water supply for the greater Miami area, with a capacity of about 130 mgd, and approximately 115 mgd currently being pumped from this source. The Miami Canal conveys water to recharge the well field.

There are three large borrow pits as part of a rock pit operation, one directly north and two northeast of the proposed site, all of which hold some standing water. The Doral Country Club sewage treatment and disposal system south of the 58th Street landfill discharges treated effluent into a private lake. Agricultural irrigation is minor since most of the land within five miles is in urban development, undeveloped or controlled by some form of government.

2.3 REGIONAL HISTORIC, SCENIC, CULTURAL AND NATURAL LANDMARKS

At this time, it appears that the proposed site does not contain any sites of historic, archaeological or cultural value. A letter has been written to the Florida Division of Archives, History and Records Management, Bureau of Historic Sites and Properties, requesting a confirmation in writing of this observation.

As the site is a disturbed and transitional ecosystem typical to this region of Florida, it is not considered a scenic or natural landmark. The proposed transmission line right-of-way from the plant to the hook-up with the existing system will pass through more of the same kind of system and will endanger no area or location of known historic, archaeological, cultural, scenic or natural significance.

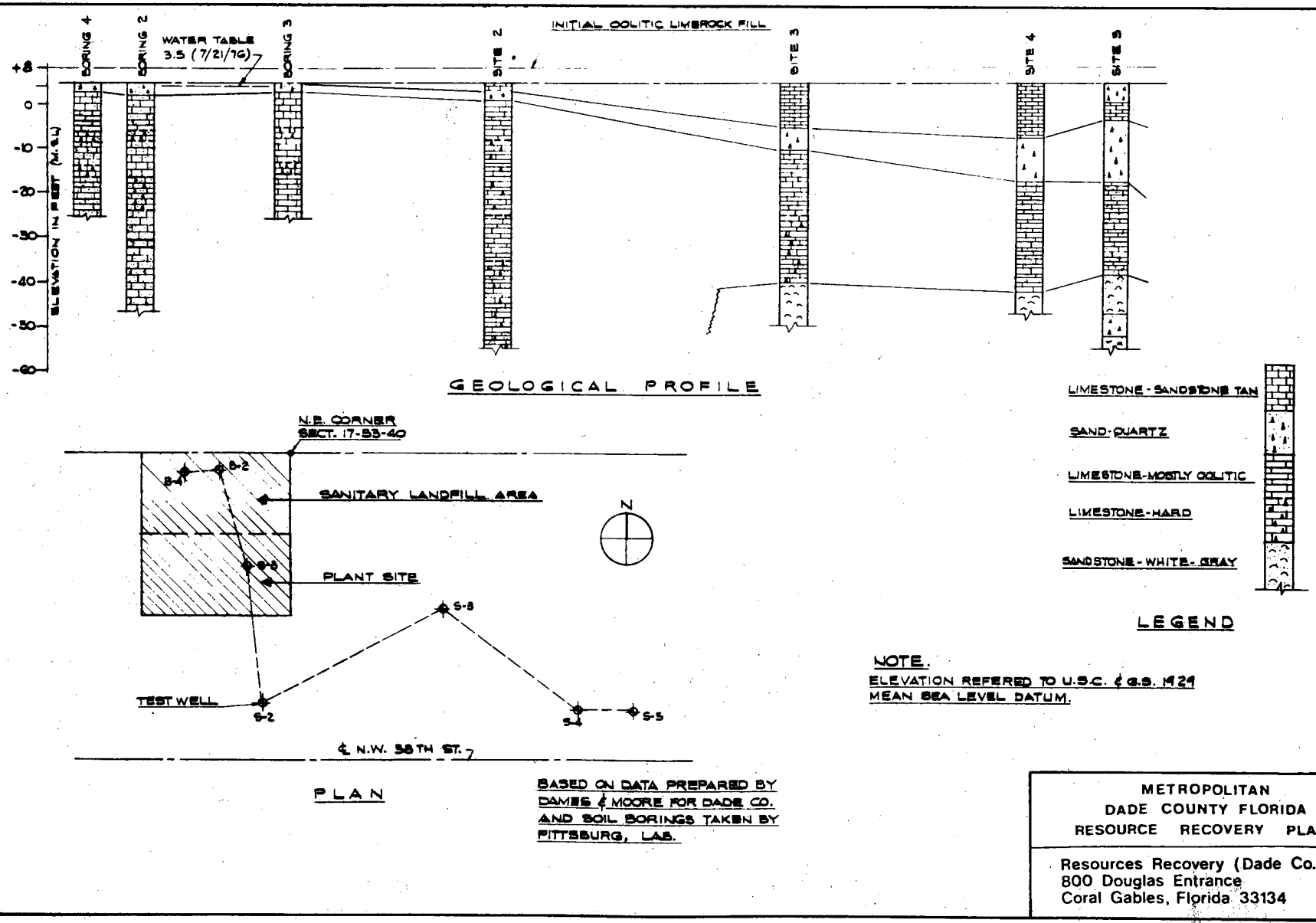
2.4 GEOLOGY

The site is level and land averages 5 feet above mean sea level. A highly pervious limestone about 4 feet to 7 feet below the surface is the beginning of the Biscayne Aquifer, which is the major source of fresh water in the Miami area. Overburden consists of sand, peat, muck and organic marls.

Test wells and test borings are presented in Figure 2-7. Data from four soil borings by Pittsburg Testing Laboratory are included in the Appendix.

Meyer (1972) reports that the Biscayne Aquifer is about 110 feet thick in this area. The aquifer overlies a relatively impermeable bed of green shelly marl in the Tamiami Formation. Locally the principal formations included in the aquifer (from bottom to top) are: the upper part of the Tamiami Formation of late Miocene age; the Fort Thompson Formation of Pleistocene age; and the Miami Limestone of Pleistocene age. The highly permeable Fort Thompson Formation, however, constitutes about 80 percent of the total thickness of the aquifer.

TEST WELLS PLAN



METROPOLITAN
DADE COUNTY FLORIDA
RESOURCE RECOVERY PLANT

Resources Recovery (Dade Co.), Inc.
800 Douglas Entrance
Coral Gables, Florida 33134

FIGURE 2-7

2.5 HYDROLOGY

2.5.1 Drainage

Figure 2-8 shows the drainage system for the area. The site is surrounded by canals. These canals include the Snapper Creek Canal to the west, the Miami Canal to the north, the Florida East Coast Canal to the east, and the Northwest 25th Street Canal to the south.

2.5.2 Water Levels

In this part of the state (i.e., Biscayne Aquifer), the surface and ground water systems are highly interconnected. In addition, the aquifer is a water table aquifer; therefore, the average water table and surface water levels are equal. The ground water table varied during the period of 1960-1972 from a low of 2 to a high of 5 feet above mean sea level. The water table slopes generally eastward toward the coast with the slope being greater in the wet than dry season.

The highest ground water levels prior to the inception of flood control occurred in 1947. High-state water levels in the project site existed between 7 and 8 feet above mean sea level (3 feet above ground level) (Kohout and Hartwell, 1967). These levels reflect the original tendency of the area to frequent and periodic flooding.

The increase in secondary canal networks associated with increased urbanization and the enlargement of the major canals has improved the total drainage capability to the extent that the highest water table levels in the project area in September, 1960 (after the passage of Hurricane Donna and Tropical Storm Florence), were 2 to 3 feet lower than those of 1947 (Kohout and Hartwell, 1967).

The improved canal system demonstrated its effectiveness again in 1968 when a total of 91.1 inches was recorded in Hialeah and more than 32 inches of rain fell during May and part of June (Leach and others, 1972). Water levels recorded at observation Well G1165, approximately 1 mile southeast of the project site, in June and July of 1968, were a maximum of 5.1 feet above mean sea level, or approximately at ground level.

In order to adequately utilize the project site for a solid waste resource recovery facility, it is planned that the entire 160 acres will be filled to a new minimum ground elevation of at least 8 feet above mean sea level. With the present and expected policies of ground water and flood management, it is not anticipated that this site will be subject to future flooding. Figure 2-9 presents the elevations of seasonal and annual water tables for the area.

REGIONAL DRAINAGE SYSTEM FOR RESOURCE RECOVERY SITE AND VICINITY

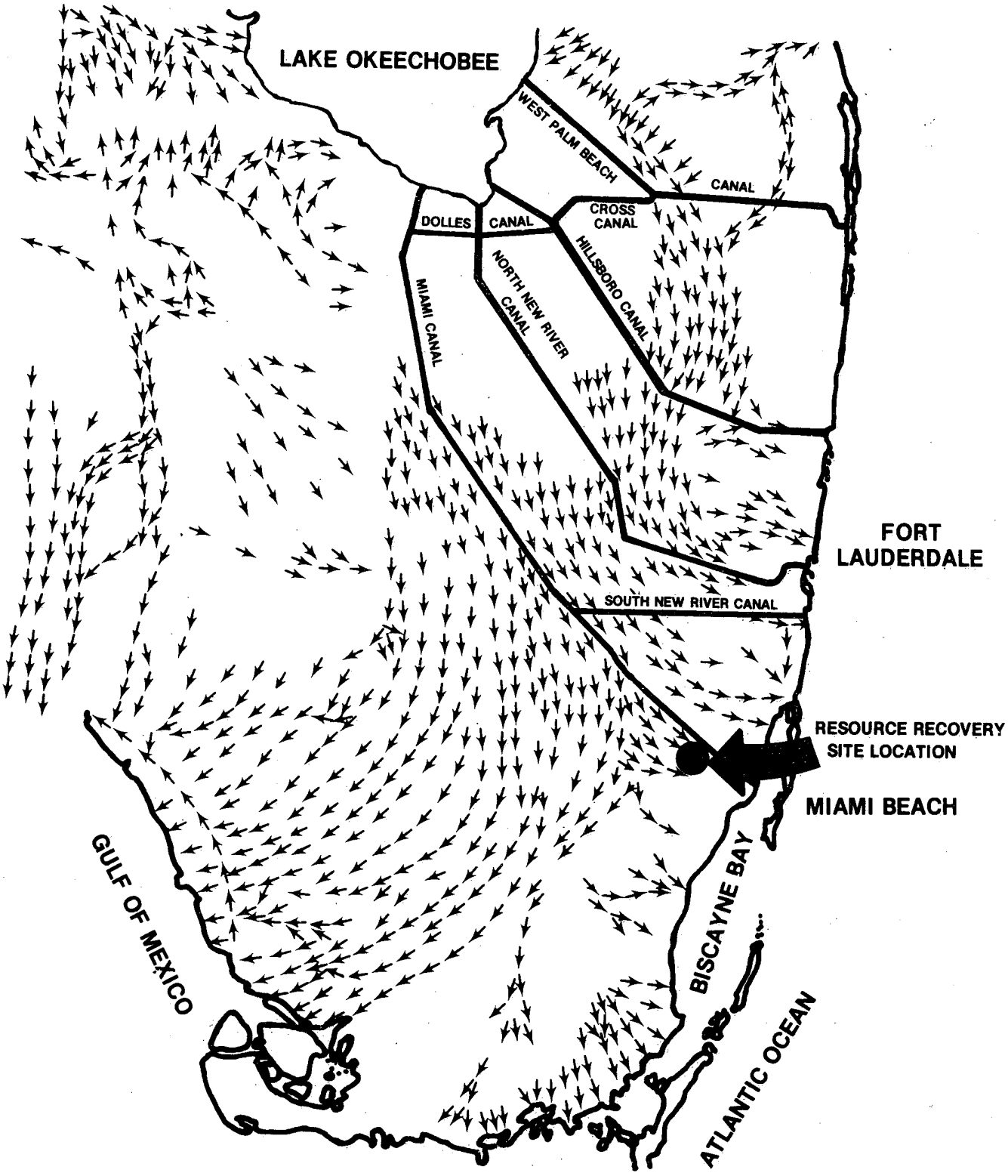
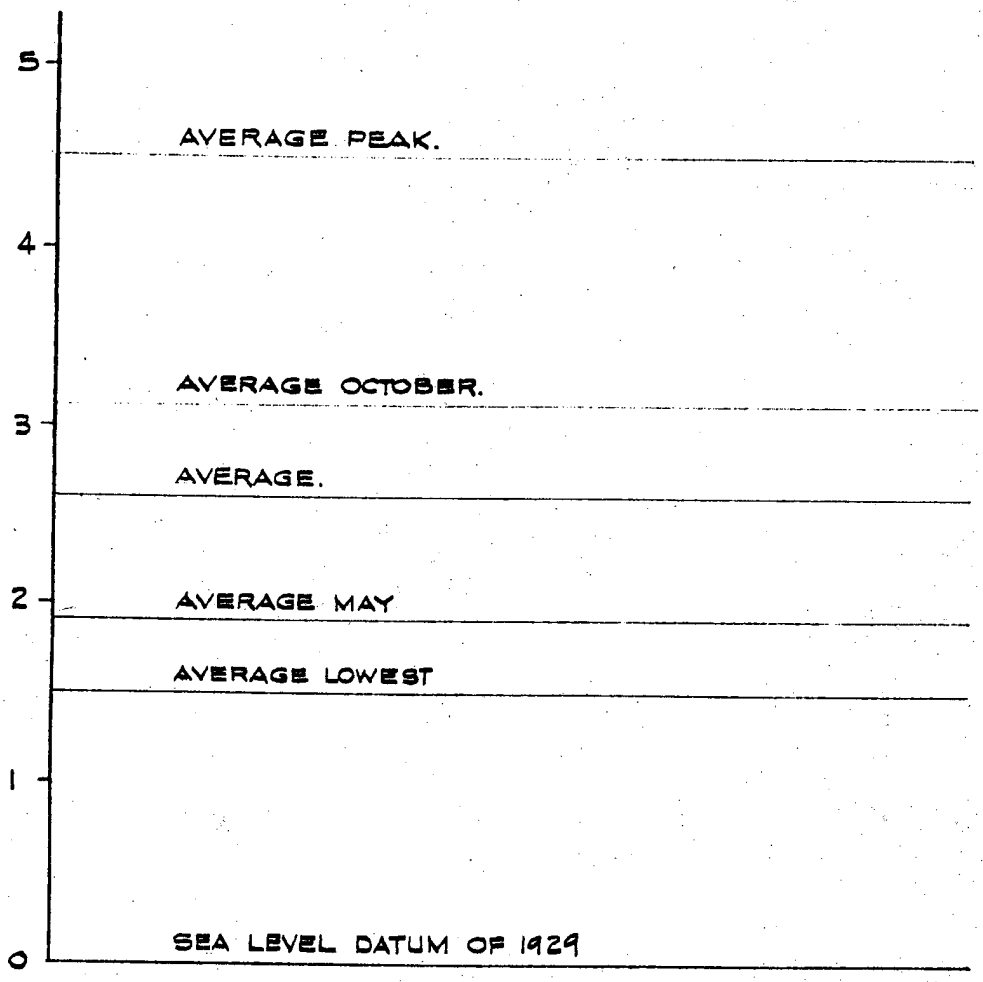


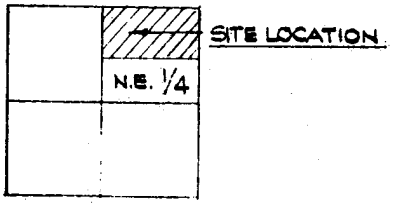
FIGURE 2-8



ELEVATION OF ANNUAL SEASONAL WATERTABLE

DATA TAKEN FROM U.S.C. & G.S. CHARTS. WATER CONTROL MANUAL DADE CO.

SEC. 17 TWP 53 RGE. 40



VICINITY PLAN

METROPOLITAN
DADE COUNTY FLORIDA
RESOURCE RECOVERY PLANT

Resources Recovery (Dade Co.), Inc.
800 Douglas Entrance
Coral Gables, Florida 33134

FIGURE 2-9

Prior to the construction of canals, conservation areas, and water management systems, the natural flow of South Florida ground water was in a generally south and easterly direction from Lake Okeechobee. Since the completion of the conservation areas and the water management systems, the region is drained primarily by the South Florida Water Management District canals and related works designed to furnish flood protection to the urban and agricultural areas during the rainy season, and to store fresh water for replenishment of the aquifer along the coast in the dry season.

This water management system depends on the water storage capabilities of Lake Okeechobee and the conservation areas. Seepage and regulated releases from the conservation areas to the canal system sustain water levels along the coast, replenish well fields, and prevent sea water intrusion (Leach and others, 1972).

In order to minimize flooding during heavy rainfall, control structures in canals are opened to permit drainage of excess water to the ocean. This causes ground water to move to the canals, thereby lowering water levels in intercanal areas. The effect of drainage (lowering of ground-water levels) decreases with distance from the canals. The rate of ground-water movement also is greatest adjacent to the canals, decreasing with distance from the canals.

Early in the dry season the control structures are closed, and, unless unseasonally heavy rains occur thereafter, they remain closed until the next rainy season. Closure of the control structures causes the flow rate and flow distribution in the aquifer-canal system to change. After the structures are closed, the inland controlled reaches of the primary canals continue to pick up ground water from the interior parts of their basins and from Water Conservation Area 3 and transfer it downstream toward the control structures, where water levels are maintained at the scheduled levels of the structures. However, the levels sustained along the lower controlled reaches are usually higher than the adjacent ground-water levels, so that water seeps from the canal into adjacent parts of the aquifer. This reversal in ground-water movement remains throughout the dry season in all canal basins except those in south Dade County.

In recent dry seasons, water levels in the interior of south Dade County have declined below sea level, temporarily resulting in an inland hydraulic gradient. Normally the hydraulic gradient is seaward. These periodic reversals in gradient affect the area south of the latitude of Homestead. The ensuing rainfall then reestablishes a seaward gradient.

Since ground water moves downgradient along lines perpendicular to water-level contours, the direction of flow within the aquifer

system in Dade County in general shows that the water levels are highest in Conservation Area 3 where flow originates, and lowest along the coast and in the south. General flow is east in north Dade County, and southeast and south in south Dade County.

The inland bending of the contours north of the Tamiami Canal (south and east of the site) is the result of drainage by the dense network of primary and secondary canals. In the north the temporary groundwater mounds along the coastal intercanal areas during the wet season tend to confirm slower drainage to canals. There, the upper part of the aquifer is composed primarily of sand, whose hydraulic conductivity is lower than that of the solution-riddled limestones of the south part of the county.

A strong influence on the movement of ground water in Dade County is the continuous large withdrawals from the municipal well fields adjacent to Miami Canal and the Snapper Creek Canal. All ground-water flow within the areas influenced by those withdrawals is toward the withdrawal centers. Canal water in the vicinity of the well fields feeds the well fields by seepage into the aquifer.

Ross (1976) reports that the water levels within the existing Dade County landfill form a slight mound. The maximum relief of the mound occurs during the early wet season when the mound has been observed to be up to 0.1 feet higher than the surrounding ground water. It appears that the mound is seasonal and is barely distinctive in the dry season. The data also suggests that the height of the mound is increasing slightly with time; however, this fact is not conclusive. Nevertheless, the mound is not very high compared to the surrounding ground water and probably will not attain much greater relief than has been observed. The basis for this evaluation is the high permeability of the Biscayne Aquifer and the associated fast dissipation of any recharge. The slight mounding effect within the landfill does, however, probably result in a gradient sloping away from and in all directions from the landfill (See Figure 2-10).

2.5.3 Water Balance

Ross (1976) estimated the annual water budget at the site as follows:

Rainfall	65 inches per year
Evapotranspiration	37 inches per year
Recharge to Aquifer	22 inches per year
Runoff	6 inches per year

HYDROLOGICAL SURFACES IN THE VICINITY OF THE RESOURCE RECOVERY SITE

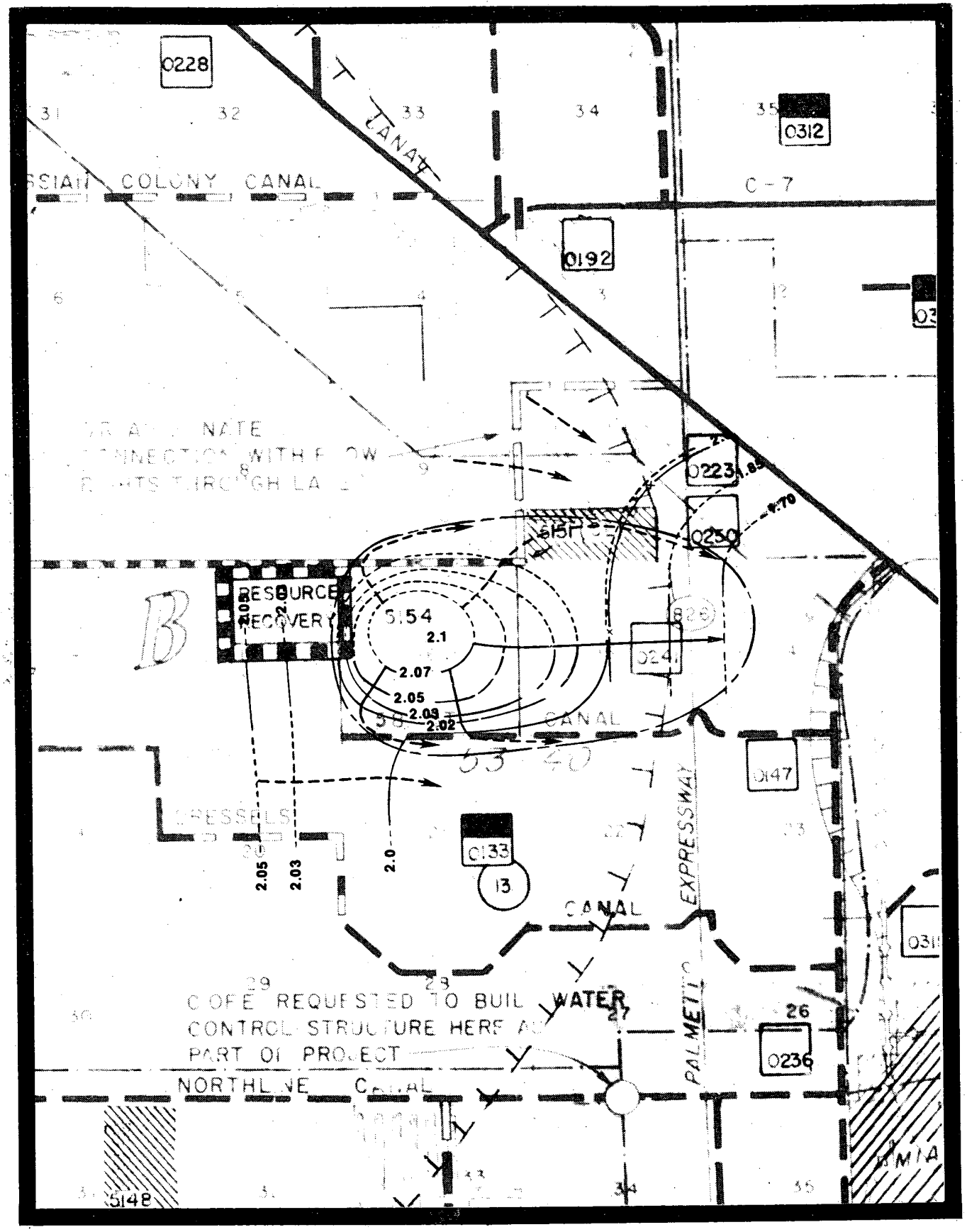


FIGURE 2-10

2.5.4 Chemical Quality

The chemical quality of the surface water is indicated in Table 2-2 and was obtained by Wingerter Laboratories, Inc., from an established borrow pit approximately 3/4 of a mile northeast of the Northeast corner of the project site.

The chemical quality of ground water at varying depths from 10 to 60 feet is indicated in Table 2-3. This information was obtained from monitoring Well Number 2 approximately 500 feet south of the Southeast corner of the project site, and is the average of 2 years (1973-1974) of observations and tests prepared (Ross, 1976) for Dade County.

The quality of the ground water in the vicinity of the 58th Street Sanitary Landfill was compared (Ross, 1976) to water quality standards of three governmental agencies: U. S. Public Health Service, Florida Department of Pollution Control (now under the Department of Environmental Regulation), and the Environmental Protection Agency. The proposed criteria with respect to ground water quality in the areas between the landfill and the Hialeah/Miami Springs well field were compared to the quality of ground water at Sites 6 and 7 (refer to Figure 2-6).

Review of the USGS supplied chemical water quality data suggests several significant contaminants are present in the ground water to cause the water in the area of contamination to be unacceptable for drinking water. Since monitoring Well Number 7 is the nearest monitoring well to the Hialeah/Miami Springs well field's cone of influence, relatively high concentrations of certain chemical parameters would also suggest the potential of a future water-quality problem to the well field. The concentrations of selected chemical parameters found in water obtained from Monitoring Well Number 7 are indicated below.

Parameter	Concentration Observed	U.S. EPA Preliminary Criterion (1972)
Ammonia Nitrogen	2.10 mg/1	0.5 mg/1
Total Iron	6.5 mg/1	0.3 mg/1
Total Manganese	0.400 mg/1	.05 mg/1
Total Zinc	6.5 mg/1	5.0 mg/1
Phenols	.150 mg/1	.001 mg/1

Table 2-2. Results of Surface Water Analysis, Medley Borrow Pit (ppm).

Arsenic (As)	0.003	Chromium (Cr_6)	0.04
Chloride (CL)	30.00	Lead (Pb)	<0.01
Copper (Cu)	0.01	Selenium (Se)	<0.01
Cyanide (Cn)	0.032	Silver (Ag)	<0.05
Fluoride (F)	0.41		
Iron (Fe)	0.05	Ammonia (NH_4)	1.4
Manganese (Mn)	0.005	Alkalinity as $CaCO_3$	136.0
Phenols	0.02	Total Hardness as $CaCO_3$	180.0
Sulfate (SO_4)	6.2	Phosphate (PO_4)	0.31
Total Dissolved Solids	248.0	Titanium (Ti)	<0.20
Zinc (Zn)	0.023	Aluminum (Al)	<0.10
Barium (Ba)	0.0002	Sodium (Na)	16.70
Cadmium (Cd)	0.005	Hexane Solubles	12.70
COD	60.0	BOD	5.0
pH	8.0		

(Source, Wingerter Laboratories, Inc.)

Table 2-3. Results of Ground Water Analysis, Monitoring Well Number 2.

	10 Ft	20Ft	30 Ft	40 Ft	60 Ft
Total Aluminum (ug/l)	58	280	50	48	31
Arsenic (ug/l)	3	1.3	3	10	4
Boron (ug/l)	40	43	41	40	36
Cadmium (ug/l)	1	1.5	0.5	1	0.5
Chromium (ug/l)	2	7	6	7	6
Cobalt (ug/l)	1	1	1.5	1.5	1
Copper (ug/l)	1.5	6	7	4.5	7
Iron (mg/l)	1.5	3.9	2.9	3.8	3.4
Lead (ug/l)	2.5	11	4.5	4.5	1
Lithium	0	0	0	7.5	1.5
Manganese (ug/l)	23	27	21.5	29	23.5
Mercury (ug/l)	0.05	0.1	0.15	0.1	0.1
Molybdenum (ug/l)	1	1	1.5	1.5	1.5
Nickel (ug/l)	3.5	4	6	4	7
Zinc (ug/l)	46	76	23	30	20
Totals (Gross)					
Dissolved Calcium (mg/l)	90	87	90	90	92
Dissolved Magnesium(mg/l)	4.9	5.1	5.2	5.5	6.4
Dissolved Potassium (mg/l)	0.5	0.4	0.5	0.5	0.5
Dissolved Sodium (mg/l)	14	14	14	15	15
Salinity as $CaCO_3$(mg/l)	238	236	237	237	250
Carbonate (mg/l)	290	285	289	288	300
B.O.D (5 days) (mg/l)	0.5	0.5	0.5	0.4	0.6
Total Organic Carbon (mg/l)	21	20	17	16	14
Carbon Dioxide (mg/l)	16	15	16	19	12
Dissolved Chlorine (mg/l)	24	22	22	23	22
Dissolved Fluoride (mg/l)	0.4	0.4	0.3	0.3	0.3
Hardness (mg/l)	244	238	246	246	259
Non-Carbonated Hardness (mg/l)	10	4.5	12	12	7.5
Total Nitrate (mg/l)	0.01	0.00	0.00	0.00	0.00
Total Nitrogen (N)(mg/l)	1.7	1.8	1.8	1.8	1.6
Amonia Nitrogen (N) (mg/l)	0.65	0.71	0.73	0.76	0.92
Total Phosphorus (mg/l)	0.01	0.02	0.01	0.02	0.01
Dissolved Silica (mg/l)	6.0	6.5	6.3	6.5	7.6
Dissolved Solids (sum of constituents) (mg/l)	278	276	284	284	296
Dissolved Sulfate (mg/l)	2.2	2.6	2.5	2.4	2.2

Source: Ross 1976

Although all the mentioned parameters violate suggested EPA water quality criteria, the concentration of phenols obtained from the July 11, 1975, sampling of the Number 7 monitoring well, at a depth of 50 feet, presents the most hazardous apparent water quality problem to the well field. The value obtained in the sampling represents 150 times the recommended concentration for phenols in drinking water. The other chemical parameters obtained in the water from monitoring Well Number 7 do not represent a significant health hazard, but do rather negatively affect the aesthetic water quality and treatment requirements.

There are, however, some inconsistencies in the chemical data that prevent a clear determination of the magnitude of the problem. Phenols, for instance, exceed the EPA limits at Site 7; however, phenols also exceed the EPA limits at Sites 1 and 2. Site 1 is up-gradient from the landfill. The reasons for these higher concentrations at Sites 1 and 2 are not clear. In addition, phenols do not have a definite plume configuration effect around the landfill.

In order to compare the ground water quality associated with the landfill and the area between the landfill and the well field, water quality data from Sites 6 and 7 were compared to the well field water quality and the water quality of the Miami Canal. These comparisons are shown in Tables 2-4 and 2-5. In this comparison, it is realized that the Miami Canal flow consists primarily of waters received directly from rainfall; therefore, as expected, the quality of water in the Miami Canal is high. It should also be realized that the water quality of waters pumped from the well field is of better quality than normal ground water, since it is estimated that a large percentage of the water pumped from the well field is from induced infiltration from the Miami Canal and other canals in the well field area. This percentage has ranged from 78 to 100 percent during the 1940's to about 55 percent in 1971 (Meyer, 1972).

The purpose of this comparison was to show the relative quality of type of ground water obtained in the leachate plume and to provide some perspective as to the type of ground water within the influence of the Hialeah/Miami Springs well field.

By inspection of the relative water quality parameters, it can be shown that half of the parameters compared show the ground waters at Sites 6 and 7 are of poorer quality than the water in the Miami Canal. By inspection of the water quality for the well field, it should be noted that well over half the parameters indicate that the ground water at Site 6 is of poorer quality than the well field; while at Site 7, approximately one-half of the parameters indicate water of poorer quality than the well field raw water.

Table 2-4. Water Quality Comparison Between Miami Canal Above Control At NW 36th Street and Sites 6 and 7.

PARAMETER (mg/l)	36th Street Max.	36th Street Min.	Site 6 Max.	Site 6 Min.	Site 7 Max.	Site 7 Min.
Specific Conductance (umhos/cm)	950	540	890	610	627	360
pH	8.6	7.5	8.0	7.0	8.1	7.1
Color	60	30	300	26	100	20
Turbidity	28	1	150	3	103	4
BOD	7.3	1.0	1.8	0.0	2.7	0.5
Dissolved Solids (Residue @ 180°C)	493	284	508	309	386	172
Hardness (Ca,Mg)	240	210	520	260	330	180
(Non-Carb)	56	0	200	0	37	0
Bicarbonate	296	208	520	314	376	216
Alkalinity	253	184	427	305	308	177
Chloride	140	42	70	30	31	5
Fluoride	0.6	0.3	1.1	0.0	0.4	0.0
Sulfate	43	0.0	8.6	0.0	7.6	0.0
Silica	10	3.4	11.0	6.3	8.8	3.7
Arsenic*	20	0	15	0	17	0
Calcium	80	64	130	94	120	69
Cadmium*	1	0	13	0	14	1
Cobalt*	1	0	10	0	10	1
Chromium* (hexavalent)	1	0	20	0	10	0

Table 2-4. Water Quality Comparison Between Miami Canal Above Control at NW 36th Street and Sites 6 and 7 (Cont'd.).

PARAMETER (mg/l)	36th Street Max.	36th Street Min.	Site 6 Max.	Site 6 Min.	Site 7 Max.	Site 7 Min.
Copper	0.01	0.00	0.01	0.00	0.006	0.001
Iron	0.30	0.00	9.8	1.3	6.5	0.5
Lead*	27	1	46	0	16	0
Magnesium	19	6.8	12	4.4	6.7	2.0
Manganese	0.03	0.00	0.07	0.01	0.40	0.01
Mercury*	2	0	0.4	0.0	1.7	0.0
Potassium	5.2	0.09	16	0.60	1.8	0.5
Sodium	86	28	48	17	21	4
Strontium	1.2	0.68	1.1	0.80	0.99	0.43
Zinc*	60	0	12000	0	6500	0
Orthophosphate (P)	0.030	0.003	0.40	0.00	0.03	0.00
Total Phosphate (P)	0.050	0.010	0.41	0.01	0.06	0.00
Ammonia Nitrogen	1.00	0.00	16.00	1.00	2.10	0.02

* Units in µg/l.

Table 2-5. Water Quality Comparison Between Sites 6 and 7 and Hialeah-Preston Well Field Raw Well Water.

PARAMETER (mg/1)	HIALEAH-PRESTON* TYPICAL AVERAGE ANALYSES 1973 - 1974	SITE 6		SITE 7	
		Maximum	1975 Average (Max. at Site)	Maximum	1975 Average (Max. at Site)
Alkalinity ($CaCo_3$) Methyl Orange	230	427	348	308	291
Hardness ($CaCo_3$)					
Non-Carbonate	20	200	12.7	37	12.8
Total	250	520	337	330	298
Carbon Dioxide Free (CO_2)	25	95	47	71	36.7
Chlorides (Cl)	42	62	49	31	29
Fluorides (F)	0.2	1.1	0.3	0.4	0.3
Sulfates (SO_4)	24	8.6	5.3	7.6	5.9
Calcium (Ca)	88	130	123	120	108
Iron (Fe)	0.8	5.2	5.2	1.6	1.3
Magnesium (Mg)	7.0	12.0	8.9	6.7	6.4
Silica (SiO_2)	8.0	11.0	11.0	8.8	8.2
Turbidity	Nil	150	20	43	26.2
Total Solids	350	504	447	365	349

Table 2-5. Water Quality Comparison Between Sites 6 and 7 and Hialeah-Preston Well Field Raw Well Water (Cont'd.).

PARAMETER (mg/l)	HIALEAH-PRESTON* TYPICAL AVERAGE ANALYSES 1973 - 1974	SITE 6 Maximum	SITE 6 1975 Average (Max. at Site)	SITE 7 Maximum	SITE 7 1975 Average (Max. at Site)
Electrical Conductivity (EC x 10^6 @ 25°C)	580	890	783	629	612
Color	50	300	160	100	63
pH	7.3	8.0	-	8.0	-

* Data furnished by Dade County Water & Sewer Authority.

The deeper Floridan Aquifer contains water under sufficient artesian pressure to flow to the surface, but the water generally contains dissolved constituents in excess of the limits recommended for drinking water (Leach and others, 1972). This artesian aquifer exists about 600 feet below the ground surface, and depths to productive wells are usually 1,100 feet.

2.6 METEOROLOGY

Temperature

Temperature means and extremes for Miami are presented in Table 2-6. The climate is tropical with a large marine influence from the Atlantic Ocean and Biscayne Bay. The mean temperature varies from 67°F in January to 83°F in August with an annual average temperature of 75.5°F. Record extreme temperatures on an annual basis ranged from a recent low of 31°F to an all-time high of 98°F. Although the sun's elevation hits nearly zenith during the summertime, temperatures do not exceed 100°F. The reason can be attributed to the high relative humidities with subsequent cloud cover formation and the abundant convective-type precipitation.

Relative Humidity and Precipitation

Relative humidity, an indication of the percentage amount of moisture in the air at a given temperature, is presented in Table 2-7 for the hours of 0100 and 0700 in the morning and 1300 and 1900 in the afternoon. The highest humidities coexist with the coolest ambient temperatures, namely at 0700 or near dawn. Similarly, the lowest humidities coincide with the highest ambient temperatures, in this case at 1300.

Over 75 percent of the annual precipitation falls during the six warmest months, May through October. The mean annual precipitation is 60 inches, but this has varied from as little as 37 inches to over 89 inches in the last thirty years. The majority of rain is in the form of short-lived convection showers. Precipitation means and extremes are also presented in Table 2-7.

Severe Storms

Thunderstorms are the most frequent of severe storms, occurring an average of 75 days per year. These storms happen year around, but nearly 75 percent occur from May through October.

Tropical cyclones, and more specifically hurricanes, have invaded the Miami area coastline very infrequently since the 1960's, but always remain a threat in any given year. According to statistics compiled by Simpson and Lawrence (1971), the probability that a tropical cyclone will enter the 50-mile coastal stretch from South Miami to Pompano Beach any given year is 20 percent, with a 16 percent chance that it will be of hurricane intensity, and only a 7 percent chance that its maximum winds will exceed 124 mph, that of a great hurricane. Tropical cyclones usually approach Miami from early August to late October.

Statistics compiled by the Severe Local Storms (SELS) branch of the National Severe Storms Forecast Center (Pautz, 1969) show that 25

Table 2-6.

Temperature Means and Extremes (°F)
Miami International Airport, Miami, Florida
1941 - 1970

Month	Mean	Average Diurnal Maximum	Average Diurnal Minimum	Record Maximum[a]	Record Minimum[a]
January	67.2	75.6	58.7	87	31[b]
February	67.8	76.6	59.0	89	32
March	71.3	79.5	63.0	90	37
April	75.0	82.7	67.3	96	46
May	78.0	85.3	70.7	94	53
June	81.0	88.0	73.9	98	65
July	82.3	89.1	75.5	96	69
August	82.9	89.9	75.8	98	68
September	81.7	88.3	75.0	95	69
October	77.8	84.6	71.0	92	51
November	72.2	79.9	64.5	89	39
December	68.3	76.6	60.0	86	34
Annual	75.5	83.0	67.9	98	31

a 34-year period of record, 1943 - 1976
b 1977 -- all time record low temperature

Table 2-7. Precipitation and Diurnal Relative Humidity
Miami, Florida

Month	Precipitation (inches)[a] Mean[a]	Maximum[b]	Minimum[b]	Relative Humidity[c] (%) hour (LT) 0100	0700	1300	1900
January	2.15	6.66	0.04	80	84	60	70
February	1.95	6.56	0.01	78	82	57	66
March	2.07	7.22	0.02	77	82	56	65
April	3.60	10.21	0.07	75	80	54	64
May	6.12	18.54	0.44	80	83	61	70
June	9.00	22.36	1.81	84	87	67	75
July	6.91	13.51	1.77	82	86	65	73
August	6.72	16.88	1.65	83	87	66	74
September	8.74	24.40	2.63	86	90	68	78
October	8.18	21.08	1.50	83	90	68	78
November	2.72	13.15	0.09	80	84	60	70
December	1.64	6.39	0.13	79	83	59	69
Annual	59.80	89.33	37.00	81	84	62	71

a 1941 - 1970
b 1943 - 1975
c 1965 - 1976

tornadoes (or waterspouts) were spotted within the 1° latitude by 1° longitude square centered just south and west of Miami during the years 1955-1967. This averages out to roughly 1.9 tornadoes per year. The tornado recurrence interval for any specific point location within the 1° square is estimated by a methodology of Thom (1963) to be 802 years. Therefore, the mean recurrence interval for a tornado striking a point within this square is 802 years. The most common tornado month is June.

Mixing Depths

The monthly and average mixing depths for Miami as estimated by Holzworth are listed in Table 2-8. The highest afternoon mixing depths occur in the spring, while the lowest morning depths occur in mid-winter. The mean high humidity and low-level cloudiness prevent mean mixing depths subsidence below 500 meters.

Atmospheric Stability

Monthly and annual frequencies of Pasquill's stability classes are portrayed in Table 2-9. Frequent and strong sea breezes cause a very heavy predominance of neutral and stable air (D and E stabilities), counteracting the effect of high incident sunshine over urban Miami. The joint frequency of wind per stability class is available in Table 2-10. As can be seen, there is a large easterly component of wind under neutral and stable air masses.

Wind Patterns

A combination of easterly trade winds superimposed on frequent easterly (on-shore) sea breezes gives Miami a large dominance of easterly winds. During several months, easterly winds prevailed over 25 percent of the time, and in an annual period, almost 19 percent of all the time. Figure 2-11 presents monthly and annual wind roses for the 6-year period 1969-1974. The scale of the roses is 1 inch for each 10 percent frequency of occurrence. Tick marks on the N-S and E-W axes represent 10 percent increments.

Table 2-8. Mean Diurnal Mixing Depths* (Meters)
Miami International Airport
Miami, Florida

Month	Morning	Afternoon
January	666	1145
February	676	1242
March	900	1406
April	1039	1435
May	997	1483
June	1020	1309
July	1065	1392
August	1032	1364
September	957	1312
October	814	1371
November	853	1267
December	623	1258
Annual	878**	1330**

* 5-year averaged data, 1960 - 1964

** true weighted averages

Table 2-9. Frequency of Occurrence of Pasquill's Stabilities

Miami, Florida 1969 - 74

Month	Pasquill's Stability Class (%)				
	"A"	"B"	"C"	"D"	"E"
January	0.0	2.9	10.3	44.1	42.7
February	0.0	2.3	8.5	52.6	36.6
March	0.0	2.1	8.5	53.2	36.3
April	0.1	4.4	12.6	50.8	32.1
May	0.3	5.2	19.0	47.9	27.6
June	0.3	11.5	19.9	32.8	35.5
July	0.3	12.8	23.0	24.3	39.5
August	0.5	9.1	20.4	31.6	38.5
September	0.2	5.7	12.2	37.4	44.5
October	0.0	4.7	8.2	46.6	40.5
November	0.0	1.7	9.8	46.7	41.9
December	0.0	1.7	10.1	42.6	45.5
Annual	0.1	5.4	13.7	42.0	38.6

Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74

SPEED(KTS)

DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
SE	0.000037	0.000285	0.0	0.0	0.0	0.0	0.000322
SSE	0.000079	0.000114	0.0	0.0	0.0	0.0	0.000193
S	0.000072	0.000057	0.0	0.0	0.0	0.0	0.000129
SSW	0.000079	0.000114	0.0	0.0	0.0	0.0	0.000193
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.000015	0.000114	0.0	0.0	0.0	0.0	0.000129
W	0.000151	0.000171	0.0	0.0	0.0	0.0	0.000322
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.000456	0.001027	0.0	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF A STABILITY = 0.001483

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH A STABILITY = 0.000171

Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74 (CONTINUED)

SPEED(KTS)

DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.001335	0.002225	0.000970	0.0	0.0	0.0	0.004530
NNE	0.000664	0.000970	0.000513	0.0	0.0	0.0	0.002148
NE	0.000240	0.000285	0.000342	0.0	0.0	0.0	0.000868
ENE	0.000314	0.000970	0.000742	0.0	0.0	0.0	0.002026
E	0.000621	0.001654	0.001997	0.0	0.0	0.0	0.004273
ESE	0.000584	0.002567	0.003537	0.0	0.0	0.0	0.006689
SE	0.000715	0.003195	0.003195	0.0	0.0	0.0	0.007105
SSE	0.000694	0.002282	0.001654	0.0	0.0	0.0	0.004631
S	0.000631	0.002054	0.001483	0.0	0.0	0.0	0.004168
SSW	0.000614	0.001312	0.000285	0.0	0.0	0.0	0.002211
SW	0.000599	0.000685	0.000171	0.0	0.0	0.0	0.001455
WSW	0.000667	0.001084	0.000799	0.0	0.0	0.0	0.002549
W	0.000965	0.001369	0.001255	0.0	0.0	0.0	0.003589
WNW	0.000723	0.000970	0.000513	0.0	0.0	0.0	0.002206
NW	0.001189	0.000970	0.000513	0.0	0.0	0.0	0.002673
NNW	0.001425	0.001084	0.000913	0.0	0.0	0.0	0.003422
TOTAL	0.011981	0.023676	0.018884	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF B STABILITY = 0.054541

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH B STABILITY = 0.000799

Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74 (CONTINUED)

SPEED(KTS)

DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.000210	0.003594	0.008957	0.009299	0.000628	0.000114	0.022803
NNE	0.000076	0.001769	0.003822	0.006276	0.001883	0.000228	0.014054
NE	0.000004	0.000399	0.006675	0.015290	0.002453	0.000399	0.025221
ENE	0.000014	0.001312	0.012380	0.026415	0.003138	0.000228	0.043487
E	0.000319	0.002967	0.031378	0.058079	0.006219	0.000571	0.099532
ESE	0.000087	0.002796	0.020938	0.031949	0.002453	0.0	0.058222
SE	0.000266	0.003423	0.012038	0.015689	0.000628	0.0	0.032044
SSE	0.000079	0.002054	0.007987	0.007702	0.000228	0.0	0.018050
S	0.000262	0.002967	0.007303	0.006960	0.001084	0.000114	0.018689
SSW	0.000254	0.002282	0.003081	0.003138	0.000571	0.000114	0.009440
SW	0.000127	0.001141	0.003252	0.002910	0.000628	0.000057	0.008114
WSW	0.000303	0.001369	0.002910	0.004678	0.000513	0.000171	0.009944
W	0.000656	0.002054	0.003309	0.003024	0.000799	0.000171	0.010012
WNW	0.000192	0.001826	0.003937	0.003880	0.000628	0.000114	0.010575
NW	0.000253	0.002168	0.006333	0.007645	0.001883	0.000057	0.018339
NNW	0.000149	0.003252	0.006789	0.009870	0.001940	0.000057	0.022057
TOTAL	0.003252	0.035372	0.141088	0.212802	0.025673	0.002396	

RELATIVE FREQUENCY OF OCCURRENCE OF D STABILITY = 0.420584

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH D STABILITY = 0.000399

Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74 (CONTINUED)

SPEED(KTS)

DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.000382	0.003138	0.004906	0.000513	0.0	0.0	0.008940
NNE	0.000267	0.001141	0.001597	0.000342	0.000057	0.0	0.003405
NE	0.000138	0.000742	0.002624	0.000856	0.0	0.0	0.004360
ENE	0.000031	0.001084	0.004564	0.002624	0.000114	0.0	0.008417
E	0.000302	0.002396	0.012894	0.006504	0.000171	0.0	0.022267
ESE	0.000343	0.001769	0.014833	0.005078	0.000228	0.0	0.022251
SE	0.000240	0.002282	0.012323	0.003081	0.000057	0.0	0.017983
SSE	0.000395	0.001540	0.006789	0.001826	0.000057	0.0	0.010608
S	0.000462	0.001826	0.004279	0.001027	0.000171	0.0	0.007765
SSW	0.000195	0.000685	0.001597	0.000399	0.0	0.0	0.002877
SW	0.000232	0.001997	0.001597	0.000342	0.000171	0.0	0.004340
WSW	0.000208	0.001141	0.001826	0.000285	0.000057	0.000057	0.003574
W	0.000749	0.001597	0.001769	0.000571	0.0	0.0	0.004686
WNW	0.000381	0.001027	0.002681	0.000628	0.0	0.0	0.004717
NW	0.000689	0.001540	0.001997	0.000513	0.000114	0.0	0.004853
NNW	0.000519	0.001769	0.003423	0.000399	0.000057	0.0	0.006167
TOTAL	0.005534	0.025673	0.079701	0.024989	0.001255	0.000057	

RELATIVE FREQUENCY OF OCCURRENCE OF C STABILITY = 0.137209

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH C STABILITY = 0.000856

Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74 (CONTINUED)

	SPEED(KTS)						
DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.007391	0.021680	0.007588	0.0	0.0	0.0	0.036658
NNE	0.001588	0.005591	0.002168	0.0	0.0	0.0	0.009347
NE	0.000476	0.004507	0.003937	0.0	0.0	0.0	0.008920
ENE	0.001443	0.009414	0.011239	0.0	0.0	0.0	0.022096
E	0.004631	0.031321	0.026700	0.0	0.0	0.0	0.062652
ESE	0.004176	0.021394	0.010497	0.0	0.0	0.0	0.036067
SE	0.005349	0.015119	0.005762	0.0	0.0	0.0	0.026230
SSE	0.005350	0.010669	0.002396	0.0	0.0	0.0	0.018414
S	0.007115	0.016260	0.002282	0.0	0.0	0.0	0.025657
SSW	0.003625	0.009071	0.001312	0.0	0.0	0.0	0.014008
SW	0.002920	0.007759	0.001883	0.0	0.0	0.0	0.012562
WSW	0.003077	0.008729	0.002396	0.0	0.0	0.0	0.014202
W	0.005131	0.011125	0.002054	0.0	0.0	0.0	0.018309
WNW	0.006123	0.010726	0.002453	0.0	0.0	0.0	0.019302
NW	0.006698	0.016203	0.004906	0.0	0.0	0.0	0.027807
NNW	0.007192	0.019683	0.007074	0.0	0.0	0.0	0.033950
TOTAL	0.072284	0.219249	0.094648	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF E STABILITY = 0.386182

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH E STABILITY = 0.011182

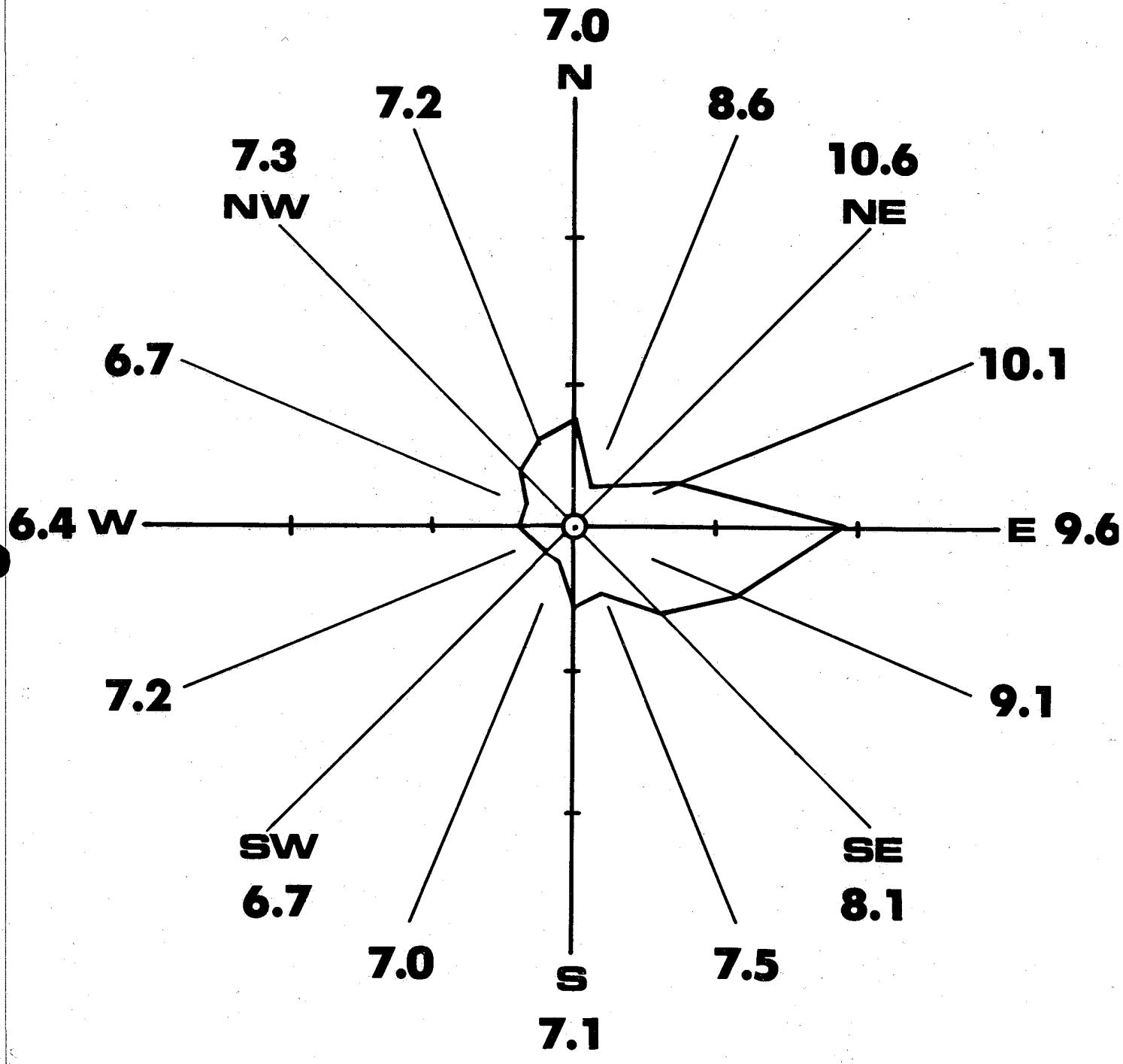
Table 2-10 JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS, MIAMI, FLORIDA, 1969-74 (CONTINUED)

	SPEED(KTS)						
DIRECTION	0 - 3	4- 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	0.009334	0.030694	0.022421	0.009813	0.000628	0.000114	0.073003
NNE	0.002632	0.009471	0.008101	0.006618	0.001940	0.000228	0.028990
NE	0.000856	0.005933	0.013578	0.016146	0.002453	0.000399	0.039366
ENE	0.001805	0.012837	0.028925	0.029039	0.003252	0.000228	0.076086
E	0.005822	0.038339	0.072969	0.064582	0.006390	0.000571	0.188672
ESE	0.005187	0.028583	0.049806	0.037026	0.002681	0.0	0.123283
SE	0.006632	0.024304	0.033318	0.018770	0.000685	0.0	0.083708
SSE	0.006602	0.016659	0.018827	0.009528	0.000285	0.0	0.051901
S	0.008540	0.023163	0.015347	0.007987	0.001255	0.000114	0.056407
SSW	0.004779	0.013464	0.006276	0.003537	0.000571	0.000114	0.028740
SW	0.003886	0.011581	0.006903	0.003252	0.000799	0.000057	0.026479
WSW	0.004270	0.012437	0.007930	0.004963	0.000571	0.000228	0.030400
W	0.007653	0.016317	0.008387	0.003594	0.000799	0.000171	0.036920
WNW	0.007414	0.014548	0.009585	0.004507	0.000628	0.000114	0.036795
NW	0.008815	0.020881	0.013749	0.008158	0.001997	0.000057	0.053658
NNW	0.009281	0.025787	0.018199	0.010269	0.001997	0.000057	0.065591
TOTAL	0.093507	0.304997	0.334322	0.237791	0.026928	0.002453	

TOTAL RELATIVE FREQUENCY OF OBSERVATIONS = 1.000000

TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE = 0.013407

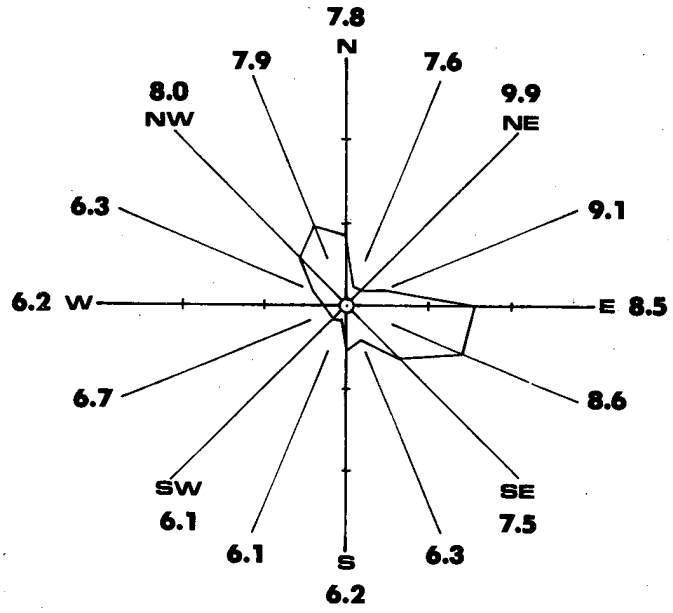
SIX-YEAR AVERAGED MONTHLY AND ANNUAL WIND ROSES FOR MIAMI (MIA), FLORIDA, 1969-74. SCALE PER TICK MARKS REPRESENTS 10 PERCENT. AVERAGE SPEEDS GIVEN IN KNOTS.



ANNUAL

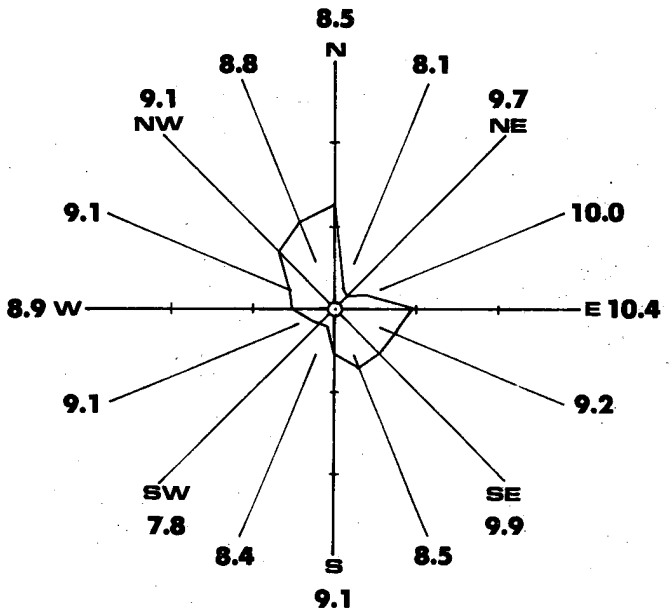
CALM - 1.3%

FIGURE 2-11



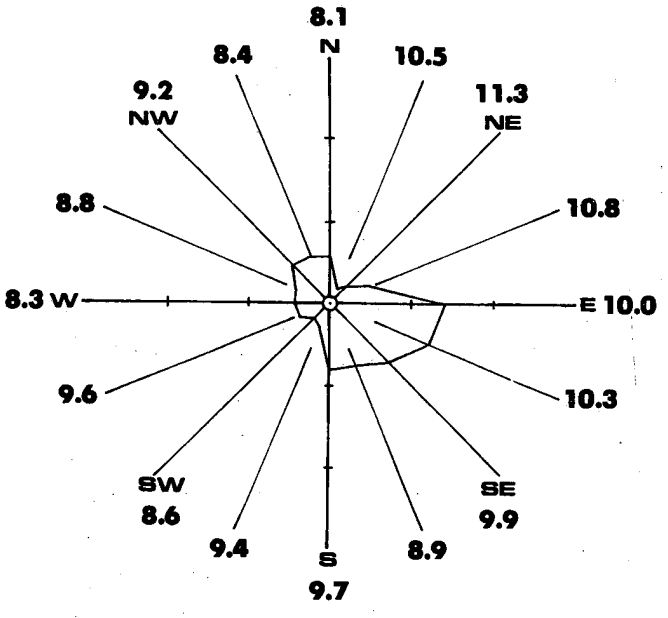
JANUARY

CALM - 1.4%



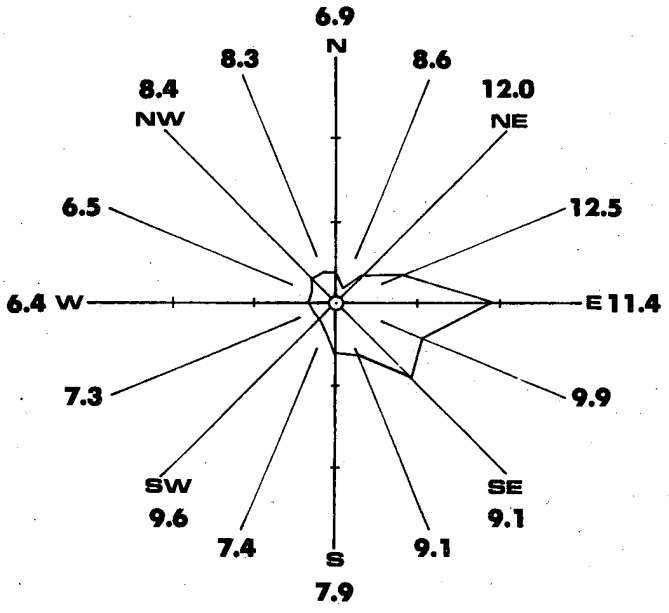
FEBRUARY

CALM - 0.4%



MARCH

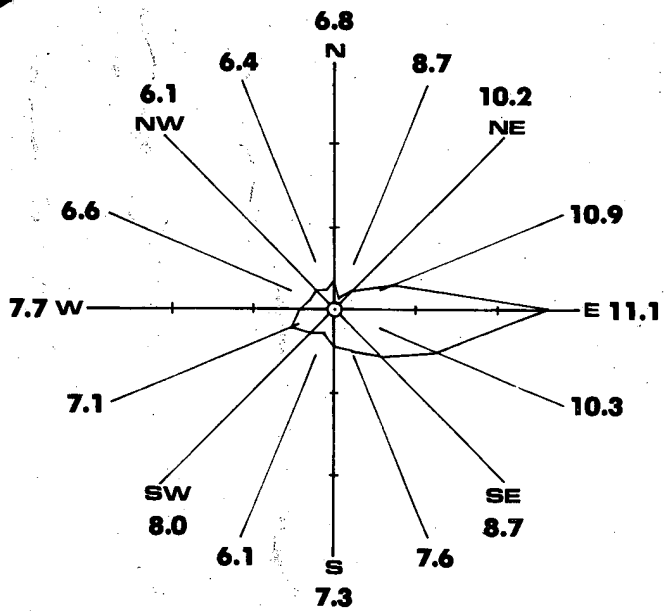
CALM - 0.5%



APRIL

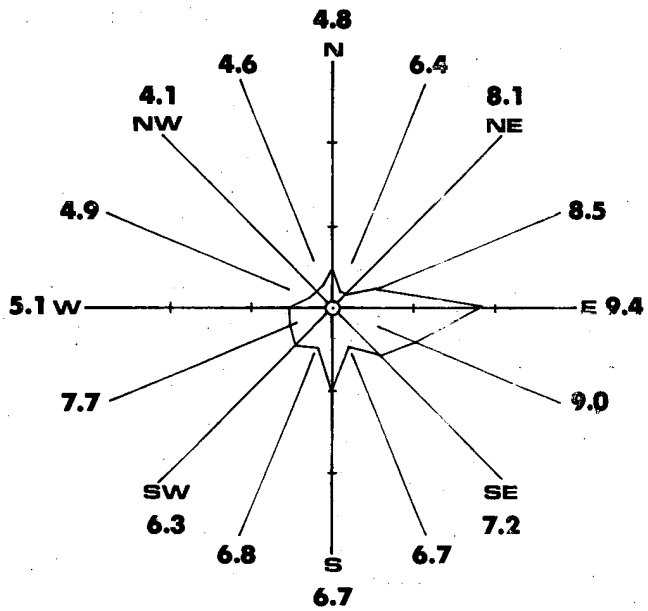
CALM - 0.1%

FIGURE 2-11 CONT'D



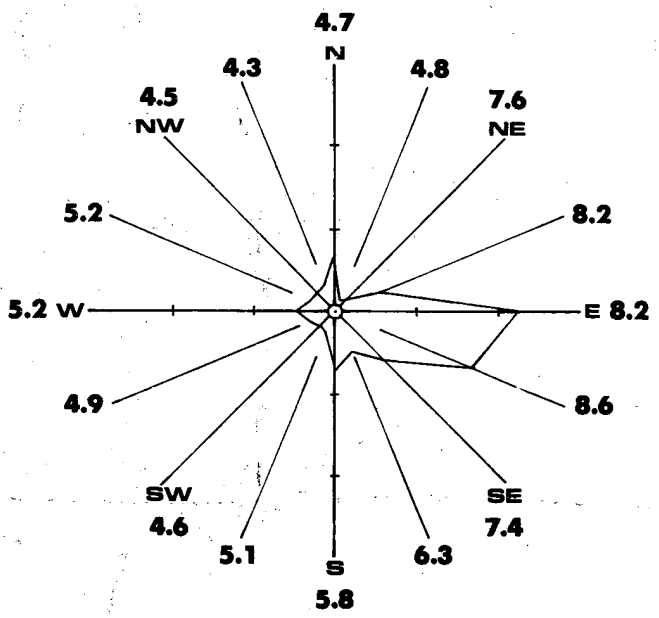
MAY

CALM - 0.7%



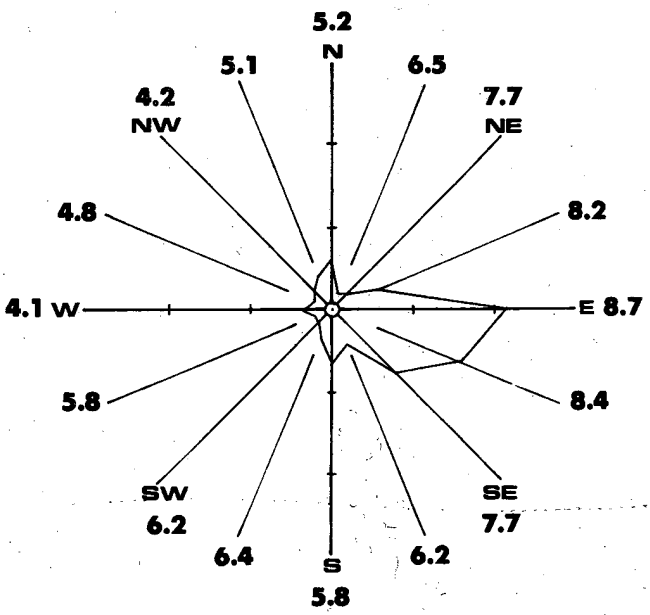
JUNE

CALM - 2.4%



JULY

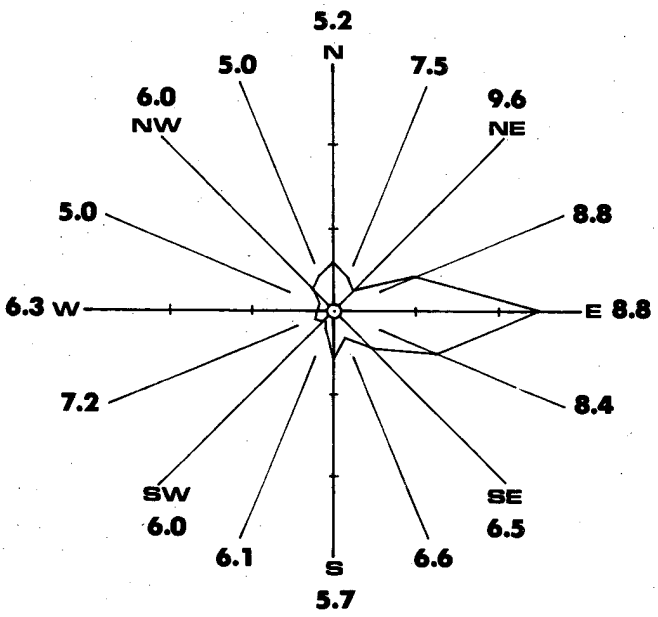
CALM - 2.6%



AUGUST

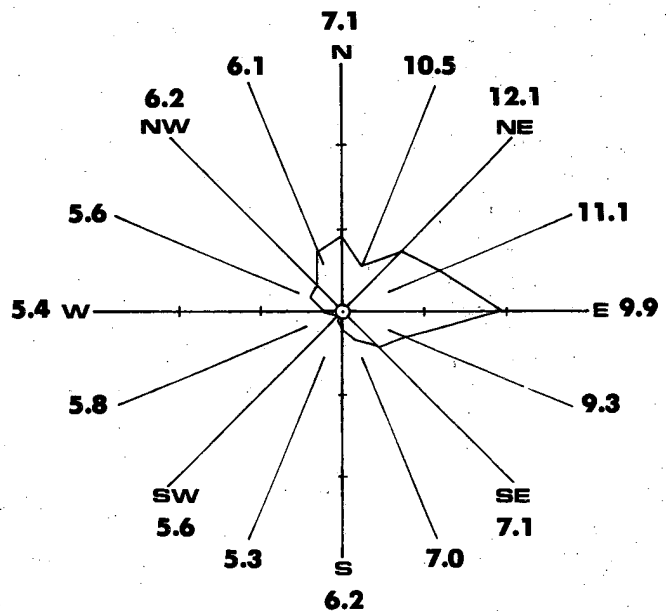
CALM - 2.7%

FIGURE 2-11 CONT'D.



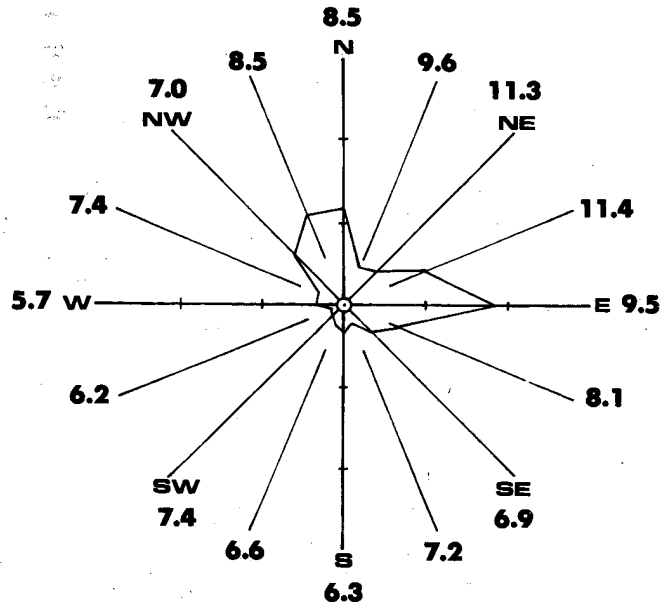
SEPTEMBER

CALM - 3.1%



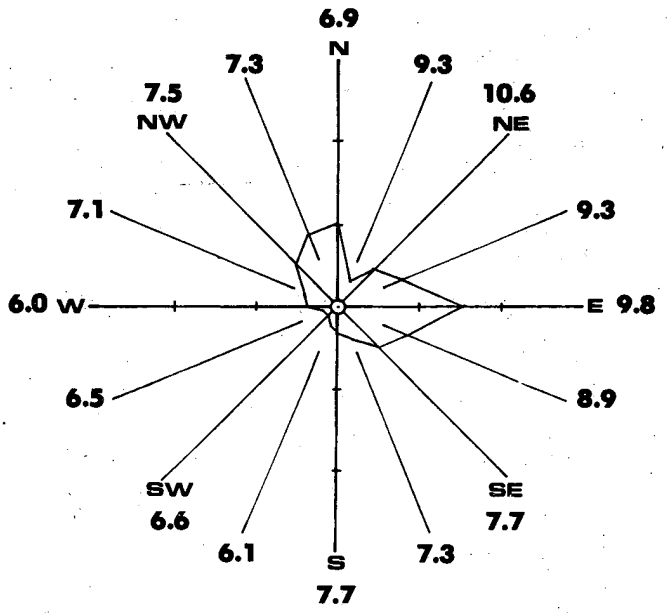
OCTOBER

CALM - 1.3%



NOVEMBER

CALM - 0.2%



DECEMBER

CALM - 0.6%

FIGURE 2-11 CONT'D

2.7 ECOLOGY

Setting: The site is directly adjacent to the Dade County Landfill. The area surrounding the site is bounded on three sides by dikes supporting the transmission lines of Florida Power and Light Co. The area is now under intensive water management and flood control (see Section 2.3.2). Besides these altering and partially containing conditions, the area is crossed in numerous places by tractor cuts. Prior to urbanization of the region, the area was a part of the Everglades which covered South Florida (Davis, 1943).

Ecosystem Description: The existing ecosystem is a transitional and disturbed ecosystem showing a progressive alteration from its previous natural state as a wetland (Figure 2-12). Presently it is characterized as a mixed wetland-Melaleuca forest ecosystem. The area surrounding the site excluding the existing landfill is similar to the site. The dominant plants of the site, based on cover analysis, are sedges (Cyperaceae family), sawgrass (Cladium jamaicensis) and Melaleuca quinquenervia (Table 2-11, Figure 2-13). The fauna is typical of the transitional nature of the ecosystem exemplified by the plant communities, with the most apparent species being song birds (e.g., sparrows, blackbirds, starlings), gulls and crows, small mammals (e.g., mice, rats, rabbits and opposums), common reptiles (e.g., rat snakes and box turtles), and amphibians (e.g., tree frogs and toads). (Refer to Table 2-12.)

No rare or endangered species of plants or animals associated with natural wetlands were found on the site. The likelihood of such species from Dade County being found on the site is low, either because of the unique habitat requirements of the species or the disturbed nature of the site (Table 2-13). However, several species of birds considered species of special concern (Florida Committee on Rare and Endangered Plants and Animals, 1976) have been seen in the area when water levels are high enough to provide adequate feeding. The present disturbed nature of the site lowers the probability of their use of the site as a feeding area.

Several game species including rabbits (Sylvilagus palustris, and possibly S. floridanus), mourning dove (Zenaidura macroura), and deer (Odocoileus virginianus) are found in the area or are known to pass through the area. According to the Florida Game and Freshwater Fish Commission, deer populations are considered to be low in numbers (one per 100 acres) if they exist at all in the immediate area of the site.

The changing nature of the existing ecosystem is exemplified by the plants. The most indicative species of disturbance of the wetland system is Melaleuca. This plant is an introduced tree from Australia (Wharton, et al., 1976). Melaleuca makes up approximately 33 percent of this site, with individual trees scattered throughout the site. It is an indicator of ecological disturbance including changes in the hydroperiod (lack of prolonged flooding), destruction of natural vegetation

DESCRIPTION OF EXISTING ECOSYSTEM DYNAMICS FOR RESOURCE RECOVERY SITE

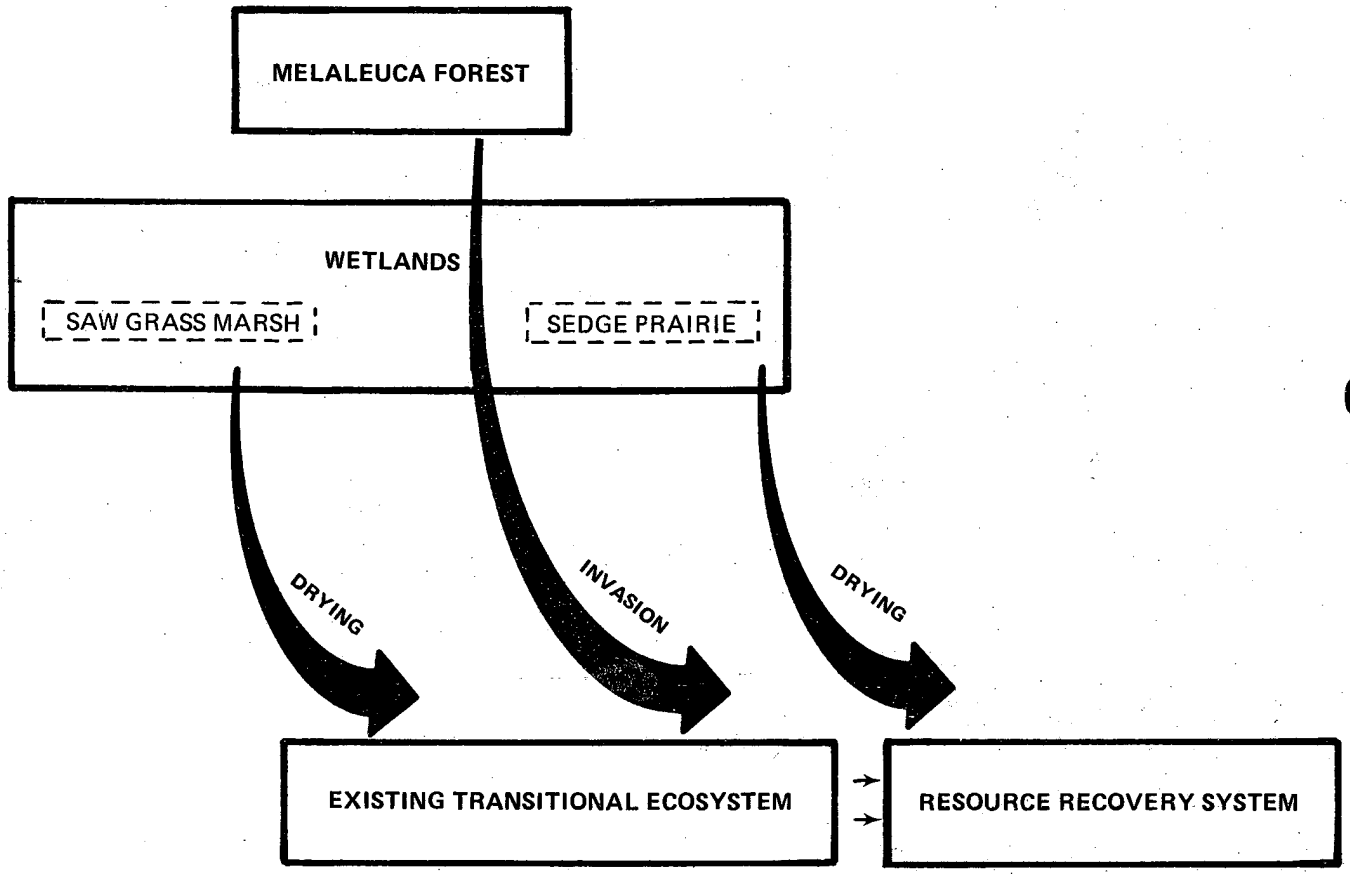
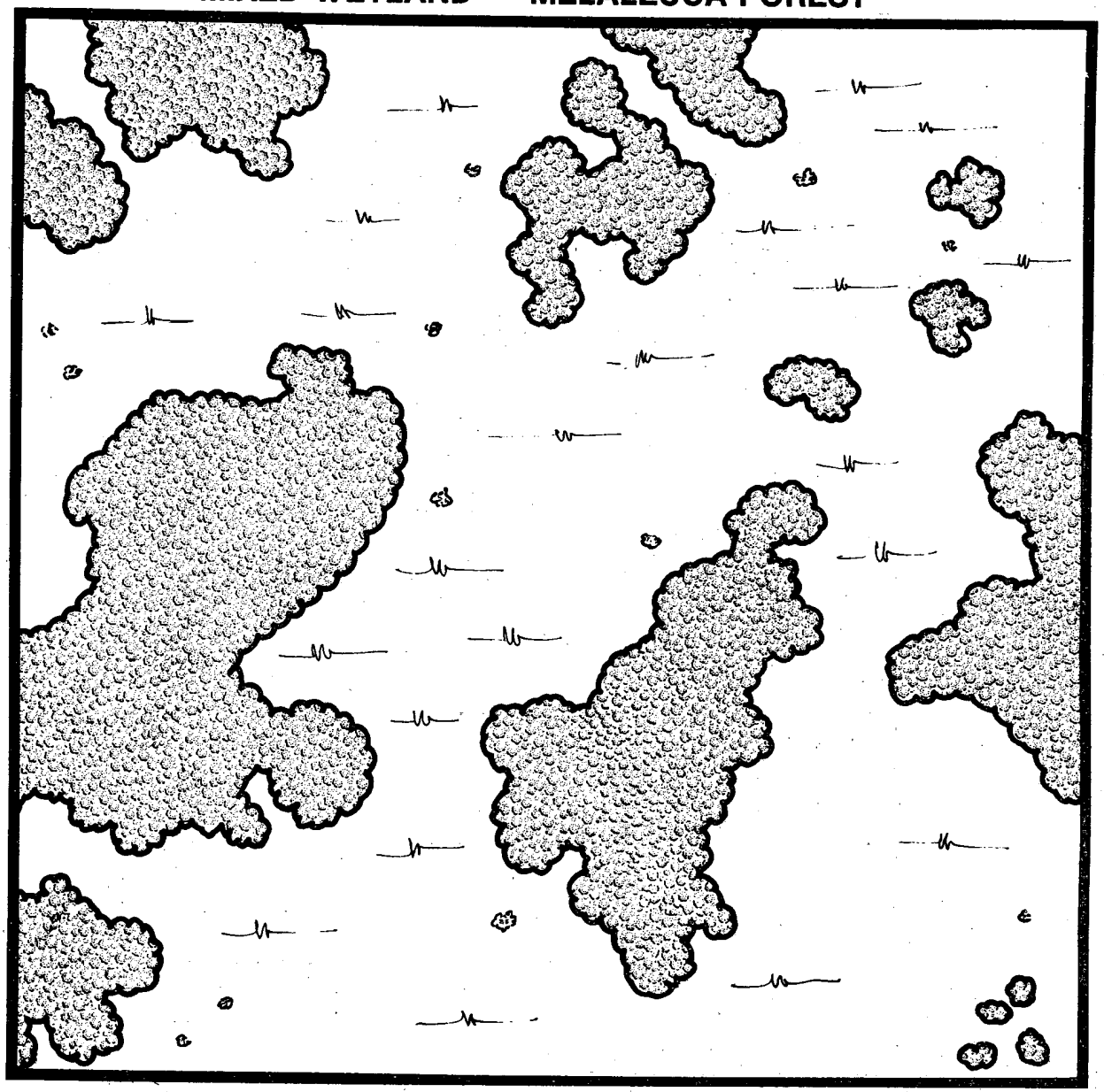
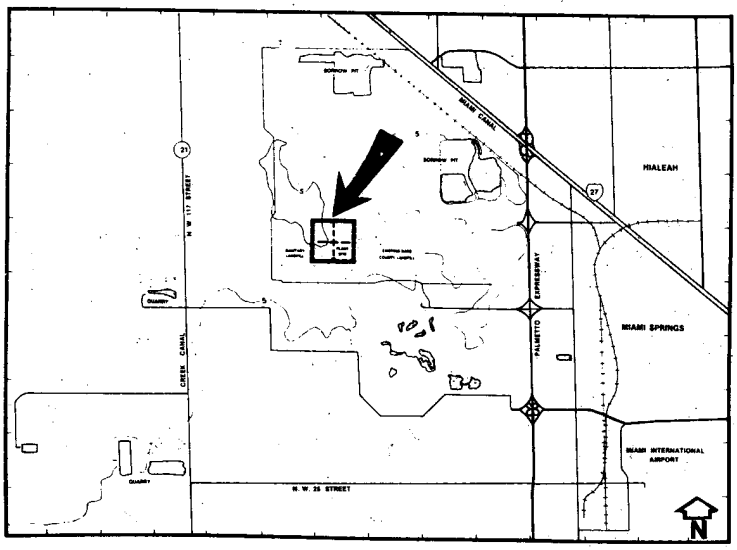


FIGURE 2-12

VEGETATION AND HABITAT MAP OF RESOURCE RECOVERY SITE

MIXED WETLAND — MELALEUCA FOREST [1]





FOREST : MELALEUCA
low value wildlife habitat

WETLANDS : MIXED SAWGRASS AND SEDGE
moderate value wildlife habitat

[1] **CLASSIFICATION BASED ON THE FLORIDA LAND USE AND COVER CLASSIFICATION SYSTEMS, 1976**

FIGURE 2-13

Table 2-11. Dominant Plant Species of Site

Community	Average Cover Class
Sedge Prairie	
Sedges (Cyperaceae family)	5
Sawgrass (Cladium jamaicense)	1
Wax Myrtle (Myrica cerifera)	0
Mixed Grasses (Poaceae family)	0
Saw Grass Marsh	
Mixed Grasses (Poaceae family)	3
Sawgrass (Cladium jamaicense)	1
Wax Myrtle (Myrica cerifera)	1
Marsh Fleabane (Pluchea rosea)	1
Sedges (Cyperaceae family)	1
Melaleuca Forest	
Melaleuca quinquenervia	2
Sawgrass (Cladium jamaicense)	1
Sedges (Cyperaceae family)	1
Leather Fern (Acrostichum danaeaefolium)	0
Royal Fern (Osmunda regalis)	0
Wax Myrtle (Myrica cerifera)	0

1. 5 = 76-100% cover; 4 = 51-75% cover; 3 = 26-50% cover; 2 = 6-25% cover; 1 = abundant and less than 5% cover; 0 = occasional and less than 5% cover; average cover class based on 10 quadrants.

Table 2-12. Typical Fauna Groups Possibly Associated With the Mixed Wetland-*Melaleuca* Forest Area Including Resource Recovery Site

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Birds

Great Blue Heron (*Ardea herodias*)
American Egret (*Casmerodius albus egretta*)
Green Heron (*Butorides striatus*)
Snowy Egret (*Egretta thula*)
Louisiana Heron (*Hydranassa tricolor*)
White Ibis (*Eudocimus albus*)
Turkey Vulture (*Cathartes aura*)*
Black Vulture (*Coragyps atratus*)
Sharp-shinned Hawk (*Accipiter striatus*)
Red-tailed Hawk (*Buteo jamaicensis*)
Red-shouldered Hawk (*B. lineatus*)
Marsh Hawk (*Circus cyaneus*)
American Kestrel (*Falco sparverius*)
King Rail (*Rallus elegans*)
Common Gallinule (*Gallinula chloropus*)
Killdeer (*Charadrius vociferus*)
Common Snipe (*Capella gallinago*)
Laughing Gull (*Larus atricilla*)
Ring-billed Gull (*Larus delawarensis*)
Mourning Dove (*Zenaida macroura*)
Ground Dove (*Columbina passerina*)
Smooth-billed Ani (*Crotophaga ani*)
Barn Owl (*Tyto alba*)
Barred Owl (*Strix varia*)*
Common Nighthawk (*Chordeiles minor*)*
Belted Kingfisher (*Megaceryle alcyon*)
Common (Yellow-shafted) Flicker (*Colaptes auratus*)
Red-bellied Woodpecker (*Melanerpes carolinus*)
Downy Woodpecker (*Picoides pubescens*)
Tree Swallow (*Iridoprocne bicolor*)
Rough-winged Swallow (*Stelgidopteryx ruficollis*)
Barn Swallow (*Hirundo rustica*)
Purple Martin (*Progne subis*)
Blue Jay (*Cyanocitta cristata*)
Common Crow (*Corvus brachyrhynchos*)*
House Wren (*Troglodytes aedon*)
Carolina Wren (*Thryothorus ludovicianus*)
Northern Mockingbird (*Mimus polyglottos*)*
Grey Catbird (*Dumetella carolinensis*)
Brown Thrasher (*Toxostoma rufum*)

Table 2-12. Typical Fauna Groups Possibly Associated With the Mixed Wetland-Melaleuca Forest Area Including Resource Recovery Site (continued)

Birds

American Robin (Turdus migratorius)
Blue-gray Gnatcatcher (Polioptila caerulea)
Loggerhead Shrike (Lanius ludovicianus)
Starling (Sturnus vulgaris)
White-eyed Vireo (Vireo griseus)
Black and White Warbler (Mniotilta varia)
Black-throated Blue Warbler (Dendroica caerulescens)
Black-poll Warbler (Dendroica striata)
Prairie Warbler (Dendroica discolor)
Palm Warbler (D. palmarum)
Northern Waterthrush (Seiurus noveboracensis)
Common Yellowthroat (Geothlypis trichas)
American Redstart (Setophaga ruticilla)
Eastern Meadowlark (Sturnella magna)*
Red-winged Blackbird (Agelaius phoeniceus)*
Boat-tailed Grackle (Quiscalus major)*
Common Grackle (Quiscalus quiscula)
American Goldfinch (Carduelis tristis)
Rufous-sided Towhee (Pipilo erythrophthalmus)
Savannah Sparrow (Passerculus sandwichensis)

Mammals

Opossum (Didelphis marsupialis)
Short-tailed Shrew (Blarina brevicauda)
Least Shrew (Cryptotis parva)
Marsh Rabbit (Sylvilagus palustris)*
Cottontail Rabbit (S. floridanus)
Rice Rat (Oryzomys palustris)
Cotton Rat (Sigmodon hispidus)
Racoon (Procyon lotor)
Mink (Mustela vison)
Striped Skunk (Mephitis mephitis)
Bobcat (Lynx rufus)
White-tail Deer (Odocoileus virginianus)
Black-tailed Jackrabbit (Lepus californicus)
Black Rat (Rattus rattus)
House Mouse (Mus musculus)
Grey Fox (Urocyon cinereoargenteus)

Table 2-12. Typical Fauna Groups Possibly Associated With the Mixed Wetland-*Melaleuca* Forest Area Including Resource Recovery Site (continued)

Amphibians

Oak Toad (*Bufo quercicus*)*
Squirrel Treefrog (*Hyla squirella*)*

Reptiles

Yellow Rat Snake (*Elaphe obsoleta quadrivita*)*
Everglades Racer (*Coluber constrictor paludicola*)
Southern Black Racer (*Coluber c. priapus*)*
Yellow-bellied Turtle (*Chrysemys scripta scripta*)
Florida Box Turtle (*Terrapene carolina bauri*)*

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*Observed on site

Sources: On-site observations; discussions with Florida Game and Fresh Water Fish Commission; U. S. Fish and Wildlife Service; Audubon Society; Layne, 1974.

Table 2-13. Rare and Endangered Species and Species of Special Concern of Dade County Possibly Associated With Transitional Wetland of Area Surrounding Site

Species	Likelihood Of Occurrence On Site
Birds	
Wood Stork (*Mycteria americana*)	v. low
Everglade Kite (*Rostrhamus sociabilis plumbeus*)	v. low
Sandhill Crane (*Grus canadensis pratensis*)	v. low
Short-tailed Hawk (*Buteo brachyurus fuliginosus*)	v. low
Little Blue Heron (*Florida caerulea*)	low*
Great Egret (*Casmerodius albus*)	v. low
Snowy Egret (*Egretta thula*)	low*
Black-crowned Night Heron (*Nycticorax nycticorax*)	v. low
White Ibis (*Eudocimus albus*)	low*
Glossy Ibis (*Plegadis falcinellus*)	v. low
Limpkin (*Aramus guarauna*)	v. low
* These birds present in area when water levels high enough to provide adequate feeding.	
Mammals	
Everglades Mink (*Mustela vison evergladensis*)	v. low
Round-tailed Muskrat (*Neofiber alleni*)	v. low
Reptiles	
American Alligator (*Alligator mississipiensis*)	v. low
Eastern Indigo Snake (*Drymarchon corais couperi*)	low**
Miami Black-headed Snake (*Tantilla oolitica*)	v. low
Plants	
Bird's Nest Spleenwort (*Asplenium serratum L.*)	v. low
Narrow Strap Fern (*Campyloneurum augustifolium*)	v. low
Dollar Orchid (*Encyclia boothiana*)	v. low
Krug's Holly (*Ilex krugiana*)	v. low
Cow-horn Orchid (*Cyrtopodium punctatum*)	v. low
Night-scent Orchid (*Epidendrum nocturnum*)	v. low

**One found 3 miles away in Melaleuca head.

Source: Florida Committee on Rare and Endangered Plants and Animals, 1976.

Table 2-13. Rare and Endangered Species and Species of Special Concern of Dade County Possibly Associated With Transitional Wetland of Area Surrounding Site

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Little Blue Heron (Florida caerulea)	low*
Great Egret (Casmerodius albus)	v. low
Snowy Egret (Egretta thula)	low*
Black-crowned Night Heron (Nycticorax nycticorax)	v. low
White Ibis (Eudocimus albus)	low*
Glossy Ibis (Plegadis falcinellus)	v. low
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* These birds present in area when water levels high enough to provide adequate feeding.	
Mammals	
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Reptiles	
American Alligator (Alligator mississipiensis)	v. low
Eastern Indigo Snake (Drymarchon corais couperi)	low*
Miami Black-headed Snake (Tantilla oolitica)	v. low
Plants	
Bird's Nest Spleenwort (Asplenium serratum L.)	v. low
Narrow Strap Fern (Campyloneurum augustifolium)	v. low
Dollar Orchid (Encyclia boothiana)	v. low
Krug's Holly (Ilex krugiana)	v. low
Cow-horn Orchid (Cyrtopodium punctatum)	v. low
Night-scent Orchid (Epidendrum nocturnum)	v. low

* One found 3 miles away in Melaleuca head.

Source: Florida Committee on Rare and Endangered Plants and Animals, 1976.

and lack of fire (Myers, 1975). The next most obvious plant not typical of the wet prairie is the wax myrtle (Myrica cerifera). This species is primarily associated with drier areas. Other studies have shown it to replace sawgrass in declining wetlands (Alexander and Crook, 1974). In addition, saltbush (Baccharis sp.) is scattered throughout the site. This species is also an invader of declining sawgrass communities (Alexander and Crook, 1974).

Along with the changing species on the site is a change in ecosystem processes such as diversity development. The diversity of the site has declined and will continue to decline even if unaffected by the Resource Recovery Project (Figure 2-14). Melaleuca out-competes other plant species (Myers, 1975). It has and will continue to develop dense stands of trees that effectively cut out the light necessary for the development of understory communities. In addition, flood control and water management of the area have caused a shift in wetland plants to a more dryland species. This lower-habitat diversity leads to lower animal diversity.

Wetlands have recognized environmental value providing some important services to man (Wharton et al., 1976). Because of the altered nature of the area, the value of some of these services to man is lower on the site than in undisturbed wetlands (Table 2-14).

2.8 AMBIENT AIR

Ambient air quality data for total suspended particulate (TSP), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, carbon monoxide, and nitric oxide are monitored throughout Miami and Dade County by the Metropolitan Dade County Environmental Resources Management. Of the above pollutants, carbon monoxide, ozone, and nitric oxide are collected only at the Environmental Resources Management office. In 1976, there were 17 TSP stations, while 24-hour SO_2 and NO_2 were monitored at 8 and 6 stations, respectively.

The only major emissions of the proposed resource recovery facility are SO_2 and TSP. The number and location of these samplers are portrayed in Figure 2-15, and a map legend can be found in the figure's lower right hand corner. The stations closest to the proposed facility, and therefore the most representative of the site's ambient air quality, are TSP Stations 11 and 12, and (both) SO_2 and TSP stations 13 and 20. Stations 11, 12, 13, and 20 are located at Hialeah, Miami Springs, Miami International Airport, and Hialeah Gardens, respectively (the airport is located 4 miles from the site). TSP concentrations for these and all other stations are presented in Table 2-15 for 1974 (baseline year) and 1976. In 1976, Stations 11, 12, and 20 had annual geometric means of 50, 50, and 51 ug/m^3. SO_2 ambient concentrations for 1976 are similarly included in Table 2-16.

DIVERSITY: EXAMPLE OF CHANGING ECOLOGICAL PROCESSES OF RESOURCE RECOVERY SITE

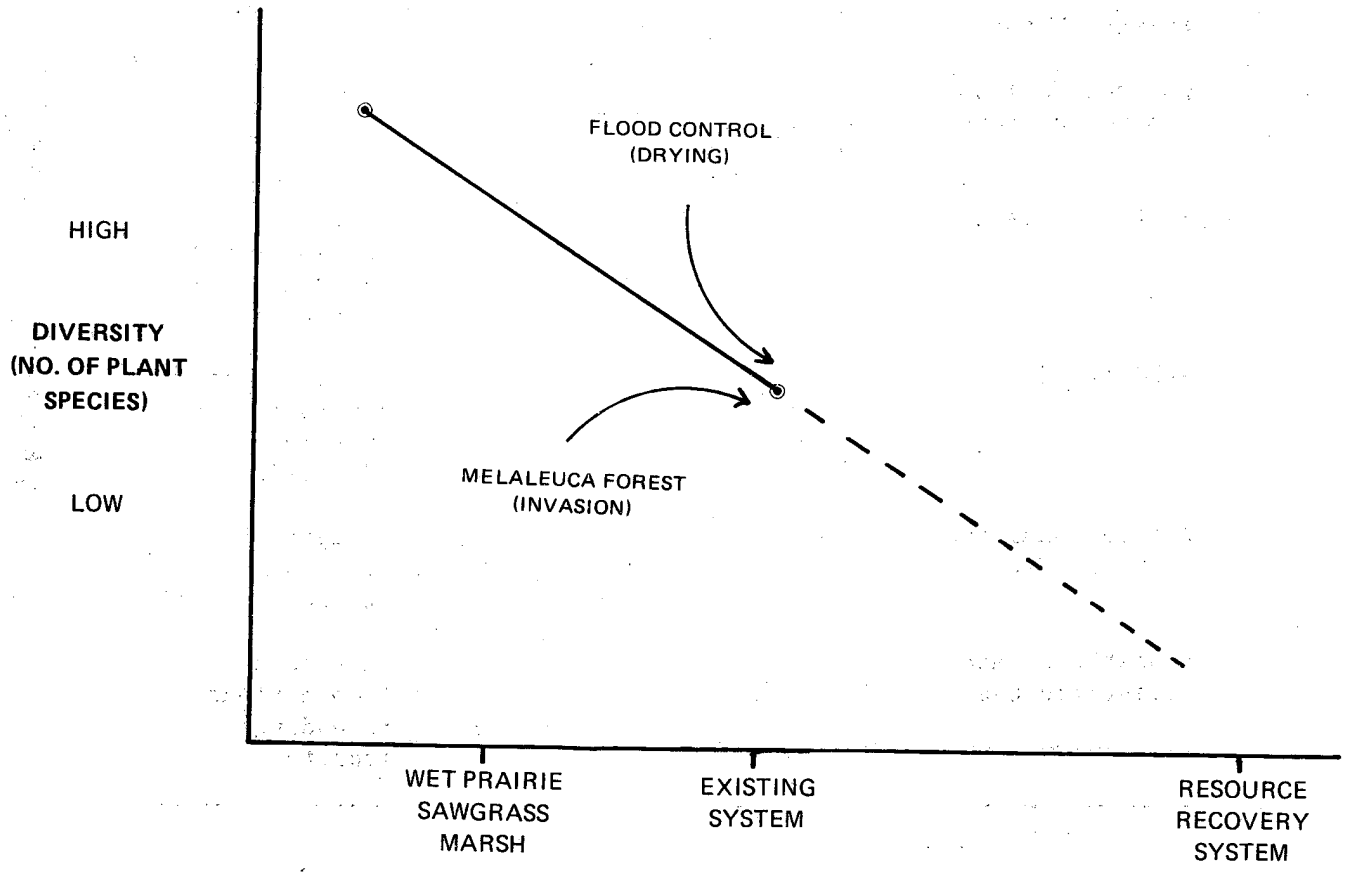


FIGURE 2-14

Table 2-14. A Comparison of Ecological Services and Relative Values of Natural Wetlands and Existing Ecosystem of Site.

SERVICE	VALUE	
	NATURAL WETLANDS	EXISTING ECOSYSTEM OF SITE
Surface Water Storage	High	High
Surface Soil and Ground Water Recharge	High	High
Waste Disposal	High	Low - lower decomposition rates with change in soil fauna, drying
Wildlife Habitat	High	Low - reduction in plant diversity and subsequent lower animal diversity
Recreational and Esthetic Use	High	Low - disturbed condition and proximity to landfill
Educational and Scientific Use	High	Low - disturbed natural conditions and surrounding human impacts

Adopted from Wharton et al. (1976)

SAMPLING SITE LOCATION MAP

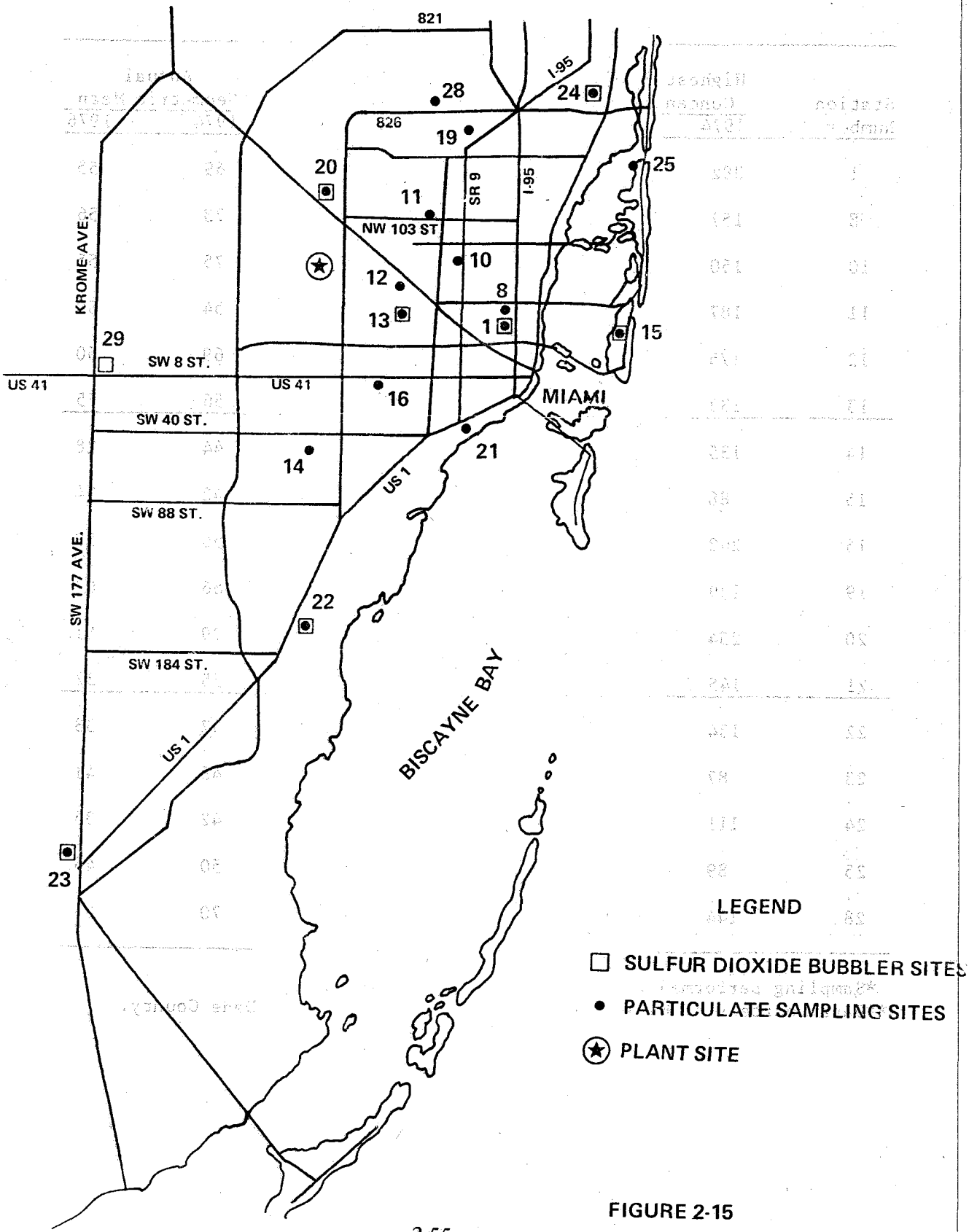


FIGURE 2-15

Table 2-15. 1974 and 1976 Total Suspended Particulate* Ambient Concentrations ($\mu g/m^3$) by Station**

Station Number	Highest 24-Hour Concentration		Second Highest 24-Hour Concentration		Annual Geometric Mean	
	1974	1976	1974	1976	1974	1976
1	382	160	132	104	69	55
8	157	87	131	87	73	56
10	150	102	118	83	75	55
11	187	224	117	106	54	50
12	175	98	140	79	69	50
13	138	105	87	102	56	55
14	135	89	93	52	44	28
15	88	70	84	64	42	34
16	268	142	182	122	56	39
19	189	126	156	120	86	62
20	254	102	203	100	79	51
21	145	58	119	58	55	32
22	134	79	132	72	57	38
23	87	78	80	72	48	41
24	111	66	70	59	42	35
25	89	182	84	95	50	45
28	144	106	142	102	70	64

*Sampling performed by Hi-Volume FRM every sixth day.
**Data courtesy of Environmental Resources Management, Dade County.

Table 2-16. Sulfur Dioxide* Ambient Concentration ($\mu g/m^3$) by Station**, 1976

Station Number	Highest 24-Hour Concentration	Second Highest 24-Hour Concentration	Annual Arithmetic Mean
1	20	20	6
13	37	16	5
15	55	52	9
20	37	37	12
22	49	39	8
23	36	28	7
24	33	23	6
29***	68	37	15

*Sampling performed by FRM 24-Hour Gas Bubbler, Temperature Regulated, August through December, 1976.
**Data courtesy of Environmental Resources Management, Dade County.
***Started August, 1976.

3.0 THE PLANT

The primary purpose of the resource recovery facility will be to dispose of municipal refuse and trash while recovering recyclable materials and energy. As a consequence, the process is atypical of conventional fossil fueled steam electric generating facilities. To present important aspects of this facility, a process description will precede the normal application for certification requirements for Section 3.0.

3.1 PROCESS DESCRIPTION

The plant is designed to receive and process both municipal refuse and trash; the former consisting mostly of residential and commercial refuse normally collected by packer trucks and the latter consisting of bulky and yard wastes. Municipal refuse will be processed directly to the Hydrapulper section as described in 3.1.1 below. Bulky and yard wastes are processed first through the shredders as described in 3.1.2. A separate pathological waste processing plant is described in 3.1.6. Figure 3-1 presents a flow diagram of the process which contains the elements discussed in the preceding sections.

3.1.1 Refuse

Raw Waste Handling

Two 60-ton capacity, 10 feet by 60 feet platform, electronic truck scales will be provided to weigh the incoming waste trucks. A prepunched card for each truck will be stored in the scale house. The card will have a truck number, district or other source, tare weight, and other pertinent information.

Upon arrival at the scale, one of two scalesmen will remove the truck's card from a rack, insert it into the scale mechanism, and press the weigh button. In just a few seconds the truck will be weighed and a ticket will be printed showing truck number, source, time, gross tare and net weight, and date and time. This ticket will be given to the driver. Simultaneously, the same information will be printed on a ledger in the office. The equipment will be suitable for producing punched tape, punched cards, or other hard copy data processing.

The plant will be provided with the most modern concepts in raw waste handling. The tipping floor will by 87 1/2 feet wide, arranged with 19 tipping positions.

Storage capacity for raw waste will be 12,650 tons, plus storage for prepared fuel from 9,000 tons, for a total storage capacity of 5 days' receipts.

FLOW DIAGRAM OF RESOURCE RECOVERY PROCESS

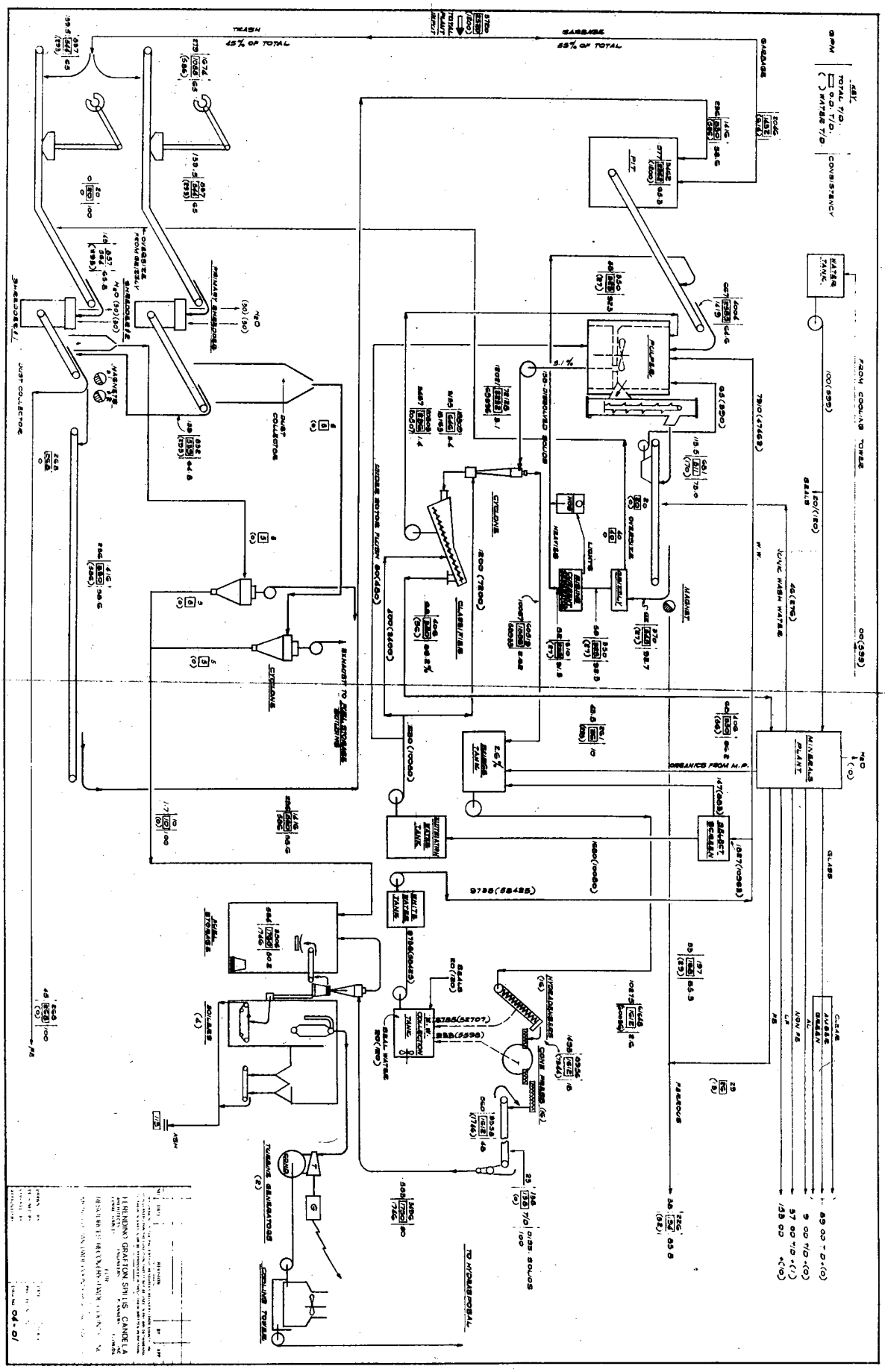


FIGURE 3-1

The waste will be dumped from the packer and transfer trucks into a relatively shallow pit. Heavy trucks are driven over the waste to compress and macerate it. This size reduction function provides a material that is readily handled on conveyors. This concept is now being used in many solid waste handling facilities.

Three tractors, equipped with large, solid waste bulldozer blades, move the macerated waste either directly into the conveyor hoppers or into the storage pile.

During receiving hours of the day, two tractors will be employed to move the waste both into the conveyor hoppers and into storage. During non-receiving hours, one tractor will move the waste from the day's storage pile into the conveyor hoppers serving Hydrapulpers. The third tractor is a reserve unit.

Four parallel 84-inch heavy duty apron conveyors will move the waste from the hoppers into the Hydrapulpers.

The conveying system will be a two section type to control waste feed. The first, horizontal section located beneath the feed hoppers will be heavy duty, cleated steel conveyors. The conveyor drives will be controlled by load sensors from the Hydrapulpers. Adjustable dams near the discharge will provide uniform depth of material at the discharge point.

The second, inclined sections will be similar to the first section except that they will operate at constant speed, approximately three times the speed of the first sections. The two sections provide uniform flow of waste into process.

Pulping

Four parallel lines of wet processing equipment will be installed, each rated at 33 1/3 tons per hour. Each line will consist of a Hydrapulper, Junk Remover, dump pump, and two liquid cyclone separators.

Each pulper will be a 20-feet diameter Model SW (Solid Waste) Hydrapulper, powered by a 1200-HP drive. Construction will be of reinforced concrete, with steel lining. Replaceable wear plates will be provided in those areas subject to abrasion. There will be hoods for each pulper.

Beneath the rotor there is an extractor plate, or screen, which has 1-inch diameter holes in it. When the waste has been pulped or ground to a size sufficiently small to pass through the 1-inch diameter openings, it is pumped to liquid cyclone as a water slurry for further processing.

Oversize waste, such as tin cans, metal, large pieces of rubber, stones, etc., are not readily broken down into small sizes. These are ejected out of the pulper through a slot located near the bottom of the Hydrapulper tub.

The slot is connected to a specially designed bucket elevator called a Junk Remover by means of an inclined chute. Recycled water is introduced into the bottom of the Junk Remover and flows back into the pulper via this chute. Thus, only those pieces which are sufficiently heavy to sink against a counter current flow of water are removed out of the system by the Junker. The lighter objects are washed back into the pulper for further grinding and pulping.

Organic Recovery

The accepted slurry from the Hydrapulper screen plate is pumped to the centrifugal separators, or liquid cyclones, where the lighter organic combustible fraction is separated from the heavy inorganic fraction. The cyclones are elastomer/ceramic lined, of the type used in the mineral processing industry, and are extremely wear resistant. The slurry is introduced tangentially near the top of the inverted cone. It flows in a helical path downward toward the small section or apex, developing a very high centrifugal force. This causes the heavy particles or inorganics to be thrown against the inner surface of the cone in a downward spiral, ejecting through the bottom opening. At this point the heavies are elutriated with white water to wash out and retrieve most of the organics entrapped with them near the bottom of the cone, forming a vortex and flowing upward and out the top center of the cone to the surge chest. Separation of the organic fraction from the inorganic fraction is now almost complete. The inorganics which were rejected at the bottom of the cone contain some residual combustibles. A spiral classifier is provided for each pair of cyclones to remove these and transfer them to the surge chest.

Ferrous Metal Recovery

The material that is removed by the Junk Remover is approximately 50 percent magnetic ferrous metals, mostly tin cans, while the other half consists of principally large pieces of nonferrous metal, large chunks of glass, some wood, and large pieces of rubber.

These materials are conveyed at high speed past a 48-inch diameter by 60-inch wide ferrous, rotating, electromagnetic drum. Magnetic materials are attracted to the drum and separated into a ferrous metal hopper.

The nonmagnetic fraction drops into the nonferrous hopper and is then passed over a grizzly screen. Large stones and other large objects are removed by a 12-foot by 36-inch grizzly and become part of the nonrecoverable residue from the system. The smaller items, principally nonferrous metals and large pieces of glass, are conveyed back into the system for regrinding in the Hydrapulper.

Aluminum and Other Nonferrous Recovery

The reject stream from the liquid cyclones, having been first screened through the 1-inch diameter holes of the extractor plate in the Hydrapulper, contains the glass, aluminum and other inorganic materials such as buttons, stone, pieces of broken china, etc. Since this glass and aluminum fraction is contaminated with other materials, a series of separating operations is required to yield a product of commercially acceptable purity.

The first step is to wash and screen the material. The oversized particles are returned to process, the fines are dewatered and conveyed to refuse.

The next step is to separate the plastics and other lighter materials from the heavier metals and glass. This is accomplished in a heavy media separator, which is standard equipment in the mining and ore dressing industries. The light materials float to the top and are then skimmed off and conveyed to fuel storage. The material is dried, and sized into plus and minus 1/2-inch particle size on screens.

A magnet removes residual ferrous metals that were not removed by a magnet located at the very beginning of the process.

Aluminum foil and light sheet aluminum such as can and tray stock is separated from the balance on an air-aspirated shaking table. Because of its shape and specific gravity, the sheet aluminum rises to the top of the material stream and is scalped off. This valuable aluminum product can be recycled directly back into the manufacture of new aluminum foil and sheet.

The next step is to separate the electrical nonconductors from conductors on a high tension electrostatic separator. This separator consists of a metallic drum which is grounded electrically and subjected to a flow of electrons from a high-voltage electrode located just a few inches away. Materials which are poor conductors, such as glass, acquire an electrical charge. The conductors such as metals and crystalline stones lose their electrical charge immediately. The non-charged particles fall off the rotating drum immediately into one hopper, the charged particles cling to the drum and fall off the bottom of it into the glass hopper.

These conductors consist of nonferrous metals which are copper, brass, chunky aluminum, and lead and zinc alloys mixed with non-metallic, poor conductors. The metallic values are recovered by running the mixture through a crusher which reduces the non-metallics to a powder, but only flattens out the metallic particles.

The two are then separated by screening. Although low in quantity, this mixture of nonferrous metals has a relatively high unit value in the secondary metals market.

Glass Recovery

The remaining stream from the high tension electrostatic separator, the nonconductors, consists of mostly mixed glass and ceramic particles. This first passes through an optical transparency sorter which removes the undesirable ceramic and any nontransparent material. The final color sorting of the mixed glass into clear, amber, and green fractions is accomplished by the optical color sorter.

3.1.2 Trash

Handling

Trash--the bulky waste items, yard waste, etc.--is delivered separately from the packer truck waste, and will be handled in a separate receiving and storage building.

A tractor will feed two lines of conveyors, as described above under Pulping.

Shredders

Two heavy duty shredders will be installed in parallel. Each will have a capacity of 40 tons per hour on bulky waste items.

The large, bulky items will be conveyed into the shredders, where the action of the high speed hammers will reduce them to particles 6 inches and smaller.

The shredded material will be discharged onto vibratory pan feeders, from which it will be conveyed to the ferrous metal recovery module.

Ferrous Metal Recovery

The ferrous metals are recovered from the shredded trash by magnetic separation. Because shredded trash contains a high percentage of materials other than iron and steel, two stages of separation are required in order to produce a high quality scrap.

The first magnet removes the magnetizable material together with some organics that cling to it. The second magnet then makes a clean separation.

The clean ferrous metal is then conveyed to a live bottom storage bin with about 2 hours' surge capacity. From the bin it is fed into a baler from which it emerges as tight bales weighing 450 to 500 pounds each.

The magnets will be of the rotating drum type, with both permanent and electromagnetic fields, 48-inch diameter by 48-inch face.

Combustibles

The material remaining after the magnetic separation is mostly combustible. However, the average size of the particles is too large for efficient combustion. In addition, the moisture content is highly variable.

To properly prepare the combustible portion of the shredded trash, it will be conveyed back to the raw waste storage pit, and then fed into the Hydrapulpers along with the packer truck wastes.

3.1.3 Fuel Preparation and Handling

The slurry is piped into a large surge tank where it is thoroughly blended. The slurry is pumped to the two-stage dewatering press apparatus.

At the first stage screw thickeners, the solids content of the slurry is raised from 3 percent to approximately 15 percent. The water then is recirculated from the thickeners back to the white water storage tank where it is recycled into the process.

At the second stage, cone presses, the solids content is raised to approximately 50 percent. The water is expressed from the presses at a very low suspended solids content, and is pumped to the white water tank. This low solids content water is used for washing the inorganics from the liquid cyclones and other areas where clean quality water is required.

The fuel is conveyed pneumatically from the presses through parallel systems directly to the boiler live-bottom metering bins. When the fuel production exceeds boiler requirements, excess is returned to the fuel storage shuttle conveyor. When boiler requirements exceed fuel produced, fuel is fed from fuel storage by separate pneumatic system. Since the pulping and materials recovery portion of the plant is designed to operate approximately 6 days a week, while the energy recovery portion is designed to run 7 days, substantial fuel storage capacity is provided--equivalent to 3 full days of production.

The inventory of fuel will be worked on a first-in, first-out basis. The fuel will be distributed in one end of the storage pile by means of a shuttle conveyor while it is being reclaimed from the other.

3.1.4 Steam Generation

Boilers with a combined nominal capacity of 765,000 pounds steam per hour will be provided. These will be standard, two drum water wall boilers equipped with integral superheaters, economizers and air heaters.

The boiler furnaces will be of the high volume type employed in the pulp and paper industry for recovering the heat value from wet bark.

Each boiler will be equipped with two stages of particulate gas cleaning equipment. The first stage will be mechanical dust collectors which will remove the large particles from the gas stream and reinject them into the furnace to burn unburned carbon. The second stage particulate cleaning equipment will be electrostatic precipitators. These will remove the fine particles to comply with the current applicable air emission standards.

The boilers will be designed to operate with reclaimed organics from solid waste as their sole fuel. However, the boilers will be equipped with auxiliary oil burners. These burners will be used primarily for start-up.

The solid waste fuel will be burned on an air swept spreader stoker. The fuel, controlled by variable speed live bottom bins, is picked up by an air blast and blown into the furnace. Approximately one-third of the fuel is burned in suspension, while the other two-thirds is burned on the travelling grate of the stoker. This type of stoker has proven to be very efficient in burning wet bark in pulp mills, and hydro-pulped fuel from a demonstration project in Franklin, Ohio.

Auxiliaries to be provided include feedwater pumps for each boiler plus an installed spare, two stage feedwater heating, deaerator, demineralizer for feedwater make-up, and an ash disposal system. The ash storage silo will have a capacity adequate for two days operation at full capacity.

Electric Power Generation

A turbo generator module, complete with transmission facilities, will be provided for the account of the Florida Power and Light Company.

Two 38.5 megawatt, 44 MVA, hydrogen or air cooled turbo generator sets will be provided. The turbines will be supplied with steam at 600 psig, 750° F at the throttle. THe turbines will be condensing, with extraction at 178, 32, and 10 psig to provide low pressure steam for the boiler room

auxiliaries. Each turbine will have a water cooled condenser. Each condenser will have a condensate pump, and a third standby condensate pump will be installed.

Electricity will be generated at 13,800 volts.

Included for the Florida Power and Light account will be the necessary 13.8 KV bus and structures, 13.8 KV circuit breakers, 13.8/240 KV step up transformer, and transmission line to the Florida Power and Light 240 KV distribution line.

Also included will be the necessary instruments and control panels. A 25-ton bridge crane will also be provided.

Water cooled condensers will be provided for the turbines in a closed circuit system. The cooling water will be circulated from the condensers to cooling towers and back to the condensers. Blowdown from the cooling tower will be used as make-up water in the processing part of the plant.

The cooling tower will be a 6-cell mechanical draft crossflow unit. Three 40,000 GPM circulating pumps, which includes a spare, will be provided.

3.1.6 Pathological Waste

A pathological incinerator will be provided to handle dead animals and other pathological waste.

The unit proposed is rated at 4,000 pounds per day on pathological waste, and is capable of disposing of small animal carcasses, up to 125 pounds per carcass. Such animals shall be incinerated within 8 hours of delivery.

The unit will be installed on a 16-feet by 24-feet concrete slab, and refrigerated storage will be provided to prevent release of decay and obnoxious odors.

3.1.7 Landfill Operation

The landfill will be operated in accordance with Florida Department of Environmental Regulation requirements.

The residues from the processs consist of approximately 167 tons per day of fine-grained ash with a density of 60 pounds per cubic foot, and 144 tons per day of a fine-grained mixture of sand, glass and various minerals with a density of 80 pounds per cubic foot (dry basis).

The ash has a potential use as road base material and will probably be sold rather than landfilled. The mixture of sand, glass and minerals

referred to as glass plant fines is virtually free of organic material and nearly noncompressible. It has been tested as a filler for asphalt and found highly satisfactory. This material will be sold for use as asphalt filler of fill material.

Provisions are being made to landfill both of these materials, as their market-development could take some time.

The landfill site will be graded in a manner that will allow the stormwater runoff from the working face, which will never exceed 10 acres in size, to drain into a holding pond.

Demolition material will be deposited directly on the landfill site at the base of the working face. Ash from the next layer and the glass plant fines will be placed on top of the ash to a total height of 10 feet. A final cover of 2 feet of soil will be such that the stormwater runoff will be in the opposite direction from the runoff at the working face, and this water will not be polluted. Grading will be such that a minimum of water will percolate through the completed fill.

3.2 EXTERNAL APPEARANCE

Figure 3-2 shows the layout of the facility at the site. Points of air pollutant emissions which are indicated in the figure will be, at 150 feet or more, the highest structures associated with the facility. The entire facility will cover 4.5 acres.

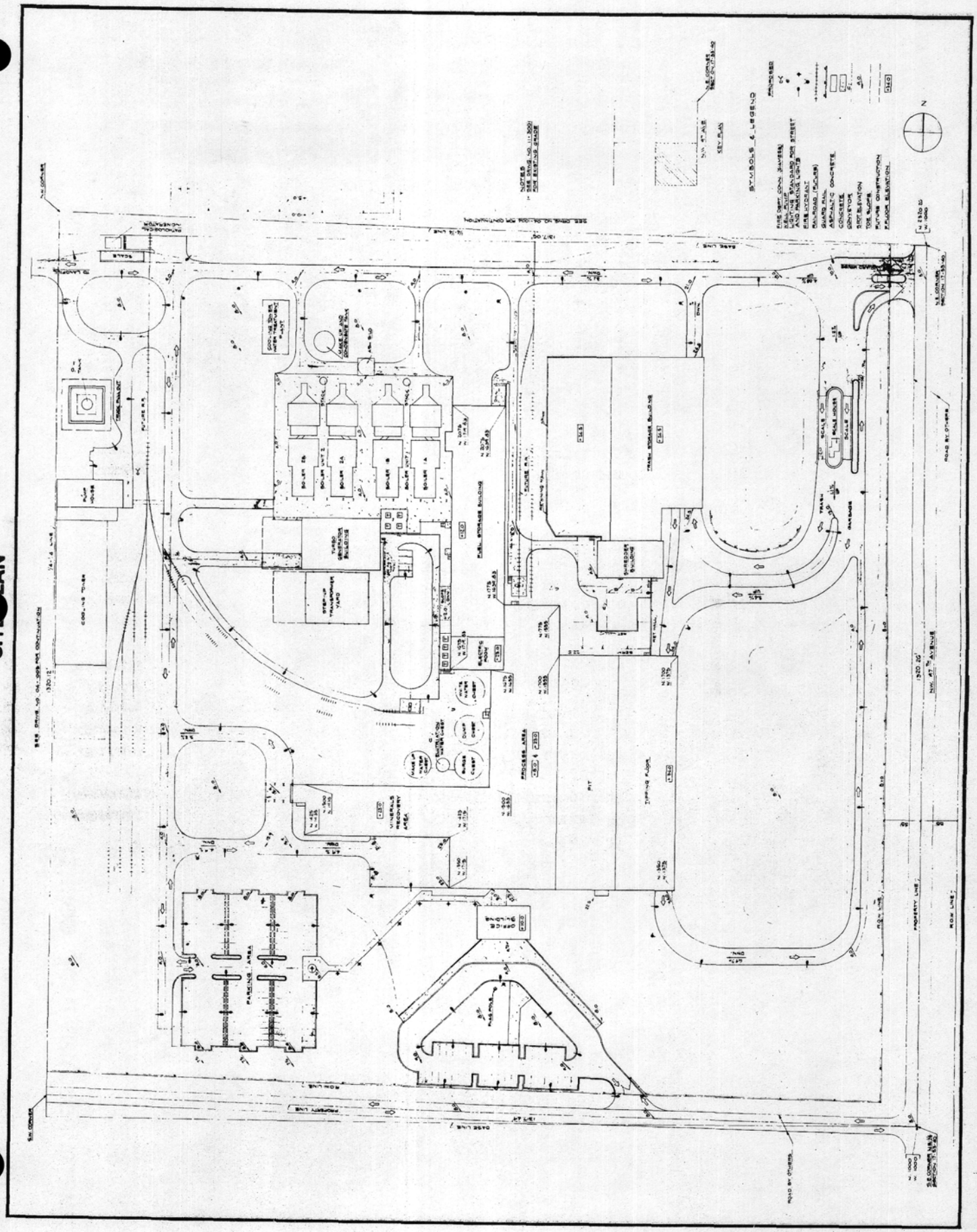
An artist's rendition of the exterior appearance of the resource recovery plant is presented in Figure 3-3. The buildings will consist of steel framed components providing required clear spans for efficient function of the processes. The facade of the structures will have prefabricated modular siding capable of providing a pleasing aesthetic effect.

Roofing systems will be constructed of components that will insulate the roof deck, span the structural elements, and provide a weathertight surface. Concrete floor surfaces will be sealed and hardened to permit proper maintenance and function in each process area.

Plant offices and employee facilities areas shall be constructed of finished materials.

3.3 FUEL

The fuel will consist of pulped refuse and trash from municipal waste sources as discussed in Section 3.1.3. Ferrous and nonferrous metals and glass will be removed from the waste prior to combustion. Presented in Tables 3-1 and 3-2 are the specifications and average analyses, respectively, for the pulped fuel. Approximate analysis of the fuel is presented in Table 3-3.


SITE PLAN
FIGURE 3-2

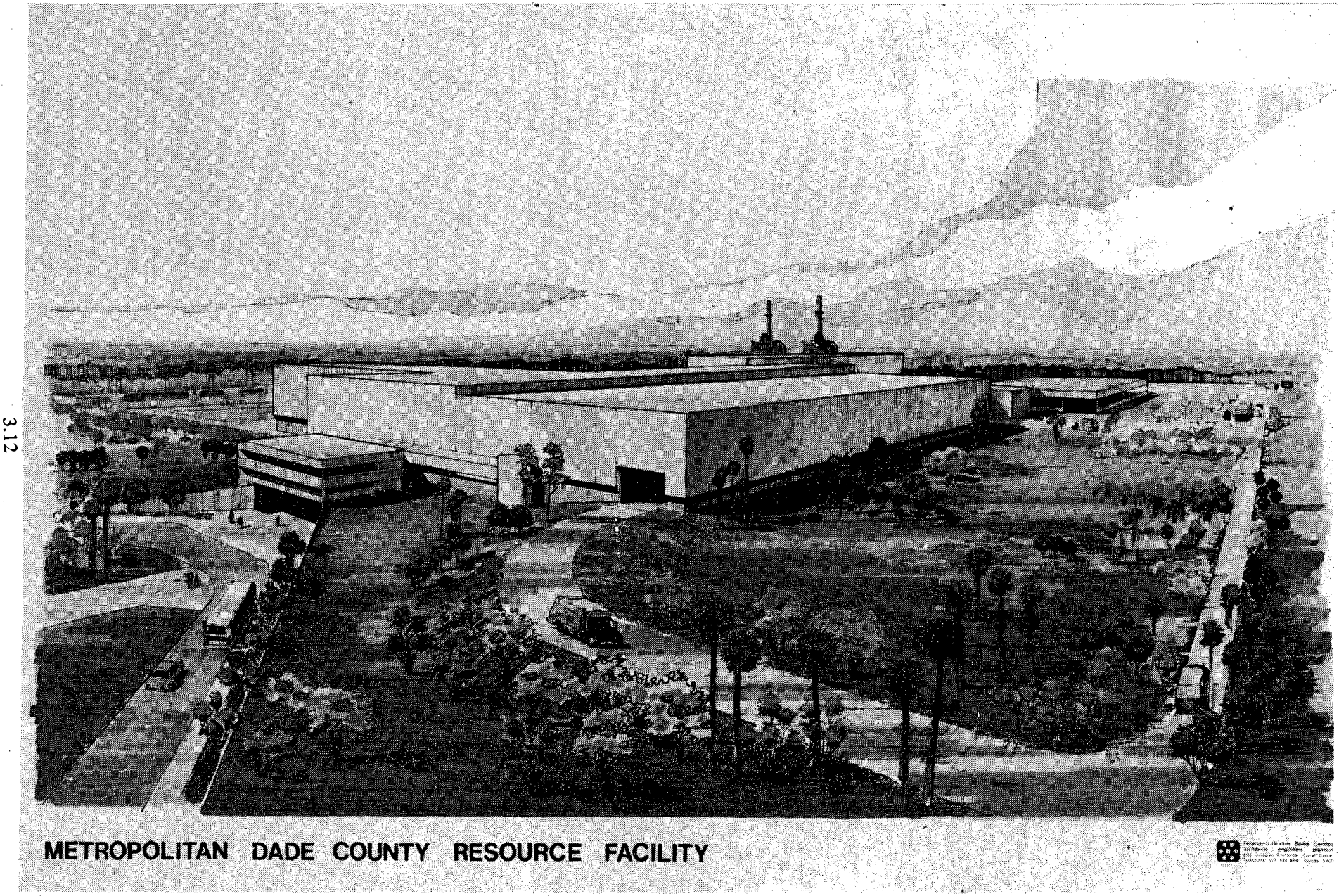


FIGURE 3-3

Table 3-1. Design Specification of Dade County Resource Recovery Pulped Fuel.

ANALYSIS (DRY BASIS) %			
Carbon	45.4	---	48.5
Hydrogen	6.1	---	6.6
Nitrogen	0.60	---	0.75
Sulphur	0.14	---	0.20
Chlorine	0.29	---	0.81
Oxygen	32.2	---	36.4
Ash	10.5	---	12.1
BTU per pound (dry)	8100	---	8700
BTU per pound (as fired)	4050	---	4350
Moisture	Nominally 50 percent		
Bulk Density	W/50% H_2O	12 lb/ft^3 as conveyed 29 lb/ft^3 in storage	

Table 3-2. Average Analysis of Dade County Resource Recovery Pulped Fuel

Total Moisture, Average %	55.9	
Ultimate Analysis		
Dry %		
Carbon	---	46.52
Hydrogen	---	6.30
Nitrogen	---	0.67
Sulphur	---	0.18
Ash	---	11.36
Chlorine	---	0.44
Oxygen (Diff)	---	34.53
TOTAL		100.00
BTU per pound (dry)		8,438

Table 3-3. Proximate Analysis of Typical Hydropulped Fuel.

Moisture	50%
Ash	
Dry	12%
As Received	6%
Volatile	
Dry	74%
As Received	37%
Fixed Carbon	
Dry	14%
As received	7%

The Resource Recovery Facility is designed to burn 3,744 tons per day of pulped fuel, with sufficient storage available for 11,200 tons or three days of steam production. As the storage area will be entirely enclosed, no spillage or runoff will occur. Figure 3-1 shows the location of the pulped storage area.

The ultimate source of the pulped fuel, which originates from residential and commercial sources, must be transported in trucks to the facility. Since the proposed Resource Recovery Facility is located adjacent to the existing Northwest 58th Street landfill, little additional travel for the waste trucks will be required. Greenleaf (1972), in analyzing the engineering and economic aspects of solid waste disposal of Dade County, determined that from 1980 to 1990 there will be a 39 percent and 38 percent increase, respectively, in production of rubbish and trash. It is projected that in 1980, the solid waste disposal requirements (rubbish and trash) for Dade County would exceed 1,900,000 tons per year. Since solid waste requirement for Resource Recovery is 936,000 tons per year, the availability of fuel to meet electric power generation capabilities will exist through the 1990's.

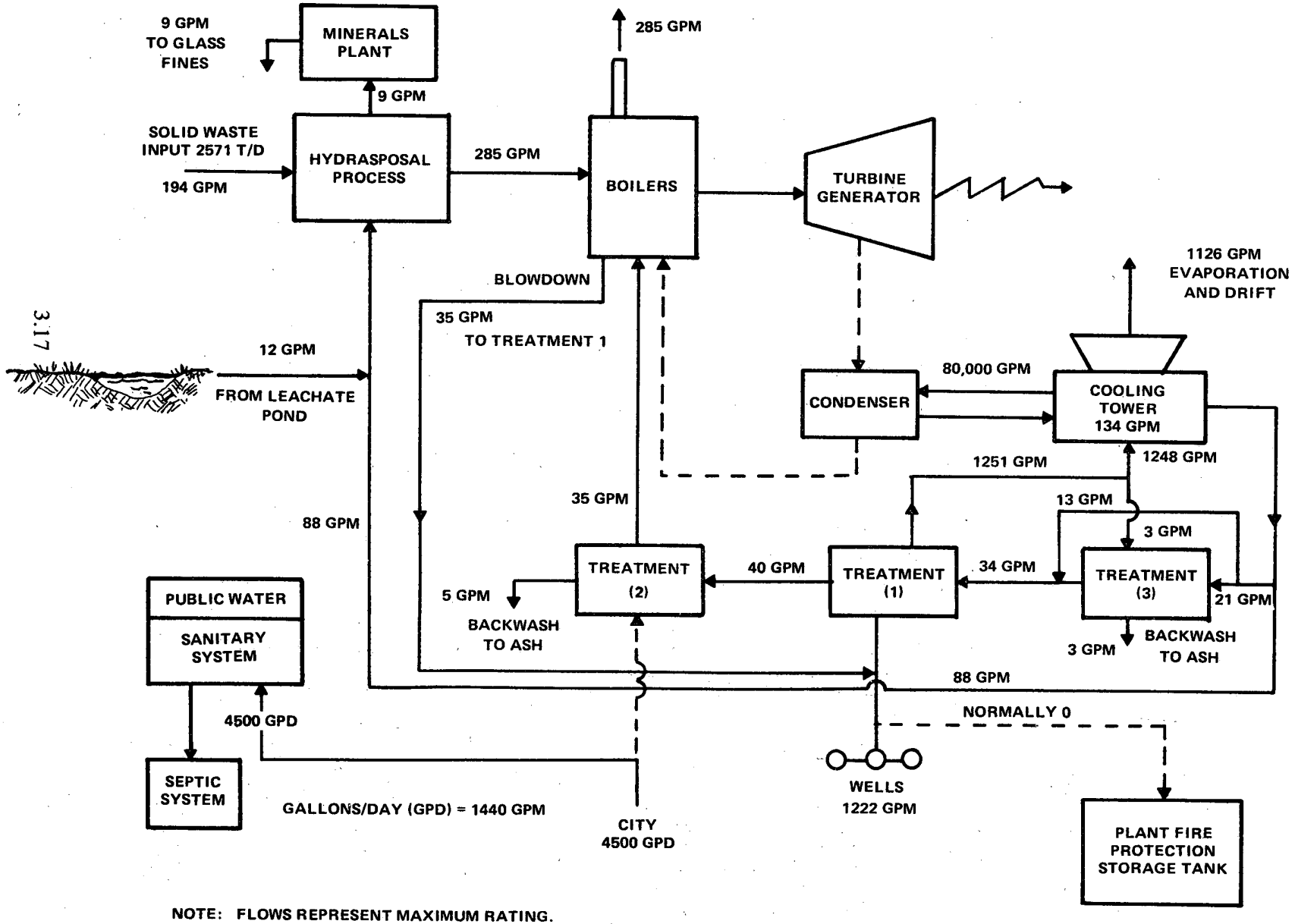
3.4 PLANT WATER USE

Figure 3-4 shows the water use flow diagram plan for the facility. All plant water, with the exception of the public water system, will be from three wells, including one spare, located on the site near the cooling tower (refer to Figure 3-1). The wells, of 750 gallons per minute capacity each, will withdraw water from the Biscayne Aquifer at 60-foot depths. The water from this depth is presently contaminated from the leachate cone of the existing 58th Street landfill. Beneficial effects of the use of groundwater from this area are discussed in Section 5-6.

As shown in Figure 3-4, three water treatment systems will be used in the plant water use system. Presented below are discussions of these systems.

Treatment 1--Cold Lime Softening: The characteristics of well water for cooling tower and boiler makeup are such as to provide less than two cycles of concentration. Without any pre-treatment, the maximum number of cycles would be 1.5, which would result in over 2,000 gallons per minute cooling tower blowdown. Such a quantity of waste water would be unacceptable to treat as waste water and create a liquid effluent disposal problem (the process water requirements are limited to 100 gallons per minute). Consequently, incoming makeup water will be treated by cold lime softening. A spiractor device has been selected for use. Physically, the spiractor is similar to an inverted cone with supporting legs. Water and chemicals (lime slurry and coagulate) are introduced tangentially at the bottom of the unit. The mixture, which rises through a suspended bed of catalyst (a fine sand) is maintained in a fluidized bed by the upward velocity of water. Proceeding upward in the spiractor, additional area of the expanding section decreases velocity sufficiently

RESOURCE RECOVERY FACILITY WATER USE FLOW DIAGRAM



NOTE: FLOWS REPRESENT MAXIMUM RATING. (DESIGN RATING = 0.92 MAX.; AVERAGE RATING = 0.65 MAX.)

FIGURE 3-4

where there is no catalyst suspended. At this point, there is a sharp line of demarcation between the crystalline bed and stable treated water. Calcium carbonate is removed by plating on the catalyst forming a hard dense round grain (about the size of bird shot). This material is removed with the unit shut down. With this process, the blowdown material can be dewatered to approximately 98 percent solids. Approximately 7,900 pounds per day of sludge will be produced from this process. The cycles of concentration can be increased to approximately ten.

Treatment 2--Boiler Demineralizer: To treat the softened water (Treatment 1) to an acceptable quality for use as boiler feedwater, a two-stage, two-train ion exchange demineralizer will be used. The cation anion resins would require regeneration by using caustic and H_2SO_4. Since backwash from the demineralizer consists of caustic and sulfuric acid, they react and neutralization occurs. A neutralization tank will be constructed to accommodate this reaction. Approximately 7,560 gallons per day of backwash will be generated and disposed of by using it as ash sluice water.

Treatment 3--Cooling Tower Demineralizer: The requirements for no effluent discharge from the proposed resource recovery facility will necessitate some recycling of cooling tower blowdown. To remove sulfates and chlorides from the blowdown, a two-step, two-train ion-exchange demineralizer will be used. Since the quality of water from recycle to Treatment System 1 need not be totally demineralized, 38 percent of the blowdown for recycle (1.3 GPM) will bypass the ion exchanger. The backwash from this unit, approximately 4,890 GPD, will be neutralized and added to the ash. Small amounts of caustic or acid can be added to bring the pH of backwash to 7.

The main use, 97 percent, of this water is for cooling, with the balance going to the boiler make-up treatment system. Blowdown from the cooling tower shown in Figure 3-4 goes to the hydrasposal process make-up. The solids content of the blowdown exits from the hydrasposal system with the boiler fuel. Upon combustion, the solids become part of the ash, which is landfilled at the site. Boiler blowdown is used as partial makeup (2.3 percent) for cooling tower and other water needs. Backwash from the demineralizers it utilized to wet down the ash at the silo and also goes to the landfill.

Well water will also be used for intermittent requirements such as chemical cleanings of the boilers, fireside and air preheater washings, ion-exchange regenerations and carbon filter backwashes.

There are no effluent discharges from the plant's well water system. Public water and sanitary water will be processed by an on-site septic system.

Table 3-4 presents the daily consumption of water for two operation modes at maximum and minimum power operation. The facility will normally generate electric power at maximum capacity Monday through Saturday from 7:00 A.M. to 11:00 P.M., referred to as "peaking hours." During other periods, the plant will operate at a capacity determined by the remaining quantity of fuel available. There are two options of operation for these periods. The first involves "off peak" operation of the electric generating system for seven days per week with two boilers operated at 60 percent capacity and two boilers banked. The other option would be to run "off peak" generation six days per week with all boilers banked on Sunday.

3.5 HEAT DISSIPATION SYSTEM

The electric generating portion of the resource recovery facility will utilize a wet mechanical draft crossflow cooling tower for the disposition of waste heat. Presented in Figure 3-5 is a flow diagram of the circulating water using the cooling tower. Figure 3-6 is a cross-section of the tower, showing the main components of the tower.

The tower will have a maximum circulating flow rate of 80,000 gallons per minute. The maximum inlet temperature to the tower is 101°F with an outlet temperature of 86°F. The tower will be designed to dissipate 660 million BTU's per hour. Table 3-5 outlines pertinent information on the cooling tower and the blowdown make-up requirements.

A typical analysis of the well water at Section 17 is discussed in Section 2.5. The resulting blowdown concentration from the cooling tower passes to the hydrasposal plant and thence to the fuel.

Table 3-4. Plant Water Use for Resource Recovery Facility

	Maximum Operating Conditions		Minimum Operating Conditions	
	Rate	Gallons/Day	Rate	Gallons/Day
A. 7 DAY WEEK OPERATION SYSTEM				
Boiler Blow-Down	35 gpm	50,400	17 gpm	27,360
Cooling Tower Blow-Down	122 gpm	175,680	73 gpm	105,120
Cooling Tower Evaporation Cooling Tower Drift	1,126 gpm	1,621,440	743 gpm	972,000
Public Water	3.1 gpm	4,500	3 gpm	3,300
B. 6 DAY WEEK OPERATION SYSTEM				
Boiler Blow-Down	35 gpm	50,400	27 gpm	38,880
Cooling Tower Blow-Down	122 gpm	175,680	102 gpm	146,880
Cooling Tower Evaporation Cooling Tower Drift	1,126 gpm	1,621,440	946 gpm	1,362,240
Public Water	3.1 gpm	4,500	2.3 gpm	3,300

Table 3-5. Cooling Tower Design Specifications.

Type of Tower	Mechanical Draft Crossflow
Height	62
Heat Rejected (BTU/HR)	660×10^6
Maximum Circulating Flow (gpm)	80,000
Water Inlet Temperature (°F)	101
Water Outlet Temperature (°F)	86
Drift Loss (% Flow)	0.008
Evaporation Loss (% Flow)	1.4
Maximum Water Make-Up (gpm)	1,250
Maximum Blowdown (gpm)	663
Wet Bulb Temperature (°F)	80

3.6 CHEMICAL AND BIOCIDE WASTE

In order to control corrosion, scaling and fouling in the cooling water system, certain chemical additives will be used. The ultimate disposal of such chemicals, as discussed in Section 3.4, will be in the process.

Chromate (15 to 20 ppm) or $CrO_4^{=}$ will be utilized as a corrosion inhibitor. A film of ferric oxide interspersed with chromic oxide is formed over the anodic region of the iron. The film is very dense and adherent and protects the iron over a broad range of water characteristics. A chemical which provides this protection is Betz 40P, which is a zinc chromate chemical, and polyphosphate. This chemical also provides protection of cathodic areas since polyphosphates polymerize and deposit a thin film.

To inhibit scaling and fouling due to high calcium and iron in ground water, a dispersant will be used. The function of a dispersant is to: (1) control particle agglomeration and subsequent settling by reducing interparticle attractive forces, and (2) prevent particle deposition by reducing particle-surface attractive forces. Dispersants are low molecular weight compounds whose solubility and performance are not affected by pH in most applications. Chemicals which may be used are Betz 419, an organic phosphate, or Nalco 344, an organic polymer.

For biocide control, chlorine will be used intermittently. The exact amount of chlorine has not been determined. However, 0.2 ppm injected into the circulating water over a 30-minute period two to three times per day should provide effective biological control. To improve the performance of chlorine, a non-oxidizing biocide may be added. Like chlorine, a non-oxidizing biocide is used in shock treatments.

The above chemical additives will only leave the recirculating water system through blowdown. As discussed in Section 3.4, the cooling tower blowdown will be used as process water. Since the process water is used in pulped fuel production, the chemical additives will eventually appear in the ash. Table 3-6 presents the concentration of the blowdown constituents in the process water and the percent by weight of the constituents present in the ash.

The quality of boiler feedwater necessary to satisfactorily operate in the steam-turbine cycle requires the use of different chemicals than does the heat dissipation system. In addition, the quantity of the chemicals needed is considerably less than that required to treat the cooling water system, since a water treatment system (demineralizer) will further treat boiler feedwater.

Two chemicals, hydrazine (20-30 ppb) and neutralizing amine (0.5 ppm), will be used to control corrosion in boiler, economizer, piping, etc.

Table 3-6. Cooling Tower Blowdown Constituents and Resultant Ash Concentration.

Blowdown Constituents	Concentration (ppm)	Percent by Weight of Ash (dry)
Total solids	425 (a)	0.3
Methyl orange alkalinity (as $CaCO_3$)	225	--
Calcium (as $CaCO_3$)	225	--
Sulfates	200	--
Chlorides	125	--
Silica (as SiO_2)	30	--
Chromate (as $CrO_4^{=}$)	10	0.007
Organic phosphates	10	0.007
Nonoxidizing biocide	0.5	Negligible

a. The solids consist primarily of calcium salts such as calcium carbonate, calcium bicarbonate, calcium chloride, and calcium sulfate; some sodium and magnesium salts will also be present.

(Source: Treatment of cooling tower recirculating water for Dade County Resource Recovery Plant; Equitable Environmental Health, Inc., April, 1977)

Hydrazine removes dissolved oxygen (O_2), which causes corrosion and pitting of steam lines, turbines, etc., by reacting to form nitrogen and water. To prevent CO_2 corrosion in steam and condensate lines, a neutralizing amine (ammonia derivative) will be added. Approximately 0.144 pounds per day and 2.4 pounds per day of hydrazine and neutralizing amine, respectively, will be used.

To inhibit scaling on tube surfaces, coordinated phosphate--pH control will be used. The soft sludge formed by this procedure will be removed with boiler blowdown. Approximately 2 pounds of PO_4 will be used each day. The chemicals leaving with the boiler feed water blowdown will go to the cold lime softening unit. Final disposal will be land filled as either spiractor wastes or ash.

3.7 SANITARY AND OTHER WASTES

3.7.1 SANITARY WASTES

Sanitary wastes generated from lavatory and shower facilities used by plant employees and visitors will be treated through a septic tank system. With an estimated maximum of 150 employees and visitors, the minimum effluent discharge criteria of 30 gallons per capita per day necessitates a minimum design flow of 4,500 gallons per day. A 3,000 gallon per day capacity septic tank will be installed to serve the main plant complex. Septic tanks of 500 gallons per day design capacity will be installed to serve the pathological incinerator building, the scale house, and the turbogenerator building. All septic tanks will be designed to comply with Chapter 24, Section 24-13, of the Metropolitan Dade County Pollution Control Ordinance.

3.7.2 OTHER WASTES

The facility will generate 2291 tons per week of relatively inert solid wastes. These wastes will be generated in the steam generation and glass separation processes.

The volume of fill will be 2544 cubic yards per week at the plant design rating of 18,000 tons of solid waste per week, in accordance with the following amounts of waste materials:

Material	Amount ton/week	Density lb/cu/yd	Volume cu/yd/week
Ash	1189	1620	1468
Glass, plant fines	774	2052	754
Demolition	300	2025	295
Spiractor waste	28	2052	27
Total	2291	1800 (avg.)	2544

The ash will consist of bottom and fly ash resulting from the combustion of pulped fuel. A small amount ($\sim$1 ton) of ash will come from the pathological incinerator operations. The ash will be combined in the ash storage silo with backwash water amounting to approximately 8,200 gallons per day (refer to Section 3.4). The chemical composition of the ash as derived from similar solid wastes is presented in Table 3-7. This ash consists of 3.91 percent water solubles, of which a majority are calcium and sodium.

Demolition material to be deposited in the landfill consists of a mixture of building and road materials--stone, brick, concrete blocks and sections, tile, timbers, dry wall and plaster--limited to 300 tons per week.

Glass plant fines consist of undersize (less than 1/4 inch) particles of glass, ceramic, stone, wood, rubber, leather, plastic, and a small amount of putrescible liquid. These fines have been washed in the processing plant with blowdown water. Total amount of liquid discharged with fines is 14 tons per year, of which 54 percent or 7.6 tons is organic and 46 percent or 6.4 tons is inorganic.

The landfill site will be 80 acres of the 160 acres. The site is presently in its natural state and the 80 acres for landfilling purposes will be filled, without demucking, to elevation (+8 feet) USCGS 1929 Mean Sea Level by Dade County. Adequate drainage provisions for the site will be made at the time the site is filled to (+8 feet).

The 80-acre area is 1/2 mile long (2,640 feet) by 1/4 mile wide (1,320 feet). It will be divided into 8- to 10-acre sections, each approximately 330 feet wide. A peripheral wall approximately 12 feet high will be built up around each 10-acre cell with glass plant fine and ash covered with 2 feet of soil and seeded. This will reduce the area of concern with regard to stormwater runoff and possible leachate formation to a maximum of 10 acres at any one time, and usually less than that as the individual cells become filled.

Demolition material and inorganic glass plant fines will be deposited into the cell first to insure that the necessary 5-foot separation from the water table is maintained. Tree stumps and ashes will comprise the next layer of material, followed by additional glass plant fines and 2 feet of cover material. The cover material will be seeded with 120 pounds per acre of suitable grass seed and fertilized with 800 pounds per acre of 10-10-5 fertilizer. Temporary irrigation will be provided. This procedure will be repeated for each 10-acre cell.

Adequate drainage of the completed fill, as illustrated in Figure 3-7, will prevent leachate formation by allowing the water to run off at the fill rather than percolating through the filled material. This water will then drain from the site in the same manner it did after the site

Table 3-7. Chemical Composition of Pulped Fuel Ash.

Element	Percent
Carbon	≤65
Silicon	≤35
Calcium	3 - 8
Sodium	3 - 8
Titanium	1 - 5
Aluminum	4 - 9
Iron	.25 - .75
Copper	.10 - .25
Magnesium	.05 - .10
Lead	.01 - .05
Manganese	.01 - .05
Chromium	.01 - .05
Nickel	.005 - .01
Cobalt	.005 - .01
Boron	.005 - .01
Molybdenum	.005 - .01
Bismuth	.005
Zinc	.005
Silver	.005
Cadmium	.005
Tin	.005
Arsenic	.001

Method of Analysis: Spectrographic

was raised to (+8 feet) elevation. The small amount of water that does manage to percolate through the cover material will be insulated from the water table by the 5 feet of separation that will be provided. Monitoring wells will be installed to insure that the system is operating properly.

Surface water runoff from the cell that is being filled, which will never exceed 10 acres in size, will be collected and utilized as process water. A small drainage canal will move the water from the cell to a collecting pond. The pond will have an impervious liner and a capacity of 3,900,000 gallons. This water will be pumped to the resource recovery plant and used as makeup water in the hydrapulpers. The collecting pond has the capacity to handle the runoff from the worst storm condition experienced in the past 25-year cycle from a 10-acre cell plus the 2-acre pond. Cover material for the landfill operation will be purchased and stockpiled on the site. The location of the stockpile will vary as the fill progresses and the cover material will be loaded and moved to the required location with the front end loader and ash hauling trucks as described in the equipment list (Appendix B). There will be no borrow pit on the site.

Access to the landfill will be solely through the resource recovery plant entrance. All-weather roads will be extended from the resource recovery plant to the landfill. Signs will be placed to direct demolition waste trucks from the scale house to the landfill.

The entire 80-acre site will be fenced with an 8-foot high chain link fence and necessary security will be provided by the resource recovery plant security force. Locker rooms, toilets and shower facilities, potable water, equipment shelter and repair will all be located at the plant.

The material being landfilled is inert; therefore fire, vector and gas control will not be required. Large bulky items other than tree stumps will not be accepted at the landfill. Hazardous and liquid wastes will not be accepted at the resource recovery plant or the landfill.

3.8 AIR EMISSIONS

The air emissions sources from the Resource Recovery Facility are: (1) four pulped fuel boilers with two boilers per stack; (2) pathological incinerator; and (3) rotary dryer used in the glass plant.

Combustion of the pulped fuel will result in emissions of particulate matter and sulfur dioxide. The applicable emission-limiting regulation for the facility is restricted for particulate emissions. Based upon preliminary determination by the Florida DER, the applicable regulation is 17-2.04(6)(a)1. This regulation limits particulate emissions to 0.08 grains per standard cubic foot corrected to 50 percent excess air. To

accomplish this, a Flakt Model CKAB mechanical collector (or equivalent) and Flakt Model FAA-32 electrostatic precipitator (or equivalent) will be run in series. Table 3-8 presents design information on control equipment and resulting emissions from this source. Calculations are presented in Appendix C.

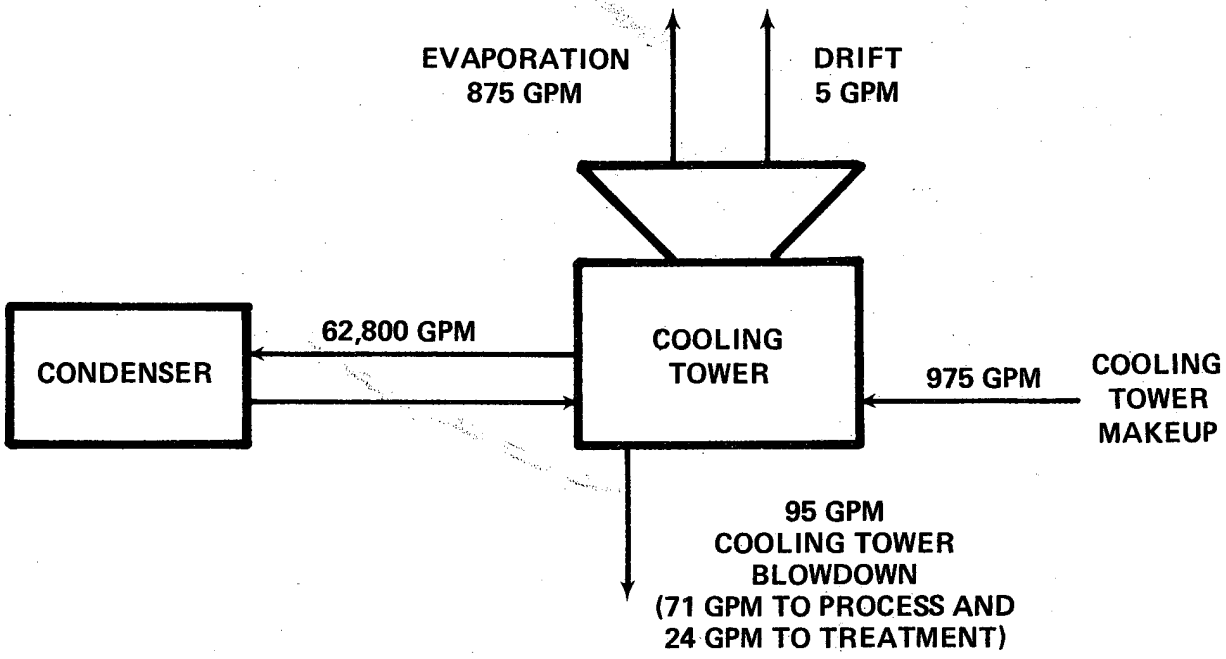
Pathological incinerator emissions are restricted through the application of a visible emission limitation, 17-2.04(6)2, New Incinerators less than 50 tons per day capacity. Table 3-9 presents pertinent information on the pathological incinerator.

The very nature of this facility requires extensive odor control and plant ventilation equipment. Garbage odors, process odors, dust and carbon monoxide fumes from delivery vehicles and Plant equipment must all be eliminated. This is accomplished by allowing sufficient air changes in each section of the Plant, and by then venting this air to the forced draft fans of the boilers. In case the boilers are unable to handle the required air changes, as for example, during off-peak periods at night when only two boilers will be on the line, excess air is passed through activated carbon filters and then exhausted to the outside. This latter situation occurs possibly only 3 or 4 hours per day. To reduce particulate emissions, dust filters are installed ahead of the activated carbon filters. Figure 3-8 is a flow diagram of the odor control and ventilation system. The exhausts from the glass recovery plant's rotary dryer will be emitted through the ventilation system. Additional information will be contained in Appendix C.

3.9 ASSOCIATED TRANSMISSION LINES

Florida Power and Light Company presently maintains a 240 KV transmission line 900 feet south of the site. To interconnect with this transmission line, an additional transmission line will be constructed east and south of the Resource Recovery Facility. The additional transmission line will be 240 KV. An easement of approximately 2,140 feet by 300 feet on adjacent Section 16 will provide a corridor for this transmission line. Figure 3-9 presents the transmission corridor. At the present time this land is used for landfill of solid wastes, and is owned by Metropolitan Dade County.

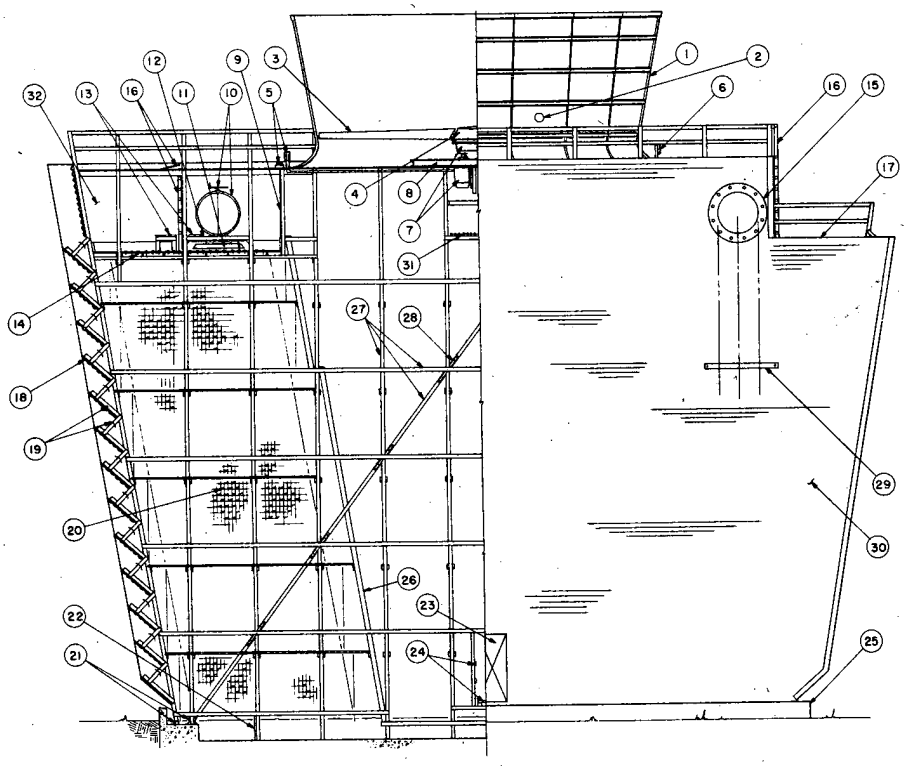
HEAT DISSIPATION SYSTEM FLOW DIAGRAM



NOTE: AVERAGE CONDITIONS PRESENTED; MAXIMUM = AVERAGE/0.71

FIGURE 3-5

FIGURE 3-6 CROSS SECTION OF COOLING TOWER, SHOWING COMPONENTS



STANDARD COMPONENTS:

1. FIBERGLASS FAN STACK.
2. INSPECTION PORT.
3. FIBERGLASS FAN.
4. FIBERGLASS FAN AIR DISC.
5. LOW OIL PRESSURE CUT-OUT & VIBRATION CUT-OUT SWITCHES.
6. O'L SIGHT GUAGE, FILL & DRAIN LINE.
7. MECHANICAL EQUIPMENT, (CLOSE-COUPLED MOTOR & GEAR).
8. MECHANICAL EQUIPMENT SUPPORT.
9. C.A.B. PLENUM AIR SEAL.
10. FIBERGLASS MANIFOLD
11. FIBERGLASS DISTRIBUTION BOX.
12. MANIFOLD SUPPORT.
13. VALVE ACCESS PLATFORM.
14. POLYPROPYLENE DISTRIBUTION NOZZLES.
15. MANIFOLD INLET FLANGE (125 lb A.N.S.I. (A.S.A.) STD DRILL).
16. HOT WATER BASIN ACCESS & LADDER.
17. OPEN HOT WATER BASIN.
18. CORRUGATED C.A.B LOUVER.
19. LOUVER BRACKET & WATER GUARD.
20. P.V.C. WEDGE FILL.
21. ANCHOR CASTINGS.
22. AIR DIVERTER.
23. PLENUM ACCESS DOOR.
24. PLENUM WALKWAY & SAFETY HANDRAILS.
25. COLD WATER BASIN (BY OTHERS).
26. "HI-V" PVC. DRIFT ELIMINATORS.
27. STRUCTURAL TIE, TRANSVERSE BRACE, TOWER COLUMN. (CLOCKWISE DIRECTION).
28. STRUCTURAL CONNECTOR.
29. RISER TIE POINT.
30. CORRUGATED C.A.B. END WALL CASING.

OPTIONAL COMPONENTS

31. MECHANICAL ACCESS WALKWAY.
32. ENCLOSED HOT WATER BASIN (EXTENDED FAN DECK).
33. STAIR & /OR LADDER (NOT SHOWN).

FIGURE 3-6

Table 3-8. Design Information of Air Pollution Control Equipment for Pulped Fueled Boilers

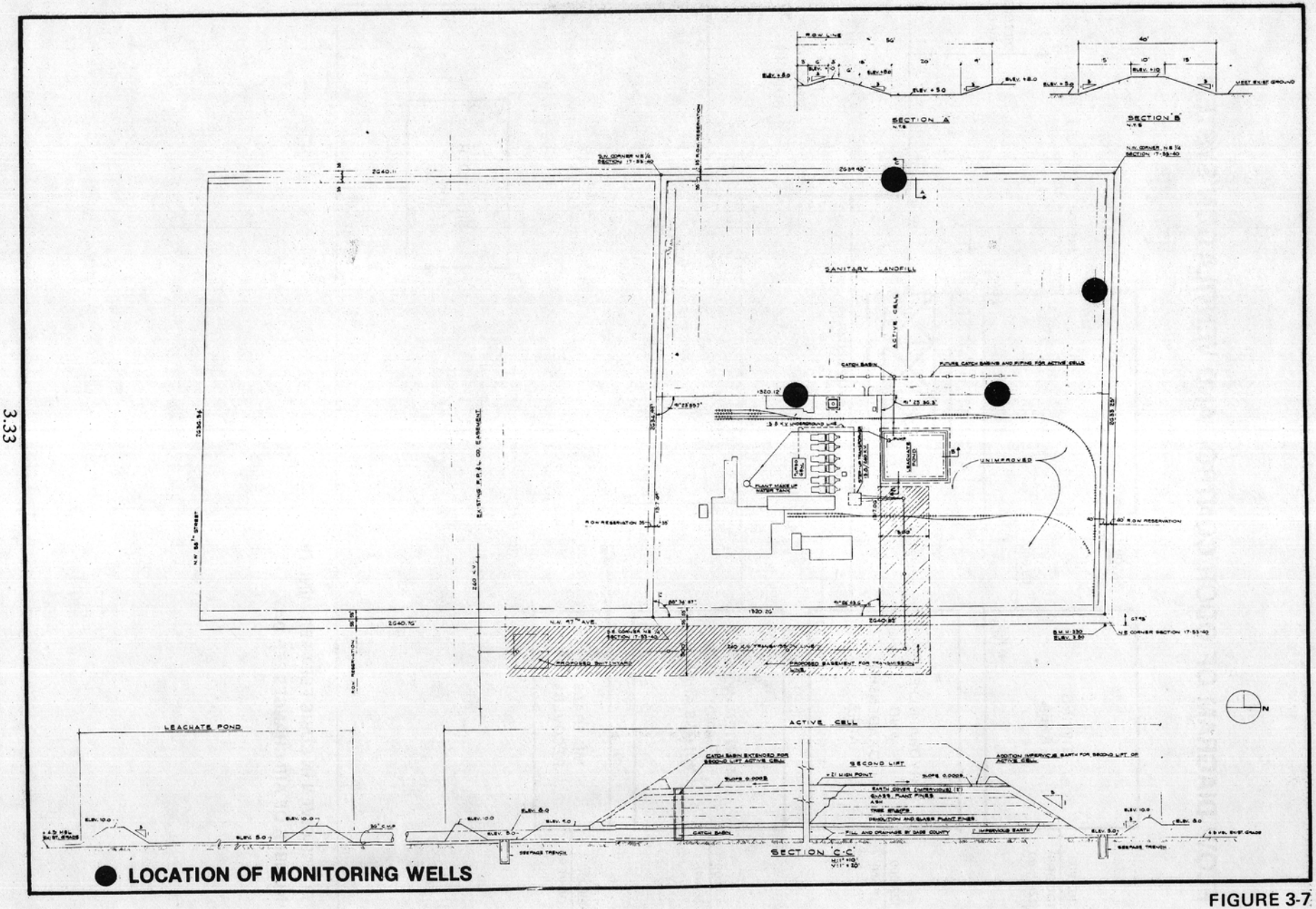
Mechanical Collector	
Manufacturer:	VIM - FLÄKT (or equivalent)
Model:	CKDB
Design Efficiency:	85%
Pressure Loss:	2.8 - 3.1 in WG
Inlet Particulate Concentrations:	10 grains/SCF
Number of Cyclones:	16 in parallel
Diameter of Cyclones (Internal):	7.6 ft.
Electrostatic Precipitator	
Manufacturer:	VIM - FLÄKT (or equivalent)
Model:	FAA-32
Surface Area:	324,454 ft.^{2}
Passing Velocity:	2.9 ft/sec.
Design Efficiency:	96%
Exit Concentration	0.06 grains/SCF corrected to 12% CO_2
Stack Parameters	
Height:	150 ft.
Actual Emissions - Particulate:	73 lbs./hr.
Regulated Emissions - Particulate:	108 lbs./hr.
Actual emissions - SO_2	288 lbs./hr.
Flow Rate:	314,000 ACFM
Temperature:	420° F
Diameter:	8.75 ft.

Table 3-9. Pathological Incinerator Information

Manufacturer:	Comtro Division, Sunbeam Equipment Corp. (or equivalent)
Model and Type:	A-35 Horizontal feed
Capacity:	800 lbs./hr.
Fuel:	Distillate
Max. BTU/hr.:	2,538,000
Stack Height:	21 ft.
Stack Diameter:	2 ft.
Stack Temperature:	1300° F
Control Equipment:	Afterburner
Visible Emissions*:	0

* From test of identical unit (can be supplied upon request)

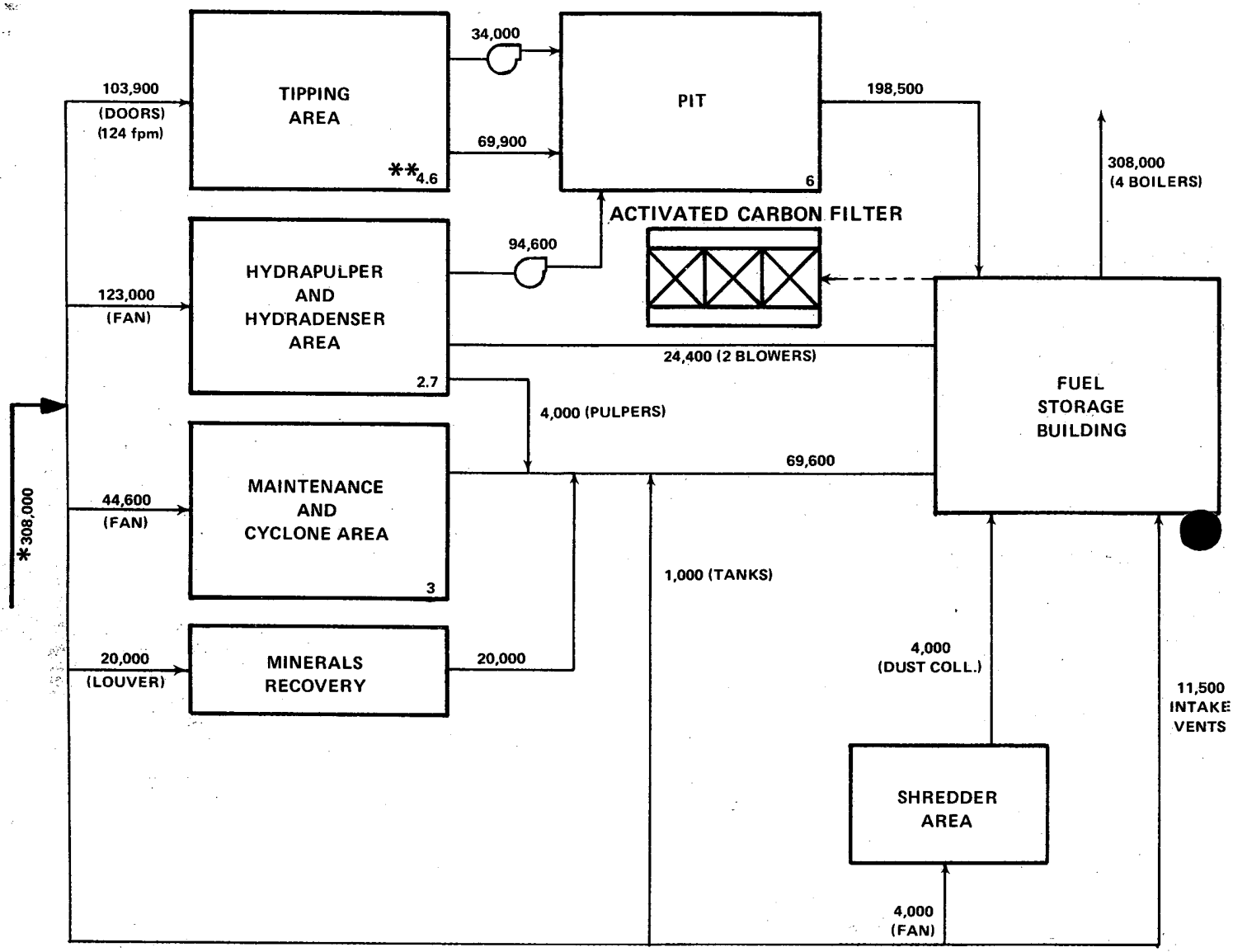
DRAINAGE PLAN



● LOCATION OF MONITORING WELLS

FIGURE 3-7

FLOW DIAGRAM OF ODOR CONTROL AND VENTILATION SYSTEM



* FLOWS GIVEN IN CUBIC FEET PER MINUTE

** NUMBER OF AIR CHANGES PER DAY

FIGURE 3-8

RESOURCE RECOVERY FACILITY'S TRANSMISSION CORRIDOR

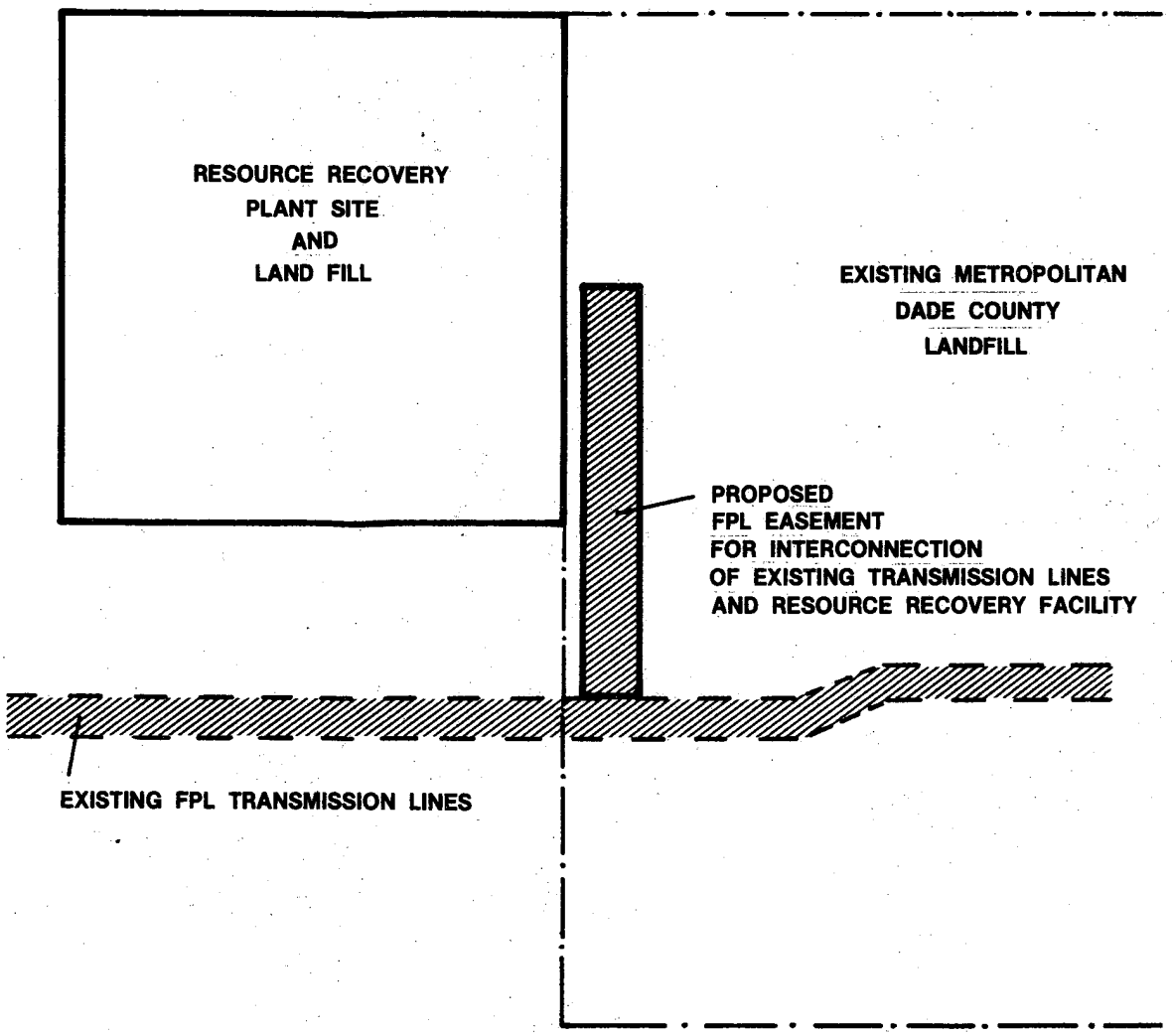
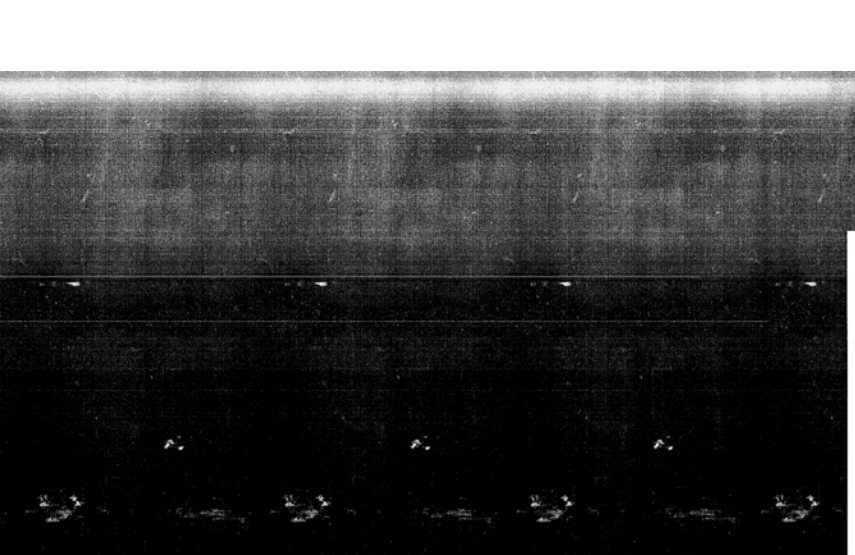


FIGURE 3-9



4.0 ENVIRONMENTAL EFFECTS OF SITE PREPARATION, PLANT AND ASSOCIATED TRANSMISSION FACILITIES CONSTRUCTION

4.1 SITE PREPARATION AND PLANT CONSTRUCTION

4.1.1 Land Use

In the ongoing process of urbanization, converting lands from their natural state to more accomodating urban uses, is an unavoidable, irretrievable commitment of resources. As discussed in Section 2, the proposed site has already been disturbed by urbanization and is presently undergoing a drying process. The result is a sub-optimum wetland, functioning below its natural capacity; yet, as it exists, unsuitable for urban development.

The preparation of the site and plant construction will eliminate the entire existing ecological system by excavation, demulching and/or filling. All existing plant and animal species and wildlife habitats will be lost. The ecological services and values of the site will also be lost (Table 4-1) during site preparation and plant construction.

Preparation of the site and construction of a solid waste processing facility will complete the conversion of 160 acres from its natural state to urban land use. Commitment of land resources at that point will be irretrievable, but the loss is minimal in comparison to the amount of similar, but undisturbed wetlands in the area. Such an action will, in the long run, have a positive effect on the overall picture of land use in the county in that it will preclude further damage to the wetland areas by reducing the demands for landfill acreage.

4.1.2 Water Use and Water Quality

Construction water requirements for the proposed facility are estimated at 75,000 gallons per day. A majority of this water will be utilized for concrete mixing, with minor amounts necessary for cleaning, hydrostatic testing of tanks, and construction personnel use. Water requirements will be supplied by wells (same as will be used for cooling tower makeup water) for all non-potable use. Potable water will be obtained from public water supplies. Portable facilities will be available for sanitary wastes.

No discharge of water used for construction will occur outside the plant boundary. Consequently, no expected water quality impact is likely to occur on the environment.

Table 4-1. A Comparison of Ecological Services And Relative Values of Natural Wetlands, Existing Ecosystem of Site and Proposed Resource Recovery Facility

SERVICE	VALUE		
	Natural Wetland	Existing Ecosystem Of Site	Proposed Resource Recovery Facility
Surface Water Storage	High	High	High--Holding Ponds
Surface Soil and Ground Water Recharge	High	High	Nominal
Waste Disposal	High Biological Process	Low	Very High--Technological Process
Wildlife Habitat	High	Low	Minimal--Animals of Landscaped Areas
Recreational and Aesthetic Use	High	Low	Low
Educational and Scientific Use	High	Low	High--Demonstration Recycling and Power Generation of Wastes

4.1.3 Air Quality

Various construction activities associated with the Resource Recovery development, including land clearing, open burning, heavy machinery operation, truck traffic and road construction, will generate air pollutants. Because of the nature of these operations, emissions are extremely difficult to quantify accurately. Thus, this discussion addresses only the qualitative air pollution aspects of these construction activities.

The most significant air pollutant generated by heavy construction operations will be particulate matter, also termed fugitive dust. The quantities of dust emitted are dependent on a number of factors, including frequency of operations, specific operations being conducted, weather, and soil conditions. The majority of generated dusts, however, are typically of large particle size and settle near the source. In addition, some of the operations, such as land clearing, are intermittent and usually of short duration.

Some of these dusts, though, will remain suspended in the atmosphere. Suspended dust emissions from heavy construction operations have been generally estimated at 1.2 tons per acre per month of activity (U. S. Environmental Protection Agency, 1975).

Open burning, also a significant source of air pollutants during construction, will emit quantities of particulate matter, carbon monoxide, hydrocarbons, sulfur oxides, and nitrogen oxides. The burning will be primarily of cleared land debris, mostly Melaleuca trees and scrub underbrush in the area. Pollutant emissions depend on the moisture of the debris, the amount of material per acre and how the refuse is arranged (piles, rows, etc.).

Emission factors for open burning of forest residues (U. S. Environmental Protection Agency, 1975) have been estimated to be: particulate, 17 pounds per ton refuse burned; carbon monoxide, 90 pounds per ton; and hydrocarbons, 24 pounds per ton. But exact emissions vary according to specifics of the burning. Open burning will normally be of short duration and conducted only as needed.

Exhausts of heavy machine and truck traffic will be a minor source of air pollutants, mainly carbon monoxide, particulate matter, nitrogen oxides, hydrocarbons and sulfur oxides. These exhaust emissions will be of relatively small quantities because of the limited amount of construction traffic expected.

Modern methods of dust control and dust emission prevention will mitigate the effects of construction in the vicinity of the proposed site, and air quality control rules of the State of Florida and Metropolitan Dade County fugitive dust emissions and open burning will be complied with. Briefly, these rules are: Florida Department of Environmental Regulation CH. 17-2.04 (3) F.A.C.; Florida Division of Forestry CH. 51-2 F.A.C.; and Metropolitan Dade County Environmental Resource Management Chapter 24, Sections 24-19.

1. All reasonable precautions must be taken to prevent fugitive dust emissions. Such precautions include using, where possible, asphalt, oil, water or chemicals for the control of dust from grading and clearing operations and on dirt roads.

2. Open burning must comply with certain conditions:

   a. Burning must be performed between 9:00 A.M. (Eastern Standard Time) and one hour before sunset; at other times, a forced draft system must be used.

   b. The burning location is at least 50 yards from the nearest occupied building or public highway.

   c. Size of piles must be no larger than can be burned within the designated time.

   d. Moisture content and composition must be favorable for good burning.

   e. Smoke emissions must not exceed 40 percent opacity or Number 2 on the Ringelmann chart, except during startup.

The heavy construction activities will have a short-term nuisance impact in the immediate vicinity, the primary impact being on suspended particulate matter levels. These levels are expected to increase during construction, both on-site and in the vicinity of the proposed facility. Ambient air quality standards for particulate matter are not expected to be exceeded beyond a few hundred feet from the operations. Permanent or long-term impacts related to heavy construction activities are not expected.

Short-term nuisance impacts will also result from open burning. Since these operations will be conducted during periods of excellent dispersion and will be intermittent and of short duration, no permanent or long-term impacts are expected.

4.1.4 Solid Waste Generation and Disposal

Solid wastes other than land clearing debris (refer to Section 4.13) will be removed by truck and disposed of in the Dade County 58th Street landfill adjacent to the construction site. This waste will consist of wooden concrete forms, shipping cartons, and other trash. An estimated 1,200 cubic yards of waste will be generated from construction. This waste will be removed during the final phases of construction. Broken concrete will be landfilled on the site.

4.1.5 Ambient Noise Levels

In assessing the probable impact development of an area will have on the existing noise levels, one must consider both traffic and equipment noise sources that will be present during the development or construction phase. These sources are by nature transient, which precludes rigorous analysis of noise impacts as is possible with traffic noise after development of an area is complete.

Studies have been conducted to determine noise levels generated by various equipment used in construction and the equipment usage during various phases of construction (U. S. EPA, 1971). Even so, a detailed analysis requires much more information than was made available for this study. However, a simple model approach was taken to obtain a reasonable estimate of the construction noise impacts as described below.

For the proposed project, the locations which are near existing noise sensitive areas and which construction will reach were determined. Once the relative locations of the construction sites and noise receptors were determined, the sound pressure level at the receptor due to construction was estimated by assuming a 6 dbA decrease in noise for each doubling of distance from the noise source. Strictly speaking, this drop-off rate applies to discrete (point) sources; the rate for a line source (e.g., traffic) is 3 dbA per doubling of distance. However, the 6 dbA was used since, in most cases, various amounts of natural vegetation are present which will attenuate the sound over that area because of geometric spreading.

The above calculation required an estimate of the sound pressure level generated at the construction site. As mentioned earlier, this study did not have detailed information regarding construction schedules which would enable rigorous analysis. The approach taken was to assume that four (4) pieces of equipment would be operating simultaneously at a single location. The sound pressure levels of those 4 items were combined into a single source by adding energy levels from each source. The 50-foot noise levels used for each source were taken from Table 4-2, which shows permissible sound pressure levels for noncontrolled construction equipment. A good approximation of a worst case is to use two sources at 80 dbA, one at 85 dbA and one at 91 dbA.

The results of the foregoing analysis are summarized in Table 4-3 for Sensitive Receptors. Examination of this table shows that maximum heavy construction activities are the only probable sources of adverse noise impacts from construction. These results show that construction of this magnitude should occur only during daylight hours.

Table 4-2. General Noncontrolled Construction Equipment Noise

Equipment		Equipment	
Earthmoving		Stationary	
front loader	79	pumps	76
backhoes	85	generators	78
dozers	80	compressors	81
tractors	80		
scrapers	88	Impact	
graders	85	pile drivers	101
truck	91	jack hammers	88
paver	89	pneumatic tools	86
Materials Handling	85	Other	
concrete mixer	82	saws	78
concrete pump	83	vibrator	76
crane	83		
derrick	88		

NOTE: All noise limits in dbA measured at a distance of 50 feet from the equipment.

Source: "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances"; U.S. Environmental Protection Agency; prepared by Bolt, Beranek and Newman, December 1971.

Table 4-3. Estimated Maximum Probable Construction Noise Impacts on Noise-Sensitive Areas for the Proposed Resource Recovery Facility

	Distance From Source To Receptor (feet)	Sound Level At Receptor From Construction (dBA)	Problem*
Recreation (Nearest Point of Doral Country Club Golf Course)	4,200	55	Possible
Nearest Single Family Residential Unit	7,400	50	None
Nearest Multi-Family Residential Unit	9,500	48	None

*Based upon Noise Pollution Level (NPL) caculated with a standard deviation of 8 dbA.

4.1.6 Construction Schedule

The construction of the facility will take 30 months. Presented as Figures 4-1 and 4-2 are time scheduling and manpower requirements, respectively.

4.2 SPECIAL FEATURES

The landfill activity will attract certain species of gulls, crows, rodents and other omnivorous species presently associated with the adjacent landfill and urbanized areas. Some predation by these species on surrounding wildlife will occur, but should not significantly affect the overall functioning of the existing ecosystem.

4.3 ASSOCIATED TRANSMISSION FACILITY CONSTRUCTION

The construction of the bed supporting the transmission line and associated road will eliminate natural vegetation and wildlife along the right-of-way. The location of the associated transmission line is at the edge of the existing landfill. This area is severely disturbed already, and the construction of the transmission line will have little impact on the natural systems of the area.

4.4 RESOURCES COMMITTED

The proposed site preparation and plant construction will necessitate the total use of 160 acres. As a consequence, permanent and irretrievable loss of part of an already-disturbed wetland will result. The proposed project is, however, a necessary activity associated with the urbanization of South Florida. Related to the amount of similar wetlands in the area and the condition of these wetlands, the loss is minimal. Some of the services and values of the site, namely surface water storage and waste disposal, will be restored during the operation of the Resource Recovery project.

The long-term effect will be positive. In addition to restoration of some of the services, the site will become a source for considerable quantities of recycled material and electrical power from the solid waste of Miami. Both of these by-products of the Resource Recovery project reflect important conservation activities which ultimately reduce the impact of human activity on natural areas.

TIME SCHEDULE

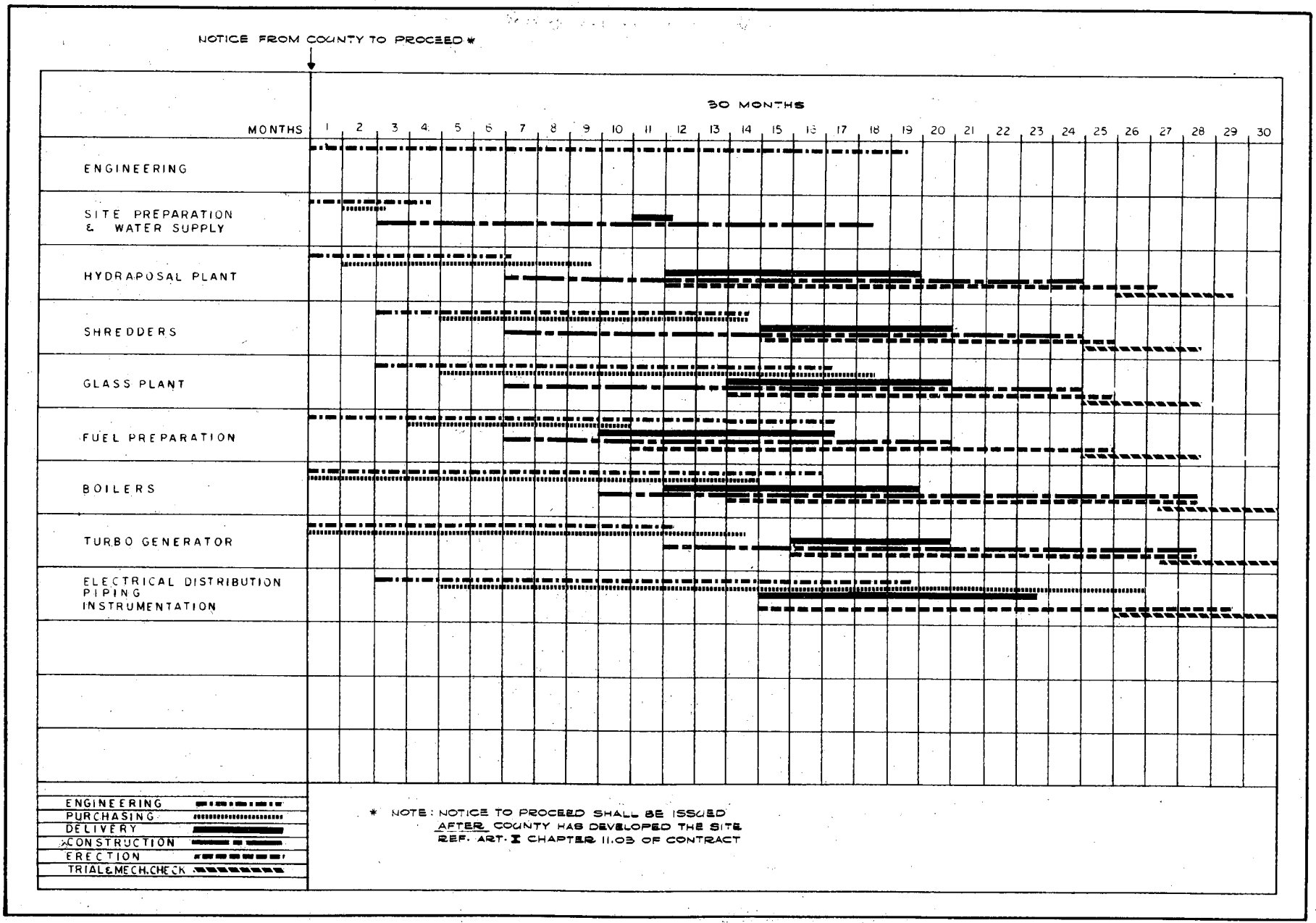


FIGURE 4-1

MANPOWER REQUIREMENTS

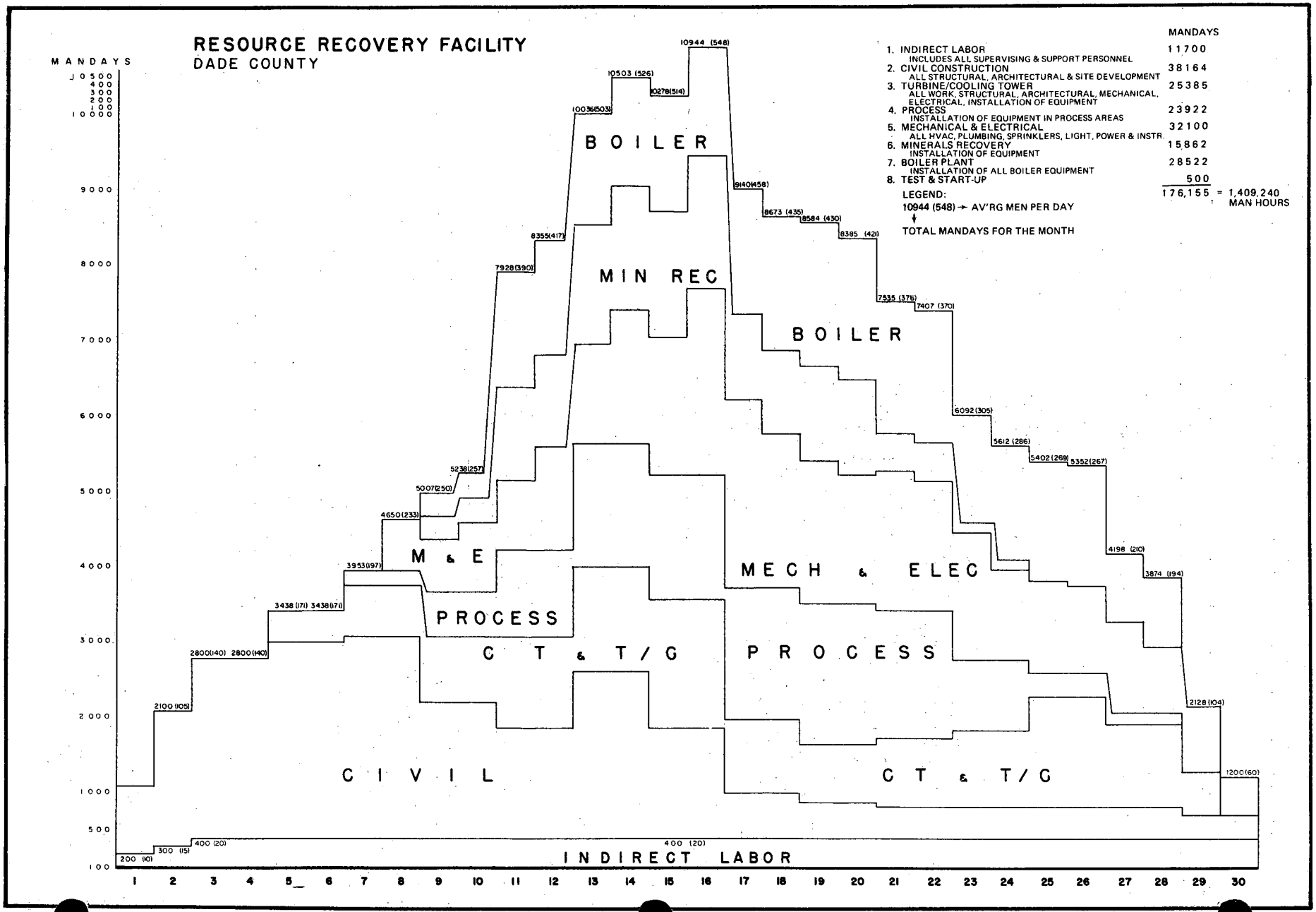
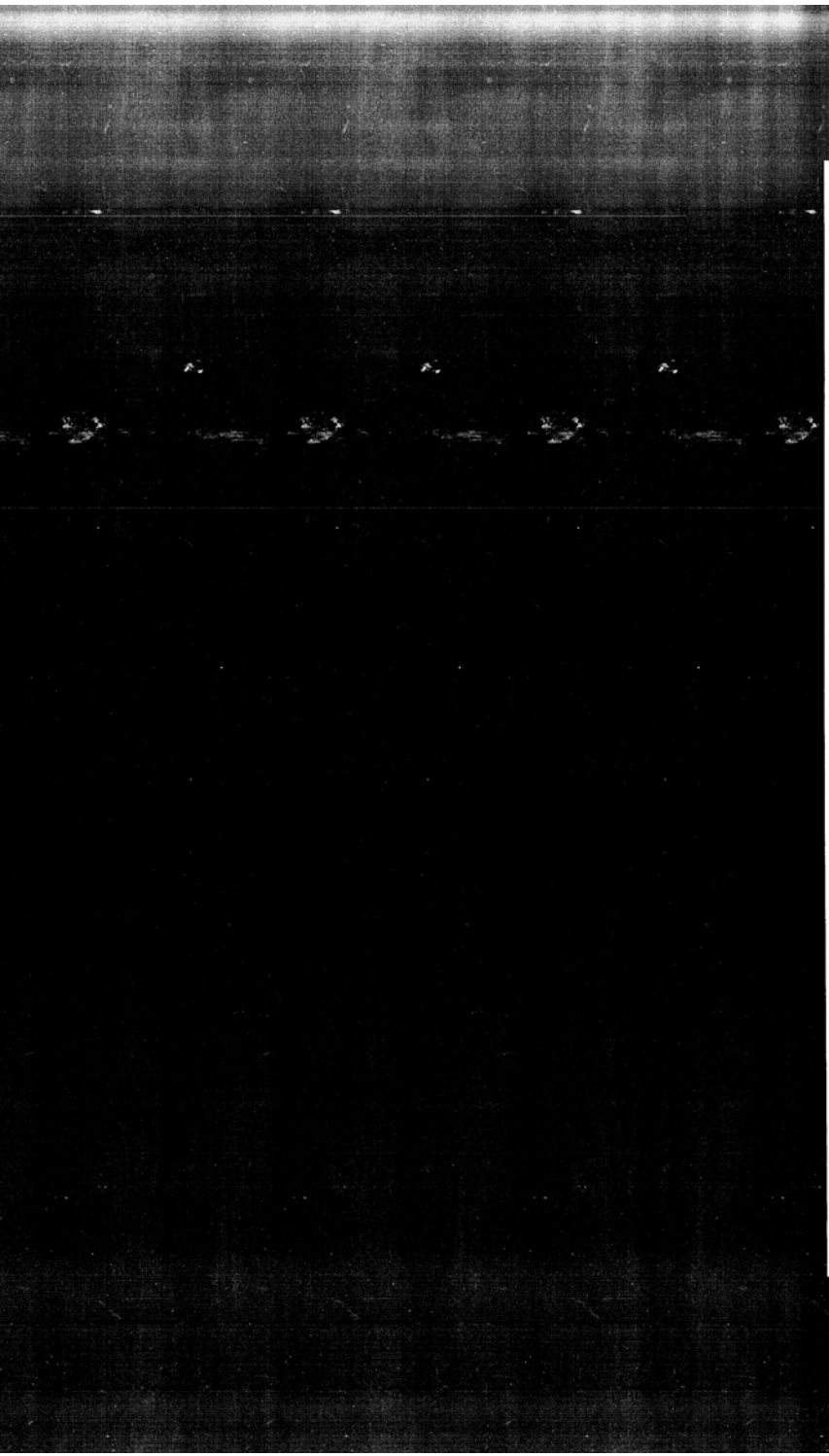


FIGURE 4-2



5.0 ENVIRONMENTAL EFFECTS OF OPERATION

5.0 ENVIRONMENTAL EFFECTS OF PLANT OPERATION

5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION

The design of the heat dissipation system, as discussed in Section 3.5, is based upon the recirculation and alternate uses of cooling water. A majority of the cooling tower blowdown water (88 GPM maximum) will be used as process water to prepare the pulped fuel. The remainder will be recirculated through a demineralizer to the cold lime softening treatment facility (Figure 3-4). The demineralizer backwash (3 GPM maximum) will be used in ash disposal. As a consequence, the present design eliminates the need to discharge any water associated with the heat dissipation system.

The Biscayne Aquifer near the project, conservatively speaking, has approximately the following aquifer characteristics:

$T = 1{,}000{,}000$ gallons per day per foot
$S = 1.5 \times 10^{-2}$

Schroeder and others (1958) report (values) ranged from 2,500,000 to 14,000,000 gallons per day per foot. No aquifer characteristics based on pump tests are available in proximity to the site.

Using the above mentioned aquifer characteristics, and based on 1.5 million gallons per day of pumping continuously for 6 months with no rainfall, the maximum drawdown in the pumped well would be less than 3 feet. One hundred feet away from the pumped well, the drawdown in the aquifer would be less than 2 feet. At 1,000 feet away from the pumped well, the maximum drawdown would be 1 to 1.5 feet. Under normal operating conditions, the drawdowns in the aquifer from the 1.5 million gallons per day withdrawal would be less than stated because the pumping will not be continuous for stated period except perhaps once in 50 years. For all practical purposes, the drawdown from the 1.5 million gallons per day well pumpage at the property line probably would be undetectable.

At the Miami Springs well field, the drawdown in the center of the well field is about 10 feet, with a withdrawal of 115 million gallons per day.

The cooling tower drift from this heat dissipation system is designed at 0.008 percent of the recirculating water, or 6.4 gallons per minute maximum (7,200 gallons per day average). Since certain chemicals are utilized to control corrosion, scaling, etc., the effects of this drift are discussed in Section 5.2.

5.1.1 Determination of Fogging Potential

General

A potential fogging condition exists when vapor emissions from a cooling tower can cause water vapor condensation to occur in its

immediate vicinity. In meteorological terminology, as water vapor is added to very moist air, the mixing ratio of that air increases towards that of saturation.

A saturation deficit is the amount of moisture a given air parcel needs to reach saturation at a given temperature. If air has a low saturation deficit and dense fog does not already exist, the fogging potential of a cooling tower increases. If dense fog already exists, saturation is already reached, and additional moisture will condense immediately.

Methodology

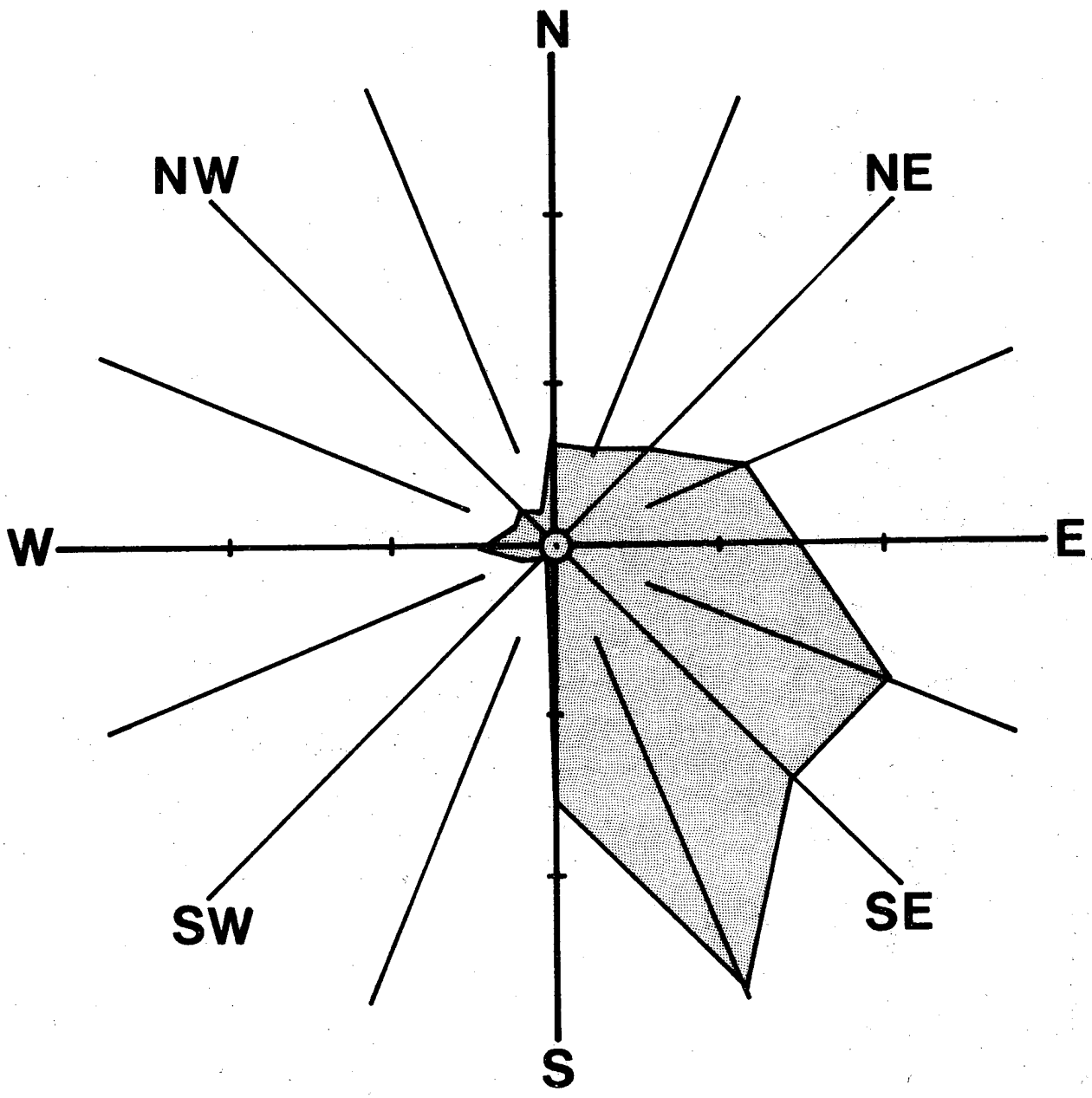
Maximum fogging potential was determined using ESE's FOGPTL computer model. The model determines the tabular and relative frequency distribution of wind and direction both seasonally and annually for each hour of maximum fogging potential. Fog is most likely to occur when a saturation deficit of 0.4 grams per cubic meter or less exists. From 6 years of surface observations at Miami International Airport, both the frequency of occurrence of saturation deficits of 0.4 grams per cubic meter or less and the frequency of occurrence of dense fog (3/8 mile visibility or less) were compared. The model assumes that the occurrence of a saturation deficit of 0.4 grams per cubic meter or less without dense fog indicates that the potential for fogging exists with the addition of moisture.

For each hour of fogging potential, the wind speed and direction is entered into a frequency distribution to determine the areas around the tower which are most likely to be affected on a seasonal basis. Figure 5-1 shows the frequency of occurrence of maximum fogging potential in the vicinity of the proposed site. As indicated in the figure, fog formed in the tower would occur mainly in the southeastern quadrant from the tower. The value at each direction represents the frequency of occurrence in that direction and not the distance downwind that the plume would flow.

Table 5-1 portrays the wind distribution of maximum fogging potential hours in tabular form. From a breakdown of wind directions into 6 wind speed classes, it is evident that the great majority of these conditions experience wind speeds from 4 to 6 knots (1 mile per hour = 0.87 knot). When these occurrences are divided by all hours, Table 5-2 gives the relative frequency of occurrence of wind distribution of fogging potential. This table was used to create Figure 5-1.

From the meteorological record used (1969 to 1974, 8 observations per day), the total number of hours in which a maximum fogging potential condition existed is 273. Appendix D contains both a tabular and percentage breakdown of these 273 observations for each season. Note that for the seasonal frequency tables, the relative

FREQUENCY OF OCCURRENCE OF MAXIMUM FOGGING POTENTIAL



RELATIVE FREQUENCY OF OCCURRENCE (PERCENT X 10^{-2}) OF MAXIMUM FOGGING POTENTIAL IN THE VICINITY OF THE PROPOSED FACILITY (LOCATED AT CENTER). TICK MARKS ON CARDINAL WIND AXES REPRESENT 0.1 PERCENT OF ALL TIME. OCCURRENCE OF FOGGING POTENTIAL DURING CALM WIND CONDITIONS IS 6.3 X 10^{-2} PERCENT. SIX YEAR PERIOD OF RECORD, 1969-74, MIAMI, FLORIDA.

FIGURE 5-1

Table 5-1. Wind Distribution of Maximum Fogging Potential.

Wind Direction	Wind Speed Class (Kts) 0-3	4-6	7-10	11-16	17-21	GT21	Total
N	7	12	7	1	0	0	27
NNE	0	1	0	1	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	2	1	1	0	0	4
E	2	4	1	1	0	0	8
ESE	1	3	0	0	1	0	5
SE	1	4	0	0	0	0	5
SSE	2	2	0	0	0	0	4
S	2	6	2	1	0	0	11
SSW	6	5	0	0	0	0	11
SW	3	8	3	0	0	0	14
WSW	2	17	1	2	0	0	22

Table 5-1. Wind Distribution of Maximum Fogging Potential (Cont'd.).

Wind Direction	Wind Speed Class (Kts) 0-3	4-6	7-10	11-16	17-21	GT21	Total
W	9	15	1	0	0	0	25
WNW	8	27	3	0	0	0	38
NW	4	25	4	2	0	0	35
NNW	13	31	5	2	0	0	51
Calm	11						11

Annual

Hours With Heavy Fog (3/8 Mile or Less Visibility) = 15

Hours of Saturation Deficit Less Than or Equal To 0.4 G/Cu. Meter = 288

Maximum Fogging Potential Hours = 273

Table 5-2. Relative Wind Distribution of Maximum Fogging Potential.

Wind Direction	Wind Speed Class (Kts) 0-3	4-6	7-10	11-16	17-21	GT21	Total
N	0.00040	0.00068	0.00040	0.00006	0.0	0.0	0.00154
NNE	0.0	0.00006	0.0	0.00006	0.0	0.0	0.00011
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.00011	0.00006	0.00006	0.0	0.0	0.00023
E	0.00011	0.00023	0.00006	0.00006	0.0	0.0	0.00046
ESE	0.00006	0.00017	0.0	0.0	0.00006	0.0	0.00029
SE	0.00006	0.00023	0.0	0.0	0.0	0.0	0.00029
SSE	0.00011	0.00011	0.0	0.0	0.0	0.0	0.00023
S	0.00011	0.00034	0.00011	0.00006	0.0	0.0	0.00063
SSW	0.00034	0.00029	0.0	0.0	0.0	0.0	0.00063
SW	0.00017	0.00046	0.00017	0.0	0.0	0.0	0.00080
WSW	0.00011	0.00097	0.00006	0.00011	0.0	0.0	0.00126

Table 5-2. Relative Wind Distribution of Maximum Fogging Potential (Cont'd.).

Wind Direction	Wind Speed Class (Kts) 0-3	4-6	7-10	11-16	17-21	GT21	Total
W	0.00051	0.00086	0.00006	0.0	0.0	0.0	0.00143
WNW	0.00046	0.00154	0.00017	0.0	0.0	0.0	0.00217
NW	0.00023	0.00143	0.00023	0.00011	0.0	0.0	0.00200
NNW	0.00074	0.00177	0.00029	0.00011	0.0	0.0	0.00291
Calm	0.00063						0.00063

Total Number of Hours Read = 17,528

totals are based on 273 observations, while the annual frequencies (Table 5-2) are based on 17,528 observations. Table 5-3 summarizes the pertinent information for each season and annually. Fogging potential increases during the cooler seasons, but can exist in any season.

Conclusions

The above methodology and results are very conservative. Actual occurrences of ground-level fogging from the cooling tower will probably be substantially below these values because of the elevated release point and the mechanical draft which will aid the plume buoyancy and help it disperse aloft. The seasonal relative percentages are believed accurate, due to the six-year period of record used. In all, however, the proposed cooling tower will not contribute much to the area's normal cloudiness.

5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

As previously discussed in Sections 3.4 and 3.5, no liquid effluent discharge will occur. All water containing chemicals, i.e., boiler and cooling tower blowdowns, cleanings, floor drains, ion exchange regeneration wastes, etc., will be either recirculated, disposed with ash, or used as process water.

The chemicals in the process water will ultimately end up in the ash and landfill (refer to Section 3.5). Ash which will contain approximately 16 percent moisture when landfilled is sluiced with ion-exchange water. Leachate will be controlled by diverting runoff from completed and active cells to a 40-acre drainage system on the property. Therefore, no deleterious environmental effects from these wastes are probable.

Cooling Tower Drift Deposition

The mechanical entrainment of cooling tower waters into the air flowing through a cooling tower results in the dispersion of drift droplets into the atmosphere having the same solute concentration as the cooling waters. The presence of biocides and rust inhibitors in the cooling waters causes some concern as to the impact of the drift deposition on the surrounding environment.

Utilizing the trajectory techniques discussed in Appendix E, estimates of annual average deposition rates were developed. For the westerly 22.5 degree sector, where deposition will be at a maximum due to the frequency of easterly winds, Figure 5-2 results. As can be seen, the rate of deposition will decrease more than four orders of magnitude within the first 200 meters of the tower. Any adverse impact of the drift is thus expected to be confined to the proposed plant site.

Table 5-3. Number of Hours of Saturation Deficit $\leq$ 0.4 g/m^3, Of Dense Fog, and of Maximum Fogging Potential -- Miami, Florida, 1969 - 1974, Eight Observations Per Day

SEASON	SATURATION DEFICIT	DENSE FOG	MAXIMUM FOGGING POTENTIAL
Winter (DJF)	106	7	99
Spring (MAM)	64	7	57
Summer (JJA)	45	0	45
Autumn (SON)	73	1	72
Annual	288	15	273

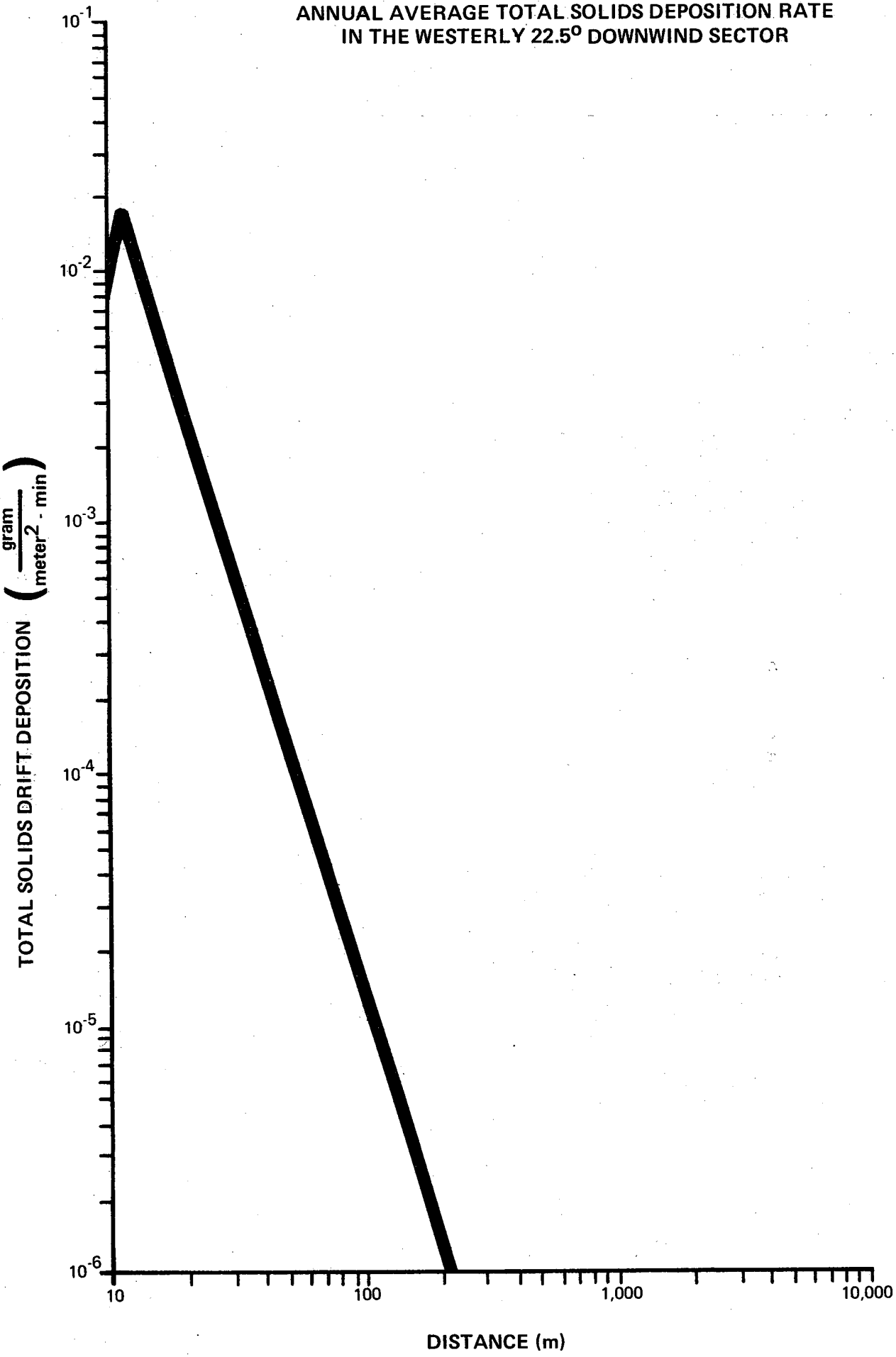

ANNUAL AVERAGE TOTAL SOLIDS DEPOSITION RATE
IN THE WESTERLY 22.5° DOWNWIND SECTOR
TOTAL SOLIDS DRIFT DEPOSITION (gram / meter² - min)
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10
100
1,000
10,000
DISTANCE (m)

FIGURE 5-2

5.3 EFFECTS ON SANITARY AND OTHER WASTE DISCHARGES

Runoff from the plant and plant site will be collected on site and will not affect the surrounding ecological systems.

5.4 EFFECTS OF AIR EMISSIONS

The local impact of the proposed facility for both long and short term TSP and SO_2 was analyzed. The AQDM results for both sulfur dioxide and particulate concentrations in 1974 are shown in Figures 5-3 and 5-4. The subsequent SO_2 and TSP AQDM results for 1980, with the new facility, are portrayed in Figures 5-5 and 5-6. The SO_2 and TSP incremental impact of the new facility on the 1980 air quality is shown as Figures 5-7 and 5-8, respectively. It is noteworthy that the incremental impact of the proposed facility at the maximum concentration is approximately one microgram per cubic meter. All results are uncalibrated, so that while the percentage increase or decrease is realistic, the actual peak value may be inaccurate. The air quality data does not corroborate these high values. Table 5-4 summarizes the annual modeling results.

The maximum SO_2 short-term impact of the proposed facility is portrayed in Table 5-5. Included are the maximum interaction and incremental values for the new plant. As with the annual results, the proposed facility is not a large SO_2 source in itself and the maximum interaction concentrations are still within the state (although not the county) ambient standards.

Short-term TSP concentrations from the proposed facility are shown in Table 5-6. Since the 1974 particulate standards were exceeded, significant deterioration does not apply. However, the short-term TSP impact of the plant is very small, even when compared to an improving overall TSP air quality.

The quantities of particulates and sulfur dioxide emitted by the proposed facilities (see Section 3.7) are not considered to be harmful to the surrounding ecological communities (Newman, 1975).

Appendix E presents a complete air quality impact analysis for the proposed facility.

5.5 EFFECTS OF THE OPERATION AND MAINTENANCE OF THE ASSOCIATED TRANSMISSION SYSTEM

The south and west sides of the area containing the site presently have transmission lines. The short segment of transmission line will be added to the site and will contribute to the general impact of transmission lines on wildlife in this area (e.g., bird collisions). Since the natural ecosystem will be eliminated by the plant and by landfill, and the location of the new transmission line will be next to the present landfill, this line should not greatly compound the problem.

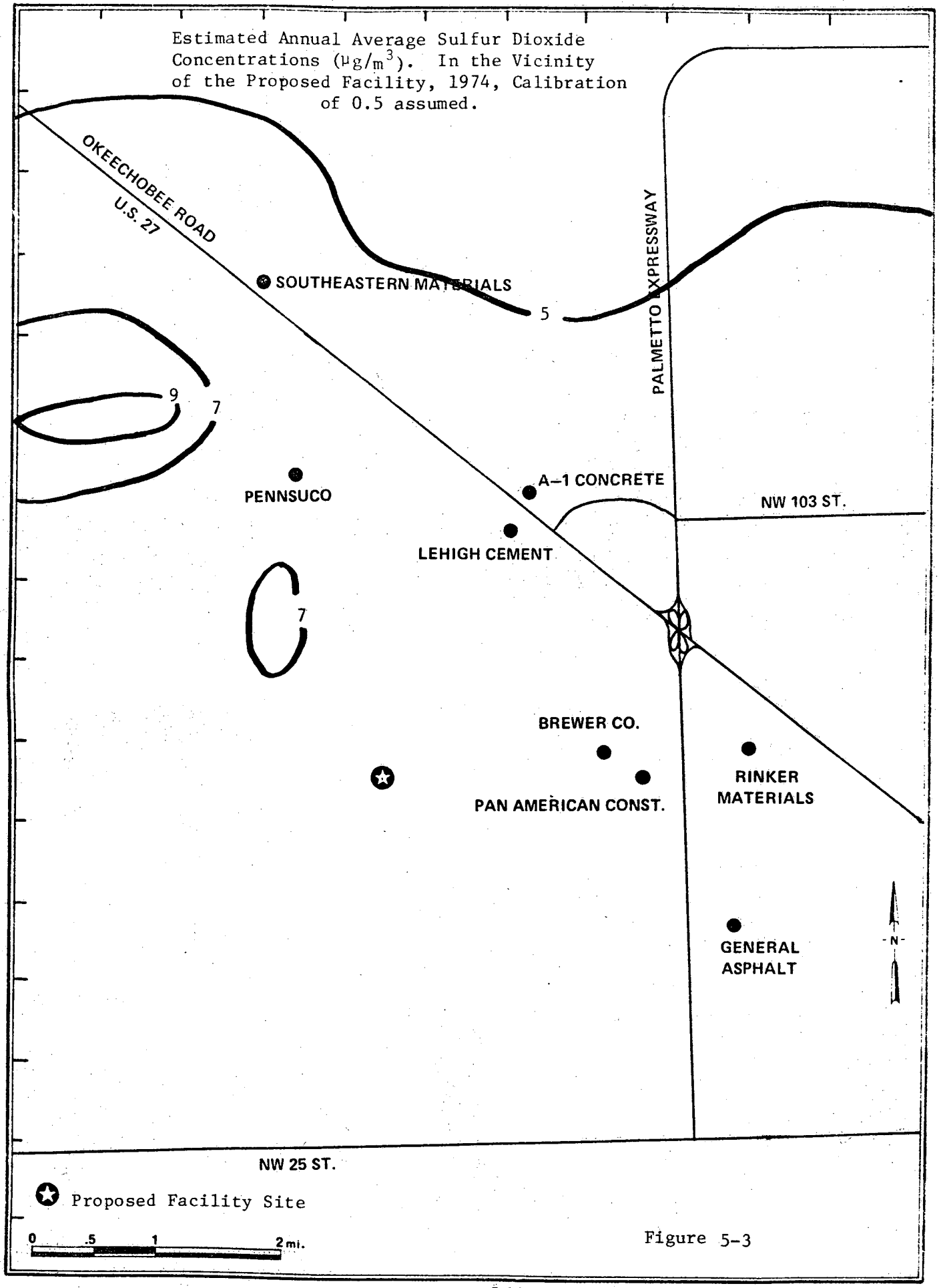

Estimated Annual Average Sulfur Dioxide Concentrations (μg/m³). In the Vicinity of the Proposed Facility, 1974, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
PALMETTO EXPRESSWAY
SOUTHEASTERN MATERIALS
5
9
7
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
7
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-3

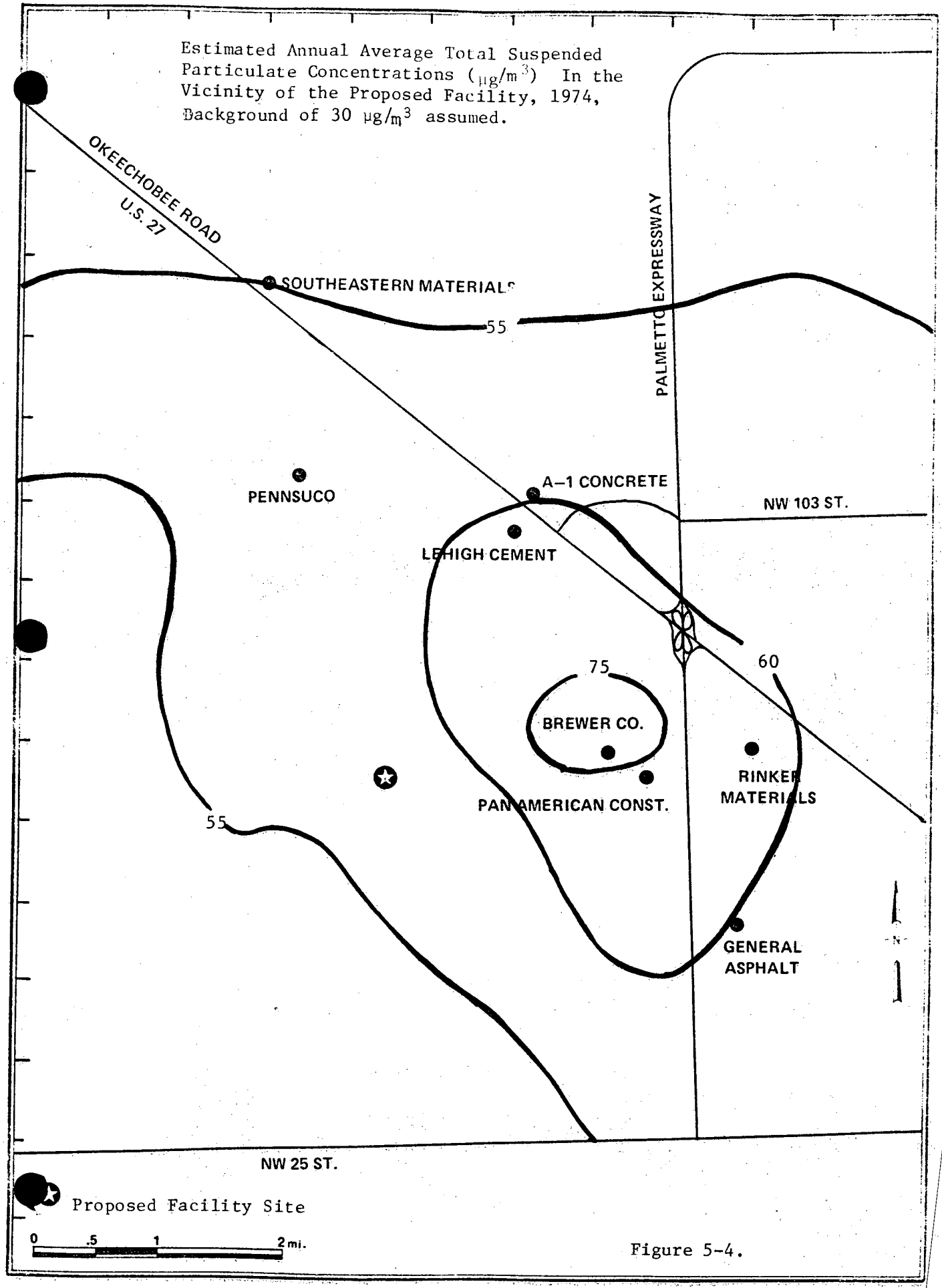

Estimated Annual Average Total Suspended Particulate Concentrations (μg/m³) In the Vicinity of the Proposed Facility, 1974, Background of 30 μg/m³ assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
55
PALMETTO EXPRESSWAY
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
75
60
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
55
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-4.

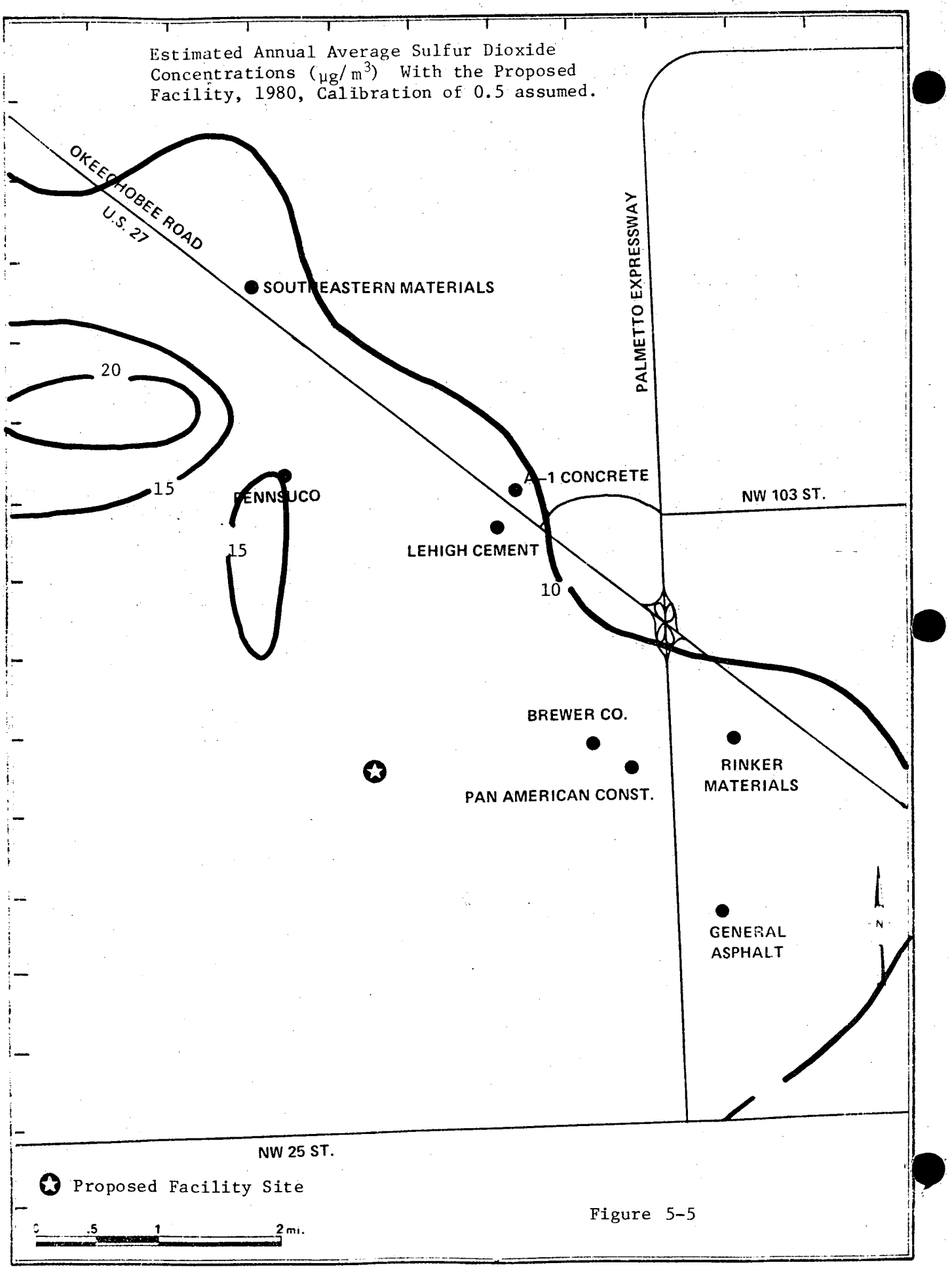

Estimated Annual Average Sulfur Dioxide Concentrations (μg/m³) With the Proposed Facility, 1980, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
20
15
PENNSUCO
15
A-1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
10
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-5

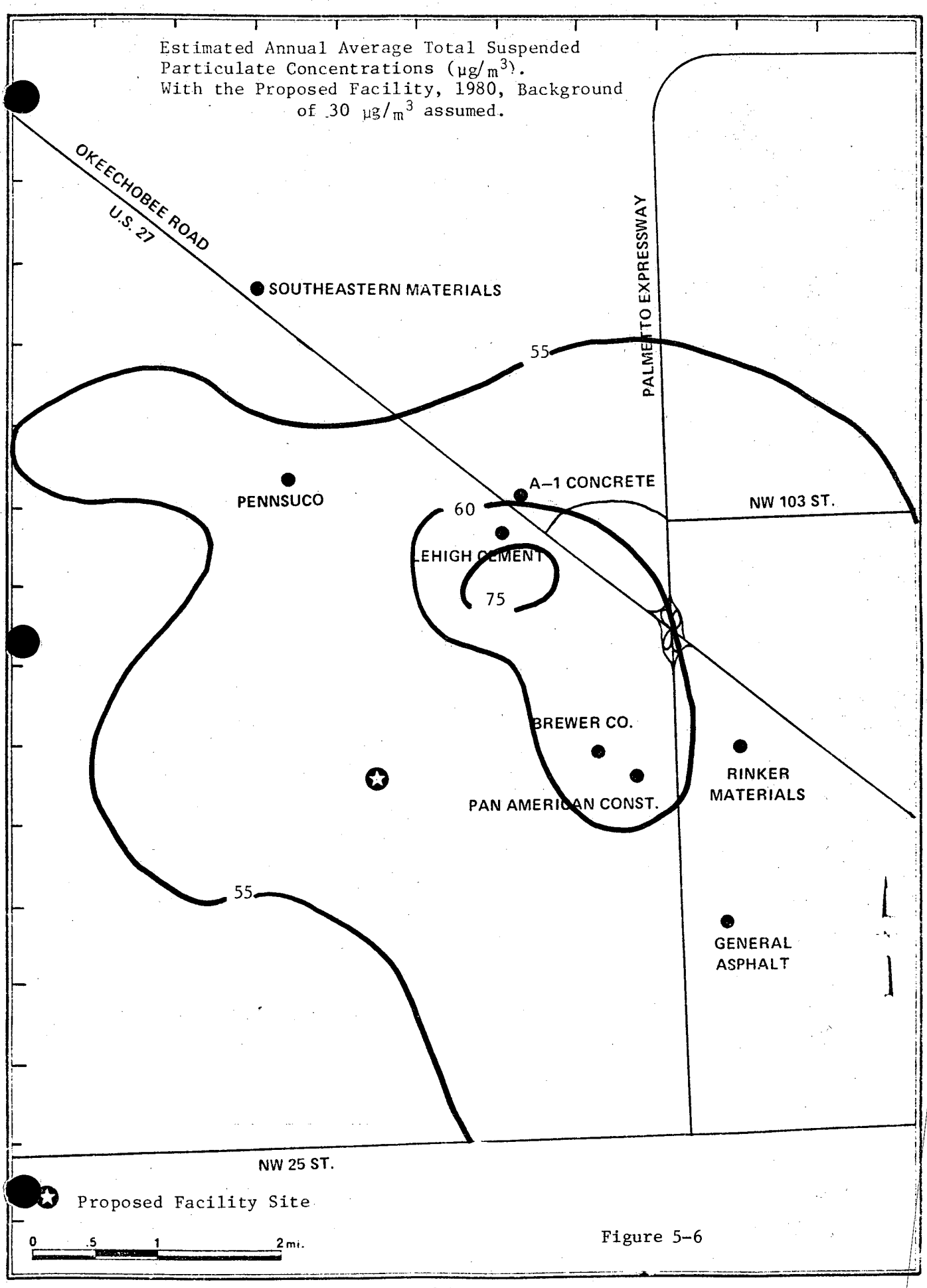

Estimated Annual Average Total Suspended Particulate Concentrations (μg/m³).
With the Proposed Facility, 1980, Background of 30 μg/m³ assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
55
PENNSUCO
A-1 CONCRETE
NW 103 ST.
60
LEHIGH CEMENT
75
BREWER CO.
RINKER MATERIALS
PAN AMERICAN CONST.
55
GENERAL ASPHALT
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-6

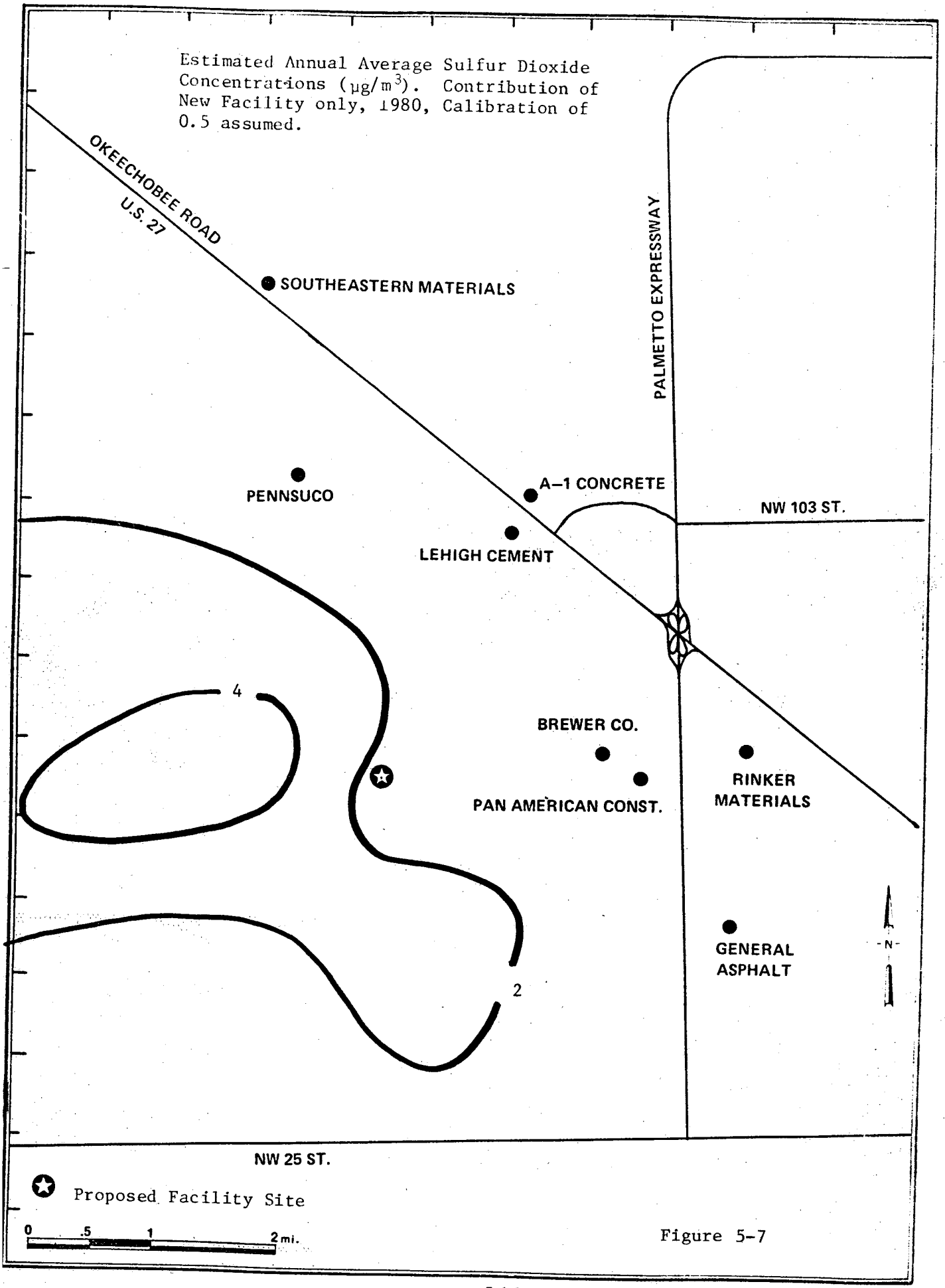

Estimated Annual Average Sulfur Dioxide Concentrations (µg/m³). Contribution of New Facility only, 1980, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
PALMETTO EXPRESSWAY
SOUTHEASTERN MATERIALS
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
4
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
GENERAL ASPHALT
2
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-7

Table 5-4 Maximum Estimated Annual Average SO_2 and TSP Concentrations ($\mu g/m^3$) 1974 and 1980

	1974	1980	Increment
Sulfur Dioxide [b]	9	27	1
Particulate [c]	166	94	1

a. New facility incremental impact at maximum.

b. Calibration of 0.5 used for SO_2.

c. Includes 30 $\mu g/m^3$ background, annual arithmetic mean calibration of 1.0.

Table 5-5 Maximum Short-term Sulfur Dioxide Concentrations ($\mu g/m^3$) for the Proposed Facility, 1980. (A calibration of 1.0 is assumed.)

Maximum Concentration	Averaging Time			
	24-Hour	3-Hour	4-Hour	1-Hour
Interaction [a]	120	298	283	325
Incremental [a]	29	95	90	114
Ambient Standards				
EPA Primary	365 [b]	NA [c]	NA	NA
State of Florida	260 [b]	1300 [b]	NA	NA
Dade County	28.6 [d]	NA	57.2 [d]	286 [d]

a. Interaction with most influential source.

Incremental Maximum Concentration from proposed facility.

b. Not to be exceeded more than once per year.

c. NA = Not applicable.

d. Maximum concentration, not to be exceeded.

Table 5-6 Maximum Short-term Particulate Concentrations ($\mu g/m^3$) for the Proposed Facility, 1980. (A calibration of 1.0 is assumed.)

Maximum Concentration	Averaging Time
	24-Hour
Interaction [a]	39
Incremental [a]	10
Ambient Standards	
EPA Primary	260 [b]
State of Florida	150 [b]
Dade County	180 [c]

a. Interaction with most influential source.

Incremental Maximum Concentration from proposed facility.

b. Not to be exceeded more than once per year.

c. Maximum concentration, not to be exceeded.

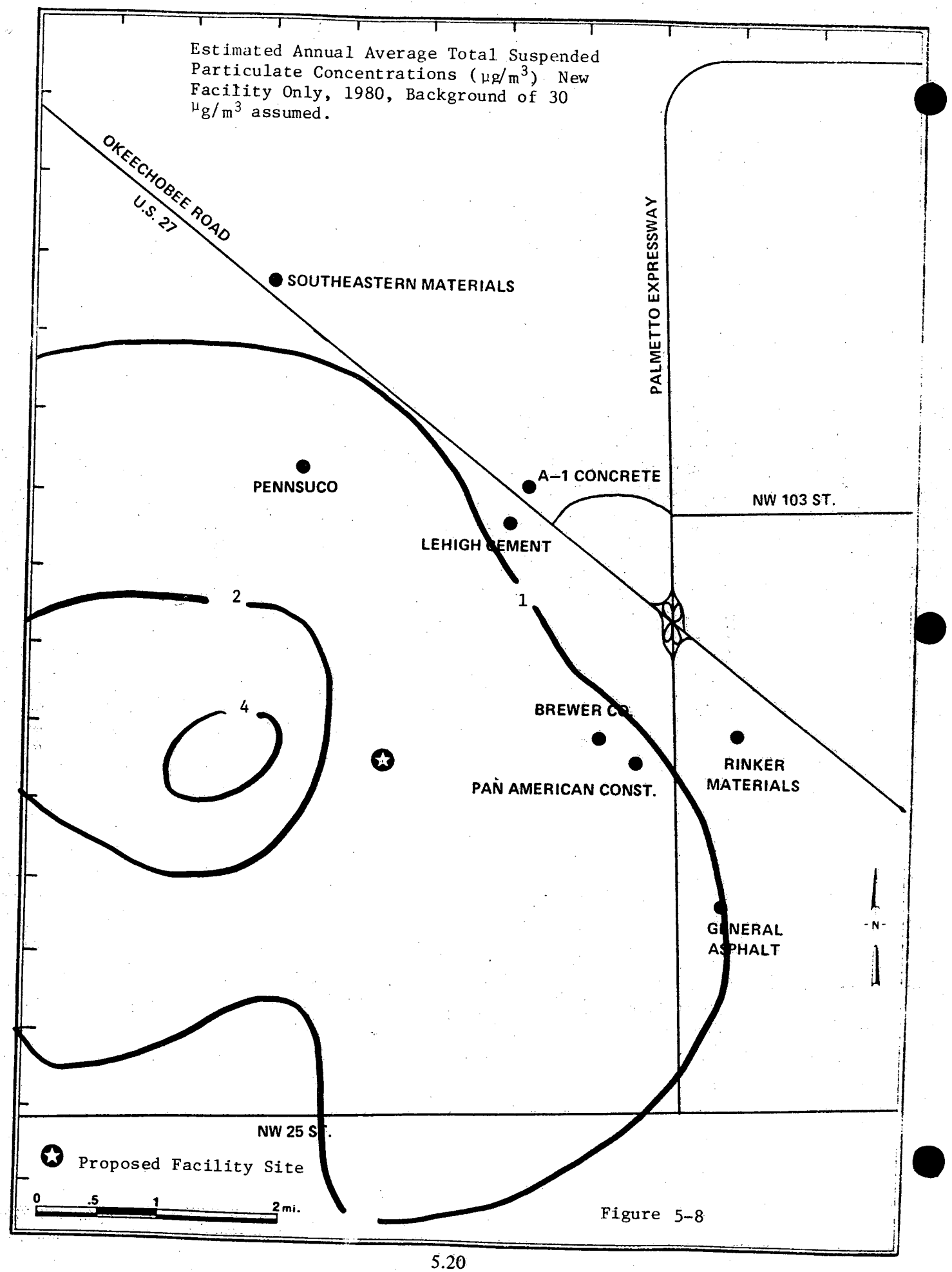

Estimated Annual Average Total Suspended Particulate Concentrations (μg/m³) New Facility Only, 1980, Background of 30 μg/m³ assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
2
1
4
BREWER CO.
RINKER MATERIALS
PAN AMERICAN CONST.
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-8

5.6 OTHER EFFECTS

Noise will be generated primarily from the truck traffic associated with the land fill. This will have minor effects on the wildlife population. The area has had similar noise conditions in the past.

When the Resource Recovery Plant becomes operational, the 58th Street Landfill will be shut down permanently. A major reduction in its leachate discharge can then take place. Converted to a park, with suitable protective top cover, it will no longer contaminate ground water. Also, fugitive dust emissions from the packer trucks and landfill vehicles will be eliminated.

The water withdrawal by the adjoining Resource Recovery Plant will tend to divert the direction of flow of the 58th Leachate cone, slowing or stopping its eastward movement toward Hialeah. This will contribute to the ongoing drying of the natural system of the area.

Noise Impact

When an object in the atmosphere vibrates, similar oscillations are induced in the surrounding air. This produces alternating regions of high and low pressure in the form of disturbances which spread out radially from the object. When these vibrations reach the ear, they induce vibrations in the ear drum which are ultimately translated as sound.

Sound has associated with it energy and usually is described in terms of three wave variables, amplitude, frequency and duration. Amplitude is a measure of the maximum excursion a sound wave makes from the average of the pressure or displacement of the wave. Frequency denotes the pitch of a pure tone and is the time required for the sound wave to oscillate between a positive and negative value of maximum amplitude. Duration is simply how long the sound persists.

The energy associated with a sound wave is described in terms of intensity which is the average energy that flows through a unit area in unit time; this is an energy flux. For spherically symmetrical waves, the intensity is proportional to the inverse square of the distance between the source and the receptor.

Since it is difficult to measure sound energy directly, a system of measurement has been developed in which the average (rms) pressure excursions are measured against a reference pressure of 20 micronewtons per square meter. A logarithmic scale has been designed with the Sound Pressure Level (SPL) measured in decibels (db) where:

$$SPL = 20 \log (P/.00002)$$

The pressure (P) is the root-mean-square sound pressure in micronewtons per square meter.

Sound is perceived by the human ear between frequencies of 16 and 20,000 Hertz (AIHA, 1975). One important characteristic of the human ear is that throughout its range of perception, sounds of equal pressure level at equal loudness are not perceived equally. Sounds of lower frequencies are not heard as easily as are sounds in the mid-range. A system of sound measurement based upon the response of the human ear has been developed. The quantity measured is the Sound Level (L) and the units are decibels (db). The sound level follows a power law such that a 10-decibel increase is perceived as doubling of loudness. An A-weighted sound level is the scale which most nearly approximates the response of the human ear. Sound level decreases as a result of obstructions such as trees and natural buffer zones that attenuate the pressure waves. Sound levels may, however, be increased by obstructions that tend to reflect sound pressure waves.

Noise is defined as sound that is objectionable regardless of its level, and as such is a subjective measurement. It is sound, however, and follows the same laws as any other sound. Noise can be excessive, erratic, intermittent or statistically random.

Environmental noise is generally measured with a sound level meter and expressed in terms of its frequency distribution or with a scale which electronically attenuates certain frequencies to match the characteristics of the human ear (A-scale) or some other receptor. Most guidelines for environmental noise are defined in terms of the A-scale and expressed as a statistical measure. The L10 is the sound level which is not exceeded 10 percent of the time during a measurement period. The L50 is the sound level which is not exceeded 50 percent of the time during a measurement period.

Noise is believed to cause stress and its related disorders. It was assumed in the past that protection against hearing loss provided sufficient protection against stress-related disorders. It is now known that levels below those believed to affect hearing are sufficient to produce physiological symptoms in humans that are related to stress (U. S. EPA), 1974).

Highway traffic has long been recognized as a major contributor to environmental noise. The U. S. Department of Transportation has published Design Noise Level criteria based upon land use (DOT, 1972). Their suggested criteria are the L10's for various land use categories and are reproduced in Table 5-7.

The U. S. EPA has published noise levels requisite to protect the public against hearing loss or activity interference for various land

use categories (EPA, 1974). Sound levels are given as Leg (24) and Leg (dn) and are yearly averages on an energy basis. The values suggested by the U. S. EPA are shown in Table 5-8. These values are for very long-term exposures and take into consideration the cumulative effects of noise. Requisite noise levels chosen to protect the public against hearing loss have been set such that 96 percent of the population will not experience a hearing threshold shift of more than 5 dbA at 4000 Hertz in 40 years of continual exposure.

In order to properly characterize the existing noise environment, an ambient noise survey in the site vicinity was conducted on May 25, 1977. A General Radio precision sound level meter was utilized for the survey. The sampling procedure recommended by Bolt, Beranek and Newman, Inc., was followed. The survey site locations are shown in Figure 5-9. The results are summarized in Table 5-9. The present noise levels in the vicinity of the existing landfill are fairly high.

Similar noise levels are to be expected near the proposed plant during operation. The noise will be generated by two main sources, truck traffic and equipment operating noise. The truck traffic is not expected to be greater than that presently found at the existing landfill. The traffic to the landfill will be rerouted on 58th Street and 97th Avenue to the facility, so that the noise impact from truck traffic will actually be quite minimal. The additional travel distance will be approximately one mile.

Equipment operating noises will largely be contained in the plant building. The main outside source of noise will consist of fans and other minor equipment. Assuming forced draft fan as a worst case, a sound pressure level of 96 dbA can be expected within a few feet of the source. Based on this assumption, the 6 db sound level attenuation per doubling of distance for hemispherical sound radiation was utilized to project noise levels to nearby sensitive locations. This noise projection technique should be quite conservative since it ignores the attenuation due to terrain effects, and these attenuation effects are expected to be in the range of 2 to 12 dbA per hundred feet. The noise projections are based on the additional assumption that the initial distance for the 96 dbA measurement was 5 feet. Table 5-10 summarizes these results. As can be seen, operating noises are not expected to cause a significant impact at the locations examined.

5.7 RESOURCES COMMITTED

See discussion 4.4.

Table 5.7. Federal Highway Administration Design Noise Level/Land Use Relationships.

Land Use Category	Design Noise Level - L10*	Description of Land Use Category
A	60 dbA (Exterior)	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	70 dbA (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	75 dbA	Developed lands, properties or activities not included in Categories A and B above.
D	Variable	For requirements on undeveloped lands, see Paragraphs 5a(5) and (6), this policy and procedure manual.
E	55 dbA	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: U. S. Department of Transportation, 1972.

* L10 represents the level which can be exceeded no more than 10 percent of the time.

Table 5-8. Yearly Average Equivalent Sound Levels Required to Protect the Public Health and Welfare.

Land Use	Measure	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)
1 Residential with Outdoor Space and Farm Residences	L	45		45	55		55
	L		70			70	
2 Residential with No Outside Space	L	45		45			
	L		70				
3 Commercial	L	(a)	70	70(c)	(a)	70	70(c)
4 Inside Transportation	L	(a)	70	(a)			
5 Industrial	L	(a)	70	70(c)	(a)	70	70(c)
6 Hospitals	L	45		45	55		55
	L		70			70	

Table 5-8. Yearly Average Equivalent Sound Levels Required to Protect the Public Health and Welfare (Cont'd.).

Land Use	Measure	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects(b)
7 Educational	L	45		45	55		55
	L		70			70	
8 Recreational Areas	L	(a)	70	70(c)	(a)	70	70(c)
9 Farm Land and General Unpopulated Land	L				(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.

b. Based on lowest level.

c. Based only on hearing loss.

Table 5-8. Yearly Average* Equivalent Sound Levels Required to Protect the Public Health and Welfare (Cont'd.).

Code: continued

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 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.

* Refers to energy rather than arithmetic averages.

Source: EPA 1974

NOISE SAMPLING LOCATIONS

FIGURE 5-9

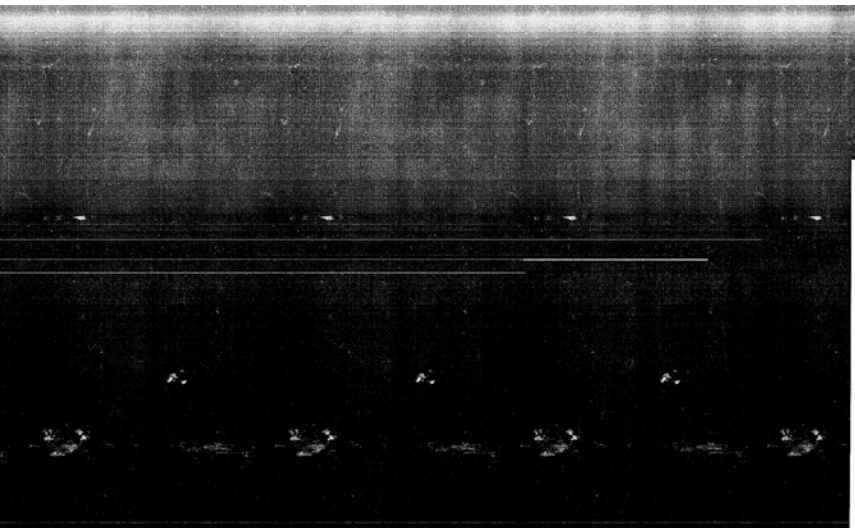
Table 5-9. Ambient Noise Survey Results, May 25, 1977.

Station Number	Description	Time	L_{50}	L_{10}
1	N.W. 58th Street, Plant Site	3:00- 3:15	46-48	50-52
1	" "	11:45-11:50	60-62	64-66
2	Proposed Site	11:55-12:00	40-42	44-46
3	Landfill Entrance	12:20-12:30	62-64	74-76
4	Landfill		68-70	72-74
5	Doral Country Club	13:20-13:30	46-48	50-52
6	NE of Proposed Site	14:00-14:20	46-48	50-52
7	NE 53rd Street and NW 79th Avenue	15:45-15:55	60-62	64-66

Table 5-10. Estimated Maximum Probable Operating Noise Impacts on Noise-Sensitive Areas for the Proposed Resource Recovery Facility.

	Distance From Source To Receptor (feet)	Sound Level At Receptor From Operation (dbA)	Problem*
Recreation (Nearest Point of Doral Country Club Golf Course)	4,200	38	None
Nearest Single Family Residential Unit	7,400	33	None
Nearest Multi-Family Residential Unit	9,500	30	None

* Based upon Noise Pollution Level (NPL) calculated with a standard deviation of 8 dbA.



6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 SURFACE WATER

The construction and operation of the proposed Resource Recovery Facility will not significantly impact on any surface waters. As a consequence, the need to monitor surface waters was not established. One grab sample analysis was performed for surface water located feet from the proposed facility. The analysis was performed by Wingerter Laboratories.

6.2 PHYSICAL AND CHEMICAL PARAMETERS

Monitoring of physical and chemical parameters in surface waters will not be performed as indicated above.

6.3 ECOLOGICAL PARAMETERS

Determination of the ecological characteristics of the site was achieved by three methods: literature review, on-site ecological survey, and discussions with knowledgeable individuals regarding the ecology of the site. A list of references and pertinent literature is included at the end of this report.

An on-site survey was made in May, 1977. During this survey, an inventory of dominant plant species was made using a modified Braun-Blanquet method. Three transects 80 meters long with 10 sampling stations 8 meters apart were laid out. The percent cover of the major plant species within an approximately 9-square meter quadrat was recorded. Other less common plant species were also recorded. Observation and recording of birds, mammals, amphibians and reptiles were made along each transect and 2 additional random surveys were made of the area. These surveys were completed with the aid of biologists from Metropolitan Dade County Environmental Resources Management Unit. Based on information gathered by the literature search and the ecological survey, contact was made with the Florida Game and Fresh Water Fish Commission, the U. S. Fish and Wildlife Service, and the Florida Audubon Society to verify and/or supplement the observed ecological characteristics of the site.

Species determinations were made using appropriate taxonomic keys cited in the list of references and pertinent literature of Section 2.7. Since the site preparation and plant construction will eliminate the natural ecosystem of the existing site, an ecological monitoring program of the existing wetland-forest on the site after construction and during operation is not applicable.

6.4 GROUND WATER

The locations of the monitoring wells are presented in Figure 3-7, labeled "Location of the Monitoring Well Site." As can be seen from this figure, there will be four new monitoring wells constructed; two wells on the eastern edge of the landfill, and one in a northerly direction. Additionally, two presently installed wells, designated Site Number 1 and Site Number 2, will also be utilized for the monitoring program.

The two wells on the existing edge of the landfill are being placed as close to the landfill as possible, to minimize the influence of the existing county landfill in the adjacent section.

Initially, samples will be drawn from the 10-foot, 20-foot, and 30-foot levels every two months. Refer to Figure 6-1 for typical detail of wells. The procedure will be to purge the wells, which will be lined with PVC pipe, with a portable motor driven pump. The pH will be determined immediately with a portable potentiometer. The sample will then be forwarded to a laboratory and analyzed for the following parameters:

Parameters for Monitoring Wells

Cd	pH
COD	NO_3
Total Dissolved Solids	NO_2
Fe	Coliform
Cu	Fecal Coliform
Zn	BOD
Pb	

Depending on the trends that are indicated by this sampling and analyzing procedure, the frequency of sampling and the parameters sampled will be modified to insure that an adequate, but not excessive, amount of data is required.

6.5 AIR

All information (emissions, meteorology, etc.) was compiled off-site by cooperating governmental agencies. Data on TSP and SO_2 air quality were obtained from 17 and 8 ambient stations, respectively, located throughout the City of Miami and Dade County. There will be no significant changes in all these programs after plant operation has begun.

Meteorological data were acquired from Miami International Airport's office of the U. S. Weather Bureau. These include both surface and upper-air climatology. Data on wind direction, wind speed and stability joint-frequencies were developed from 6-year averaged data, 1969 to 1974,

TYPICAL MONITORING WELL SITE INSTALLATION DETAIL

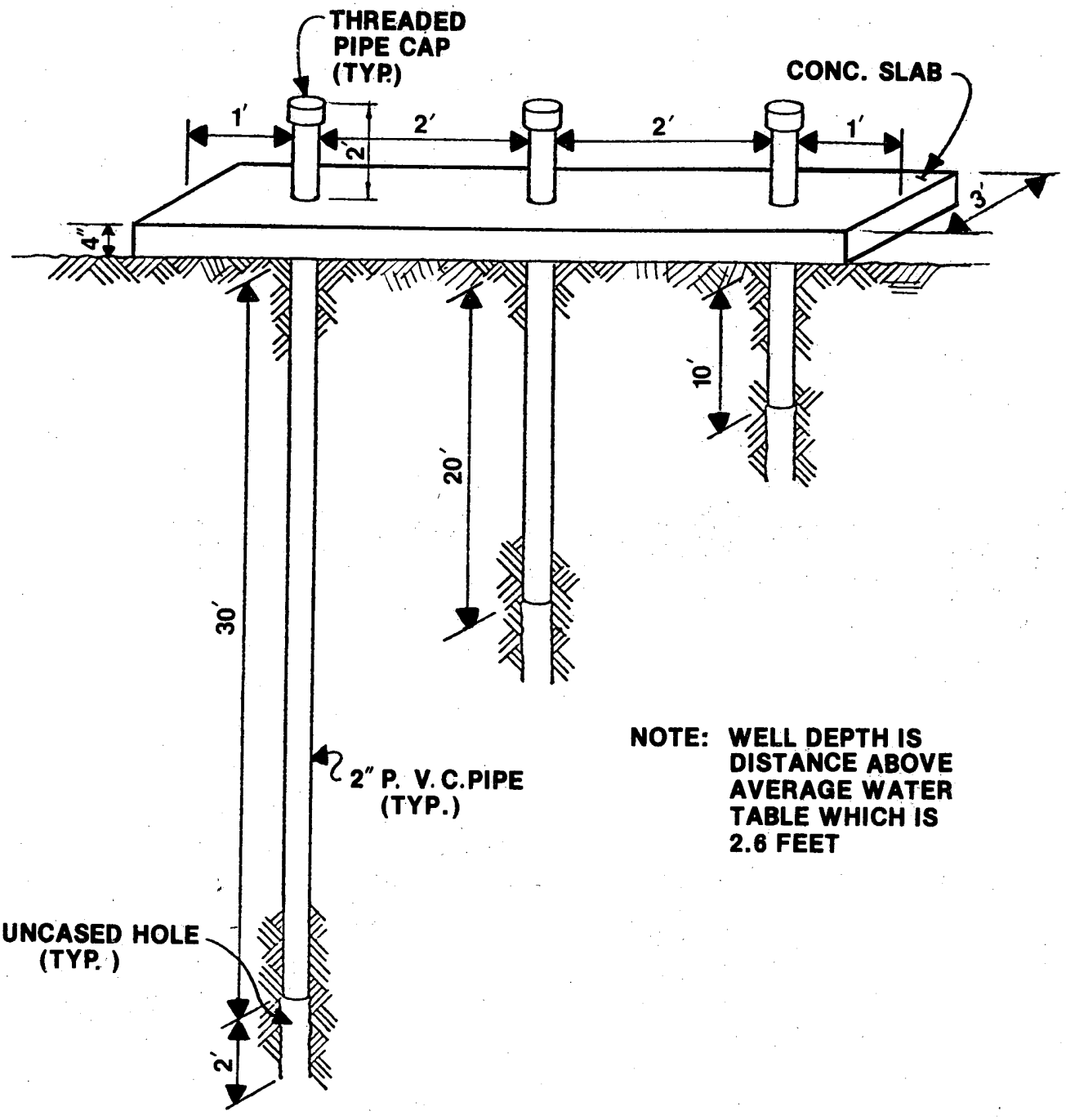


FIGURE 6-1

and the National Climatic Center's "Star" computer program, which determines Pasquill's stability classes for each hour of input. Mixing height averages were taken from Holzworth's study on diurnal mixing depths.

Since 1957, the observing weather office at Miami International Airport (MIA) has been located 7 feet above sea level. Wind sensors are located 23 feet above grade. Regular surface observations are taken just before the hour each hour, 7 days per week. Upper air soundings are conducted twice per day at 0700 and 1900 Eastern Standard Time.

Three EPA-approved diffusion models were used in the estimation of air quality and the effect that effluent systems would have on it. Long-term averages were calculated with the Air Quality Display Model (AQDM) and Holland's plume rise equation. The AQDM estimates annual average concentration levels from annual average emissions and meteorological data. ESE has calibrated the AQDM for SO_2 over 30 times in Florida and has consistently found that the model overpredicts ground-level SO_2 concentrations from 2 to 10 times. For all long-term modeling, therefore, ESE assumes model overprediction of 2 as a conservative upper limit. Long-term TSP averages were estimated using a calibration of 1.0, which implies no adjustment. A background of 30 micrograms per cubic meter was added to the concentrations.

The maximum short-term concentration close to the proposed facility was determined with the CRS-1 model. It used 1 year (1964) of hourly surface observations and upper air data to determine the "worst days" for the proposed plant. The CRS-1 destermines only 24- and 1-hour maximum yearly concentrations. To estimate concentrations of 3 or 4 hours, the Point Multiple (PTMTPW) short term model was used. This model incorporated the same hourly worst case meteorology as determined by the CRS-1, and could be used for optional averaging times with up to 25 sources.

6.6 GEOLOGY

A soil survey of the plant site was performed by Pittsburgh Testing Laboratories. These results are discussed in Section 2.4 and Appendix A.

7.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION*

It is particularly difficult to evaluate the social and economic benefits and costs of the solid waste processing facility because the effects are so widely and unevenly distributed over a number of separate bodies; namely Metropolitan Dade County, Resource Recovery, Inc., Florida Power and Light, and the public at large. The majority of the social and economic consequences of the facility are not readily quantifiable but, at the same time, must be weighed against monetized effects. As a result, the individual cost-benefit comparisons, i.e., for the county, for Florida Power and Light, etc., may appear to be out of balance. When measurable costs outweigh measurable benefits, this imbalance represents a willingness to pay for non-quantifiable positive effects.

7.1 BENEFITS

Metropolitan Dade County has long been faced with the problem of inefficient disposal of solid waste. Lack of adequate land for sanitary landfill and the infeasibility of upgrading present incineration plant operation to comply with air pollution control standards have pressured the county to consider a different means of disposal to accommodate its large volume of solid waste. This more efficient method of solid waste disposal is the primary benefit of the proposed facility.

Initially, the facility will receive 936,000 tons per year of Dade County's trash and garbage. (This figure can be expanded 50 percent to 1,400,000 tons per year, if necessary). Ninety-seven percent by volume of the materials received will be recovered in the form of material or energy and only 3 percent by volume will be sent to landfill. This represents a substantial volume reduction and a consequent similar reduction in lands required for landfill. Thus, successful operation of the facility will result in conservation of lands which would otherwise have been reserved for landfill sites.

In addition to reducing the amount of land required for solid waste disposal, conversion from landfilling of raw garbage to solid waste processing will preclude further damage to the water table, since the processed material to be landfilled is inert, consisting of ash from the boilers and fines from the Minerals Recovery Plant. Also, once the plant is in operation, the existing open 58th Street Landfill will be phased out. Although pollution of the Biscayne Aquifer from the landfill leachate will continue for some time after the closing of the site, the potential amount of pollution will be minimized by avoiding any further use as landfill.

Other benefits resulting from the conversion from raw landfill to processing of solid waste are the reduction of air and noise pollution and lowered health hazards. The clean operation of the facility and

refrigerated storage areas will abate the unpleasant odors, scattered debris and concentration of insects and vermin generally associated with landfill operations. Phasing out of the landfill (and incinerators) will also eliminate the noise of heavy equipment operation. Since the plant will meet Federal air pollution control standards and the presently operating incinerators will be phased out due to the infeasibility of upgrading them to meet these standards, there will be an overall reduction in air pollution.

As part of the waste disposal process, the plant will generate 5 billion pounds of steam annually (based on 18,000 tons of garbage per 6-day week), which will be sold to the Florida Power and Light Electrical Generating Facility located at the site. Revenues for steam paid to Resource Recovery are projected to be $6,800,000 annually. Over a 20-year period, discounted 10 percent to present dollar value, steam revenues would equal $63,695,600. The Florida Power and Light electrical facility will, in turn, generate 500 million kilowatt hours of electricity per year initially, of which 400 million kilowatt hours is annual net output to the county after deducting plant electrical processing requirements. Present demand for electricity does not require the existing fossil fuel facility to operate at maximum capacity, thus power generated by the new facility will increase the overall unutilized generating capacity by 400 million kilowatt hours per year, or 8 billion kilowatt hours over a 20-year period. Power generated by the new steam facility will displace electricity generated by oil fired plants, in which imported residual oil is used as a source of energy (refer to Section 8 for comparison of solid waste to crude oil as energy source). At present dollar values, this represents a saving to Florida Power and Light of $68,518,491 over a 20-year period. This figure is extremely conservative, based on the assumption that oil prices will be held constant over the next 20 years. Although oil price stability is highly unlikely, this assumption is necessary in order to compare the cost of oil to that of solid waste. Since solid waste as a fuel source is a relatively new concept, there are no figures from which an accurate escalation rate could be determined.

The same savings in crude oil will have second- and third-order effects on the general public as a result of reduction of imported crude oil. For the 20-year period, there is a net saving of 21,715,200 barrels of crude oil or $132,214,081, present dollar value, assuming a fixed price of oil. Again, this is a very conservative estimate, not taking into account inflation of oil prices.

The recovery and recycling of resources not only abate existing scarcity of these materials, but also represent a substantial income. Approximately 115,000 tons of material, i.e., ferrous metals, nonferrous metals, aluminum and glass will be recovered annually. At present market conditions, these materials have a market value of $5,352,000 annually. Over the 20-year period, the recovered resources will generate $50,132,184 in revenues at present dollar value. In addition, $2,193,516, present dollar value, will be generated annually by the sale of disposal services to the county during the life of the plant.

Since the resource recovery plant is among the first of its kind in the country, it can be expected that the operation will contribute significantly to the advancement of solid waste processing technology. Reception and viewing areas provided for the public will serve as an educational tool to promote understanding and support of the operation. To meet the needs of the visiting public, and of greater importance, the hauling equipment, a two-lane access road will be constructed, extending from the present end of 58th Street to the plant site.

The structure itself will be aesthetically pleasing with extensive landscaping on the grounds (refer to the artist's rendering in Figure 3-3). The phasing out of the 58th Street landfill and subsequent creation of a public recreational park, made possible by the conversion to solid waste processing, will greatly add to the environmental enhancement of the area.

Operation of the plant will require a staff and personnel of approximately 110 people. As it is the intent of the management to hire local persons whenever possible, the payroll as a result of their employment is a benefit to be counted. An estimated annual payroll of $1.8 to $2 million will put $16,860,600 to $18,734,000 in present dollars into the local economy over a 20-year period.

On a short-term basis, the plant construction will create an average of 300 jobs; however, the actual payroll is not available at this time. Assuming an average construction wage, the payroll for 300 employees for a 30-month construction period would be $15 to $20 million.

7.2 COSTS

As is the case with the benefits of the plant construction and operation, many costs are easily designated while others are difficult to quantify. The majority of costs are internal to Metropolitan Dade County, Resource Recovery, Inc., and Florida Power and Light.

A small portion of the site, 10 of 160 acres, was previously owned by the county, with the remaining acreage purchased specifically for the solid waste facility. Purchase price of the land is $2,270,000; however, a breakdown of the cost plus interest debt service was not available, making it impossible to compute the total cost discounted to present value. The $2.27 million figure will be used to reflect the cost of land acquisition, but it must be noted that this is a 2 to 5 percent overstatement in present value, since the interest has not been included.

The cost of site preparation, e.g., demucking and filling of the site and construction of the two lane access road, the solid waste processing facility purchase price, and the annual tipping fee for management services, will be paid by the County. Environmental pollution control bonds will be used to finance the facility and management costs, and Dade

County Decade of Progress bonds will cover the site preparation. As a breakdown of cost plus interest is not available, it is again impossible to compute the total cost discounted to present dollar value, thus the figures below represent an overstatement in present value.

Site Preparation (Est.)	$ 4,500,000
Solid Waste Processing Facility Purchase	$87,854,619
Annual Tipping Fee	$ 4,680,000

Purchase of steam by Florida Power and Light is the same value realized as a benefit to Resource Recovery, Inc., for the sale of steam, that is, $6,800,000 annually or $63,695,600 present dollar value for the 20 years. Florida Power and Light will also incur maintenance and operation costs of the electrical generating facility for 20 years. Other incidental costs are those of construction connections and any permits, orders, licenses and/or bonds required of the contractor in order to construct the facility.

Since the facility will be constructed on the borderline of a large metropolitan area employing local workers for construction, there are no expected shortages of housing or inflationary rentals or housing. Congestion of local streets will not be a problem as there are no through streets in the area. Temporary construction noise and dust are not expected to cause a disturbance since the lands within a 1-mile radius of the site are agricultural and industrial, with the closest urbanized areas more than 2 miles from the site.

As mentioned in Section 2.7, ecological losses, i.e., displacement of wildlife and disruption of environmental services, will be minimal and therefore have not been included in the costs of the project. Considering the size of the site, the loss of wetland area is also minimal; however, it must be considered a permanent cost in terms of loss of the land for alternative uses.

Table 7-1 summarizes cost-benefit comparisons for the Resource Recovery project.

* Information contained in this section is the latest available.

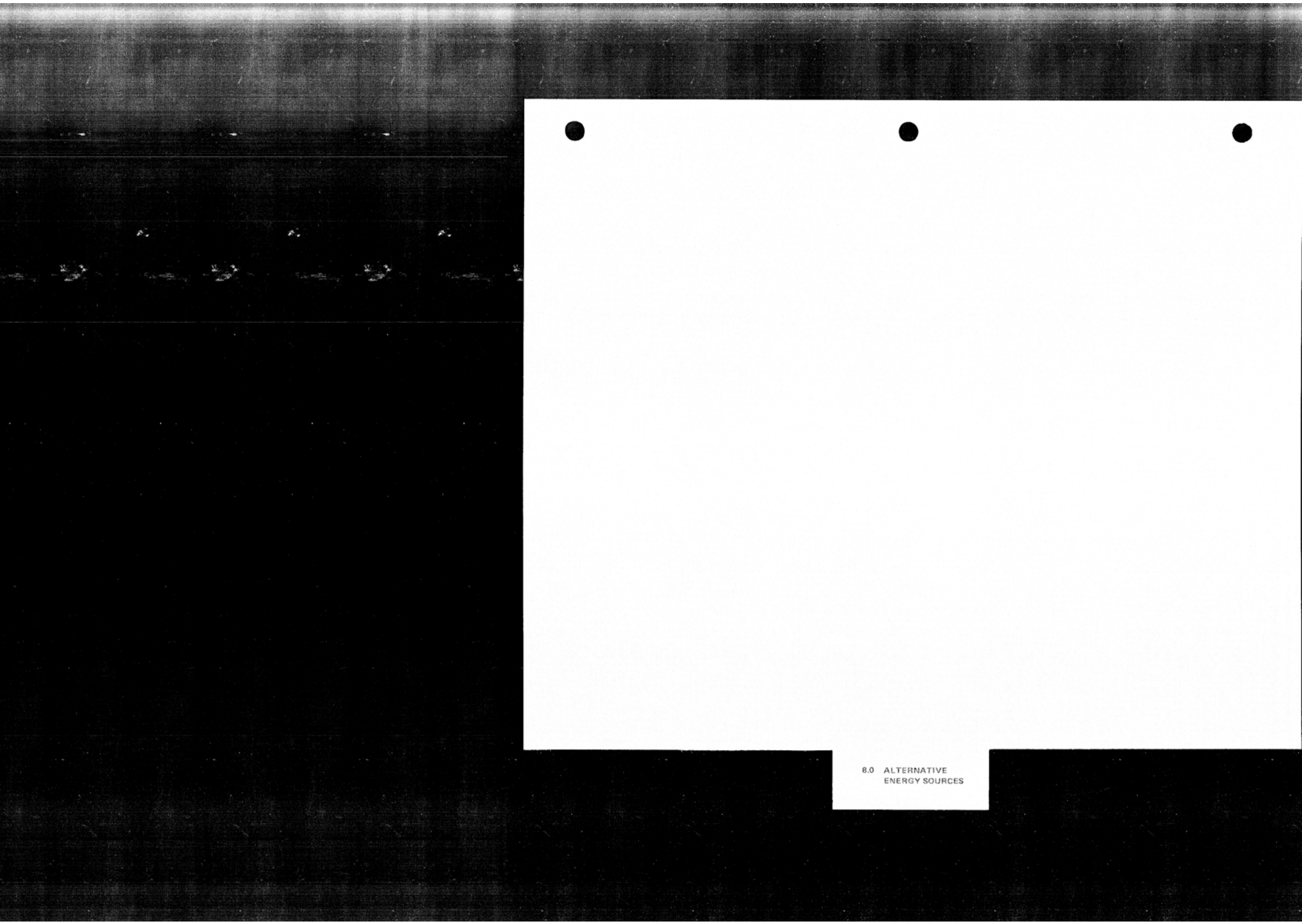
Table 7-1. Benefit-Cost Comparison.

Metropolitan Dade County		Resource Recovery, Inc.		Florida Power and Light		Public at Large	
Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Short Term	**Short Term**	**Short Term**	**Short Term**	**Short Term**	**Short Term**	**Short Term**	**Short Term**
Jobs created during construction est. $15,000,000-$20,000,000	Application fee $25,000		Construction payroll est. $15,000,000-$20,000,000		Construction connections Construction permits, orders, licenses &/or bonds		
Long Term	**Long Term**	**Long Term**	**Long Term**	**Long Term**	**Long Term**	**Long Term**	**Long Term**
Efficient disposal of solid waste Increased electrical energy generation capacity 8 billion KWH Preservation of lands Protection of water table	Land acquisition $2,270,000* Site preparation $4,500,000* Solid waste processing facility purchase $87,854,619* Annual tipping fee $4,680,000*	Sale of disposal services $2,193,516 Sale of steam $63,695,600 Revenues from recovered resources $52,942,284	Maintenance and operation of SWPF $56,988,828	Savings in fossil fuel consumption $132,214,081	Electrical generating facility purchase $12,742,381* Maintenance and operation of EGF Purchase of steam $63,695,600	Conservation of fossil fuel Increased knowledge in solid waste processing technology	

Table 7-1. Benefit-Cost Comparison (Cont'd.).

Metropolitan Dade County		Resource Recovery, Inc.		Florida Power and Light		Public at Large	
Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs
Long Term	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term
Lowered health hazards	Loss of land for alternative uses--160 acres						
Educational opportunities							
Creation of local road							

* Cost plus interest debt service not available, therefore, figure is not discounted to present value.



8.0 ALTERNATIVE
ENERGY SOURCES

8.0 ALTERNATE ENERGY SOURCES AND SITES

The primary purpose of the construction and operation of the proposed facility is disposal of solid wastes. A major benefit of the process selected is the recovery of metals, glass, and energy. Therefore, the applicability of this section is limited.

As previously noted, the Electric Generating Facility will operate at maximum capacity during peaking hours. It will directly reduce the need of the fossil fuel-derived electricity required during these periods. However, all fuel input and output must balance out on a weekly basis.

The gross electrical output of the generators will go directly to Florida Power and Light. In-plant electrical requirements amount to approximately 20 percent of the gross output. The energy available to the county will, therefore, be 80 percent of the gross.

The benefit in fuel oil saved is substantial, especially if expressed in terms of imported crude oil. "Wet" processed fuel from 1 ton of solid waste will produce an average gross generation of 517 kilowatt hours, or approximately the same as 1 barrel of Number 6 residual oil, the most commonly used utility oil. This takes into account the relatively lower efficiency of "wet" processed solid waste fuel versus oil (65 percent versus 88 percent respectively), as well as the higher steam rate for the smaller turbines versus larger utility turbines.

There are in-plant losses to be considered in both cases: 20 percent in the "Wet" Process Plant; 8 percent in the utility oil operation. Comparing with Number 6 residual oil:

1 ton SW = 517 KWH x 0.8 = 413 KWH

1 barrel #6 = 515 KWH x 0.92 = 474 KWH

In relating to crude oil imported, consideration must be given to shipping, refining and distribution losses which can amount to 25 to 30 percent:

1 ton SW = 413 KWH

1 barrel crude = 474 x .75 = 355 KWH

The true benefit results in a reduction of imported crude oil in the ratio of 1.16 barrels of crude per ton of S.W. On this basis, the net saving of imported crude oil for this Plant will be 1,085,760 barrels per year, or 21,715,200 barrels for the 20-year period.

At the present world value of crude oil of $13 per barrel, value during a 20-year period is $282,297,600. At projected 6 percent annual escalation, compounded monthly, the amount saved would be $937,165,000.

The site location of this facility has major advantages other alternative sites do not. Such advantages include:

1. Distant from residential areas;

2. Close to existing 240 KV transmission line;

3. Adjacent to an existing landfill, therefore no rerouting of waste trucks.

Within these considerations, the site selection was primarily governed by the economics of the solid waste generation and collection system and network.

In summary, the United States would not have to import 21,700,000 barrels of oil. As a result, the U. S. balance of payments will be reduced by $937,165,000 during this period.

9.0 PLANT DESIGN ALTERNATIVES

The selection of the design of the facility was based upon competitive bidding. The contractor was finally selected by Metropolitan Dade County with major considerations being cost, resource recovery potential, and other factors. Consequently, no alternatives were selected on a basis of electric generation alone.

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APPENDIX A

PITTSBURGH TESTING LABORATORY
3901 N.W. 29th AVENUE, MIAMI, FLORIDA 33142

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL.

ORDER No. MA 582

LABORATORY No. 1658

CLIENT'S No.

10-19-76

REPORT

ON
SOIL SURVEY

CLIENT: Resources Recovery (Dade County) Inc.
800 Douglas Entrance
Suite 203
Coral Gables, Fla. 33134

PROJECT: Solid Waste Recovery Plant, Dade County, Fl.

REFERENCE: Soil Borings, July 21, 1976 - MA 455 Lab 1269

In accordance with your authorization we have examined representative soils obtained in borings conducted at the above project. Various information was obtained from visual examination and correlation with the U.S.D.A. Soil Conservation Guide for Interpreting Engineering Uses of Soils. The following are the results.

SOIL SERIES - Everglades Peat

SOIL DRAINAGE CLASS - A/D High runoff potential when thoroughly wetted, low runoff potential when drained.

PERMEABILITY - Average values obtainable ranged from 0" to 20" per hour.

U.S.D.A. SOIL TEXTURE (General) - 0"-12" to 24" peat
12" to 24" - 24" to 36" sand
24" to 36" - 60" sandy gravel

DEPTH TO BEDROCK - No hard rock encountered to 50' in depth.

Tech: Anderson
cc/cc:
3 Client
1 MA

PITTSBURGH TESTING LABORATORY

John W. Harllee

John W. Harllee
Vice President

207-5 (REV.) 2/6/69

PITTSBURGH TESTING LABORATORY

LOG OF BORING

No. MA 455

nt Black Claussen

ect Solid Waste Plant

ation of Boring: See Plot Plan

er Level	1.1'
e	A.M.
	7-2-76

Boring No. 3 Date 7-21-76 Sheet 1 of 2

Type of Boring D1586 Rig SB45

Casing used HS Size ____ Drilling mud used No

Boring begun 7-20-76 Boring completed 7-21-7.

Ground Elevation Existing referred to ____ Datum

Field Party: Gier & Blackford

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						0		
		0				1		Very loose, brown sandy silt & muck
301	1-2	11				2		Medium, brown sand
		17				3		
303	304	29				4		Medium, brown sandy limerock
						5		
		23				6		
306	6-7	32				7		Dense, brown sandy limerock
						8		
		36				9		
309	9-10	45				10		Dense, brown sandy limerock
						11		Very hard limerock lens
						12		
						13		
						14		
314	14-15	24				15		Medium, brown sandy limerock
						16		
						17		
						18		
						19		
319	19-20	56				20		Very dense, brown sandy limerock
						1		Next Page

PITTSBURGH TESTING LABORATORY

LOG OF BORING

MA 455

Client

Project

Location of Boring:

Water Level

Time

Date

Boring No. 3 Date Sheet 2 of 2

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datum

Field Party:

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						20		
						21		
						22		
						23		
						24		
324	24-25	32				25		Dense, brown sandy limerock
						26		
						27		
						28		
						29		
329	29-30	30				30		Dense, brown sandy limerock.
						1		End of Boring 30.0'
						2		
						3		
						4		
						5		
						6		
						7		
						8		
						9		
						0		
						1		

PITTSBURGH TESTING LABORATORY

LOG OF BORING

MA 455

Black & Claussen

Solid Waste Plant

ion of Boring:

See Plot Plan

Level	1.0'
	P.M.
	7-21-76

Boring No. 4 Date 7-21-76 Sheet 1 of 2

Type of Boring D1586 Rig SB 45

Casing used HS Size ____ Drilling mud used No

Boring begun 7-21-76 Boring completed 7-21-76

Ground Elevation Existing referred to ____ Datum

Field Party: Gier & Blackford

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						0		
		0				1		Very loose, brown sandy silt & muck
401	1-2	1				2		Very loose, brown sand, muck & traces of silt & limerock fragments
		1				3		
403	3-4	4				4		
						5		
		19				6		
406	6-7	28				7		Medium, brown sandy limerock
						8		
		30				9		
409	9-10	49				10		Dense, brown sandy limerock
						11		
						12		
						13		
						14		
414	14-15	31				15		Dense, brown sandy limerock
						16		
						17		
						18		
						19		
419	19-20	26				20		Medium, brown sandy limerock
						21		Next Page

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PITTSBURGH TESTING LABORATORY

LOG OF BORING

No. MA 455

Client

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. 4 Date Sheet 2 of 2

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datum

Field Party:

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						20		
						21		
						22		
						23		
						24		
424	24-25	33				25		Dense, brown sandy limerock
						26		
						27		
						28		
						29		
429	29-30	31				30		Dense, brown sandy limerock
								End of Boring 30.0
						1		
						2		
						3		
						4		
						5		
						6		
						7		
						8		
						9		
						40		
						1		

PITTSBURGH TESTING LABORATORY

LOG OF BORING

No. MA 455

nt Black-Claussen

ct Solid Waste Plant

ation of Boring: See Plot Plan

r Level 1.0'

e A.M.

7-21-76

Boring No. 2 Date 7-20-76 Sheet 1 of 3

Type of Boring D1586 Rig SB45

Casing used HS Size ____ Drilling mud used No

Boring begun 7-20-76 Boring completed 7-20-76

Ground Elevation Existing referred to ____ Datum

Field Party: Gier & Blackford

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						0		
		0				1		Very loose, dark brown sandy silt & muck
201	1-2	3				2		Medium, brown sandy limerock
		18				3		
						4		
		21				5		Medium, brown sandy limerock
205	5-6	18				6		
						7		
		15				8		
		19				9		Medium, brown sandy limerock
209	9-10	23				10		
						11		Very hard limerock lens
						12		
						13		
						14		
214	14-15	19				15		Medium, brown sandy limerock with thin layers of sand & traces of silt
						16		
						17		
						18		
						19		
219	19-20	24				20		Medium, brown sandy limerock with thin layers of sand and traces of silt
						1		Next Page

EDT-5 (REV. 12/1/69)

PITTSBURGH TESTING LABORATORY

LOG OF BORING

No. MA 455

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ject

cation of Boring:

ter Level

ne

de

Boring No. 2 Date _____ Sheet 2 of 3

Type of Boring _____ Rig _____

Casing used _____ Size _____ Drilling mud used _____

Boring begun _____ Boring completed _____

Ground Elevation _____ referred to _____ Datum

Field Party: _____

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
						20		
						21		
						22		
						23		
						24		
224	24-25	53				25		Very dense, brown sandy limerock with traces of sand & trace of silt
						26		
						27		
						28		
						29		
229	29-30	38				30		Dense, brown sandy limerock
						31		
						32		
						33		
						34		
234	34-35	29				35		Medium, brown sandy limerock
						36		
						37		
						38		
						39		
239	39-40	30				40		Dense, brown sandy limerock
						1		Next Page

PROJ-5 (REV.) 2/6/59

PITTSBURGH TESTING LABORATORY

LOG OF BORING

Job No. HA 455

Client

Project

Location of Boring:

Water Level	
Time	
Date	

Boring No. 2 Date Sheet 3 of 3

Type of Boring Rig

Casing used Size Drilling mud used

Boring begun Boring completed

Ground Elevation referred to Datum

Field Party:

Casing, ft.	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
							40		
							41		
							42		
							43		
							44		
	244	44-45	30				45		Dense, brown sandy limerock
							46		
							47		
							48		
							49		
	249	49-50	36				50		Dense, brown sandy limerock
									End of Boring 50.0'
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		
							0		
							1		

PITTSBURGH TESTING LABORATORY

LOG OF BORING

Job No. MA 455

Client Black Claussen

Project Solid Waste Plant

Location of Boring: See Plot Plan

Water Level	1.0'
Time	P.M.
Date	7-21-76

Boring No. 1 Date 7-21-76 Sheet 1 of 2

Type of Boring D1586 Rig SB 45

Casing used HS Size ____ Drilling mud used No

Boring begun 7-21-76 Boring completed 7-21-76

Ground Elevation Existing referred to ____ Datum

Field Party: Gier & Blackford

Depth Casing	Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
							0		Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
			1						Very loose, dark brown sandy silt & muck
	101	0-1	3				1		
			3				2		Very loose brown sand
	103	2-3	32				3		
							4		Dense, brown sandy limerock
			16				5		
	106	6-7	22				6		
							7		
			19				8		
	109	9-10	18				9		Medium, brown sandy limerock
							10		
							11		
							12		
							13		
							14		
	114	14-15	22				15		Medium, brown sandy limerock with thin layers of sand
							16		
							17		
							18		
							19		
	119	19-20	21				20		Medium, brown sandy limerock with thin layers of sand
							21		

Next Page

-807-S (REV.) 2/6/89

PITTSBURGH TESTING LABORATORY

LOG OF BORING

No. PA 455

nt
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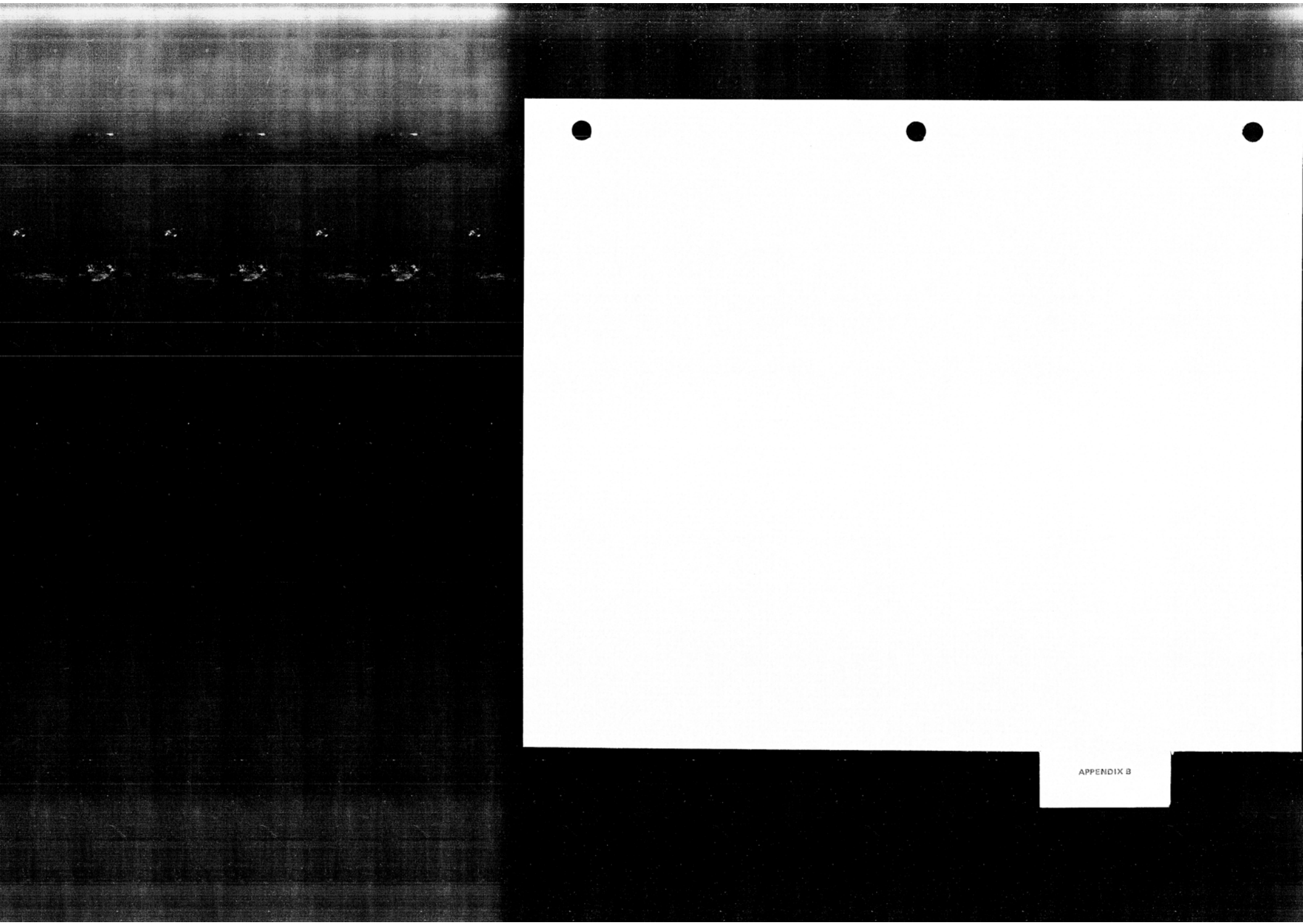
ation of Boring:

er Level	
e	
e	

Boring No. 1 Date 7-21-76 Sheet 2 of
Type of Boring Rig
Casing used Size Drilling mud used
Boring begun Boring completed
Ground Elevation referred to
Datum
Field Party:

Sample No.	Sample depth from-to (in feet)	Blows/foot on Sampler	ID of Sampler (inches)	Tot. length of recov. sample	Length of Lab. sample	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION Soil type, color, texture, consistency, sampler driving notes, blows per foot on casing, depths wash water lost, observed fluctuations in water level, notes on drilling ease, etc.
						20		
						21		
						22		
						23		
						24		
125	24-25	38				25		Dense, brown sandy limerock with thin layers of sand
						26		
						27		
						28		
						29		
130	29-30	45				30		Dense, brown sandy limerock with thin layers of sand End of Boring 30.0'
						1		
						2		
						3		
						4		
						5		
						6		
						7		
						8		
						9		
						0		
						1		



LIST OF EQUIPMENT
3,000 T/D - 18,000 T/week

Hydrasposal Module

Item	Description	QTY.	H.P.
01	Apron Feeders 74" x 22'	2	15
02	Apron Feeders 74" x 42'	2	20
03	Apron Conveyors 84" x 74'	4	100
04	Hydrapulpers - 20'	4	4800
05	Junkers - 72"	4	80
06	Dewatering Screens	4	40
07	Cyclones 26"	8	
08	Classifiers - 24" x 25'	4	12
09	Glass Conveyor - 24" x 100'	1	3
10	Hydradensers	16	480
11	Cone.Pressers - 60"	16	1280
12	Press discharge Conveyors	2	20
13	Pulped Dump Pumps	4	400
14	Slurry Pumps	3	375
15	W. W. Pumps	5	500
16	Press Water Pumps	4	60
17	Sump Pumps	2	15
18	Dump Chest Pump	1	40
19	Surge Chests 30' x 30'	2	
20	W. W. Chests 30' x 30'	2	
21	Press Water Chest	1	
22	Surge Chest Agitators - 54"	4	400

Item	Description	QTY.	H.P.
23	Junker Conveyor 36" x 140'	1	15
24	W. W. Chest Agitators 42"	2	60
25	Hydradenser (Screen)	1	45
26	Dump Chest	1	———
	Total		8,760
Iron Recovery - Pulpers			
01	Magnet, Drum	1	7
02	FE Conveyor	1	3
03	Grizzly	1	3
04	Non-FE Conveyor	1	5
05	Fe/Non-FE Separator	1	———
	Total		18
Shredder			
01	Apron Feeder 72" x 22"	2	20
02	Apron Conveyor 72' x 74"	2	30
03	Shredders	2	2600
04	Discharge Conveyors	2	10
05	Magnet Feed Conveyor	1	10
06	Intermed. Conveyor	1	3
07	Magnet	2	15
08	FE Conveyor	1	3
09	Baler Surge Bin	1	5
10	Baler Feed Conveyor	1	10
11	Baler 16 x 20	1	230

Item	Description	QTY.	H.P.
12	Bale Conveyor	1	
	Total		2,936

Metals and Glass Recovery

01	Conveyor, from Hydrasposal	1
02	Bin	1
03	Conveyor	1
04	Rotary Screen	1
05	Fines Dewaterer	1
06	Elevator	1
07	Magnet	1
08	Heavy Media Separator	1
09	Washing Conveyor	1
10	Media Recovery	1
11	Aluminum Dewatering Screen	1
12	Jig	1
13	Conveyor	1
14	Dryer	1
15	Conveyor with Magnetic Pulley	1
16	Elevator	1
17	High Tension Electrostatic Separator	1
18	Conveyor	1
19	Conveyor	1

Item	Description	QTY.	H.P.
20	Transparency Sorter	1	
21	Conveyor	1	
22	Elevator	1	
23	Color Sorter	1	
	Total		600
Fuel Storage			
01	Distribution Conveyor	1	15
02	Cranes - 6 cu. yds. (Grapple)	2	40
03	Reclaim Conveyor Feeders	2	20
04	Fuel Blowing Systems, To Stor.	2	530
05	Fuel Blowing Systems, To boiler	2	440
06	Belt Weighting Scales	4	20
07	Fume Scrubbers	4	30
	Total		1,095
Steam Plant			
01	Boilers	4	2,530
02	Precipitators	2	1,030
03	Make-up Water Pumps	2	30
04	Lot Tanks, Water Treatment	1	
05	Demineralizers	2	10
06	Ash Handling System	1	30
07	Boiler Fuel Bins	2	30

Item	Description	QTY.	H.P.
08	Fuel Oil Storage Tanks	1	
09	Fuel Oil Heater	1	30
10	Fuel Oil Pumps	2	30
11	Stack	2	
12	Chem. Storage Tanks	2	
13	Neutralizing Tank	1	
14	Condensate Tank	1	
15	Chem. Feed Pumps	4	20
16	Condensers	2	
17	Condensate Pumps	3	150
18	Cooling Tower	1	1,200
19	Cooling Tower Circ. Pumps	3	3,750
20	Boiler Feed Pumps	3	1,800
21	Feed Water Heaters	2	
22	Deaerators	2	
23	Cooling Tower Basin	1	
	Total		13,170

Miscellaneous

01	Incoming Truck Scales	2	20
02	Outgoing Truck Scale	1	5
03	Air Compressor	2	150
04	Crane, 15 T x 100'	1	30

Item	Description	Qty.	H.P.
05	Crane, 15 T x 70'	1	30
06	Crane, 5 T x 70' W. Magnet	1	10
07	Mach. Shop Tools & Equip.	1 Lot	50
08	Lab. Equip.	1 Lot	10
09	Office Equip. & Furniture	1 Lot	25
10	Wells, 700 GPM	3	45
11	Storage Bins	3	
12	Dead Animal Incinerator	1	25
13	Oil Tank and Pump Set		10
14	Fire Pumps, 1 Elec. 1 Diesel	2	100
	Total		510

Mobile Equipment		Qty.	Primary Use
01	Tractors Caterpiller D8 Tractor, Series K. Equipped with air conditioner, fully enclosed, heavy-duty hinged radiator guard,heater engine coolant heater, lighting system, radiator core protector grid, sprocket, 26" tracks, dowtherm, cylinder bracket, cylinder rod pin (2) hydraulic cylinder R.H.,hydraulic cylinder L.H., line group, push arm braces and tilt trunnion, line group, 193 hydraulic control and Balderson BDSUL-15'-6" landfill blade.	3	Pit

Item	Description	Qty.	Primary Use
Mobile Equipment (Continued)			
02	Fork Lift Trucks 4000# 2000#	3 2	S.W. Plant Glass Plant and Pathological Incinerator
03	Dump Trucks, 15 Ton Tandem Axle-off highway Diesel Engine 34000# Rear End 12000# Per Axle 5 Speed Trans.Main Axle 4 Speed Trans. Auxiliary Axle	2	Landfill
04	Front End Loader 2 cu.yd. Track Type	1	Landfill
05	Floor Sweeper Heavy Duty Wet and Dry	1	S.W.Plant
06	Farm Tractor with Mowing Accessories	1	Solid Waste & Landfill
07	Pick-up Truck 3/4 Ton	1	S.W. Plant
08	Pick-up Truck 1/2 Ton	1	S.W. Plant
09	Personnel Transporters Gas or Electric	2	S.W. Plant

APPENDIX C

APPENDIX C

Calculations

There will be 2 boilers per stack, rated at 72,000 lbs pulp fuel/hr each. The exhaust gases from the boilers are combined and then passed through a battery of 16 cyclones in parallel and then through an electrostatic precipitator (ESP), prior to discharging through a 150 foot (minimum height) stack.

The control system is expected to perform at a total efficiency of 99.4% based on 85% of the particulate matter being removed by the cyclones and 96% of the remaining particulate matter being collected by the ESP. These efficiencies are based upon manufacture's guarantee.

Particulate Emission Rates are calculated as follows:

USING 314,000 ACFM @ 420° & 22% moisture; calculated CO_2 at 11.6%; Manufacture Guarantee 0.06gr/SCF at 12% CO_2; design at 40% excess air.

$$314{,}000 \text{ ACFM} \times (1-0.22) \times \frac{528}{880} = 146{,}950 \text{ SCFMD}$$

Correction for % CO_2 $C_{12} = C_A \, 12/(\%CO_2)_A$ where C = concentration

$$C_{Actual} = 0.06 \times 1/12 \times 11.6 = 0.058\text{gr/SCF}$$

Calculated Emission:
0.058gr/SCF X 1/(7000gr/lb) X 146,950 SCFMD X 60 min/hr = 73.1 lbs/hr
73.1 lbs/hr X 24 hrs/day X 6 days/week X 52 weeks/year X 1 ton/2000 lbs
= 274 tons/year

Regulation 0.08 gr/SCF corrected to 50% excess air

Correction for % excess air:
$C_{50} = C_A(100 + \%EA)/150$ where C = concentration

$$C_{Actual} = 0.08 \times 150/(100 + 40) = 0.086\text{gr/SCF}$$

0.086/SCF X 1/(7000gr/lb) X 146,950 SCFMD X 60 min/hr = 108.3 lbs/hr
108.3 lbs/hr X 24 hrs/day X 6 days/week X 52 weeks/year X 1 ton/2000 lbs
= 405 tons/year

Sulfur Dioxide Emission Rates are calculated as follows:

USING .1% S in pulp fuel
No. 2 Fuel Oil is used for start up only
each boiler fires an average of 72,000 lbs/hr of pulp

72,000 lbs X 2 units X .001 X 2 = 288 lbs/hr of SO_2

288 lbs/hr X 24 hrs/day X 6 days/wk X 52 wks/year X 1 ton/2000 lbs
= 1078 tons/year

Storm Water Runoff

All storm water runoff will be retained on-site.

environmental science
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(904) 372-3318

JOB RESOURCE RECOVERY (DADE COUNTY) INC.
SHEET NO. 1 OF 1
CALCULATED BY BTW/GSK DATE 5/24/77
CHECKED BY RA Rizk DATE 5/25/77
SCALE N.A

CALCULATIONS OF EFFICIENCY

- DATA FROM STACK SAMPLING TESTS PERFORMED ON BABCOCK & WILCOX BOILER FUELED WITH HYDROPULPED MUNICIPAL WASTE. BOILER LOCATED AT NEKOOSA EDWARDS' PLANT IN ASHDOWN, ARKANSAS.

1. PARTICLE SIZE ANALYSIS - PRESENTED IN FIGURE 1
2. EMISSION RATE PER TON OF PULPED FUEL = 112 lbs/TON
3. DUST LOADING AT EXIT OF BOILER - 4.10 gr/SCFD
4. EXCESS AIR - 90.8%

CYCLONE EFFICIENCY

PARTICLE SIZE (μ)	% IN RANGE	EST. CYCLONE EFFICIENCY [4]	EFFICIENCY IN RANGE
>44	40	0.97	38.8%
20 to 44	18	0.95	17.1%
10 to 20	18	0.92	16.6%
5 to 10	12	0.79	9.5%
0 to 5	12	0.40	4.8%
	CYCLONE	OVERALL EFFICIENCY	86.8%

ELECTROSTATIC PRECIPITATOR EFFICIENCY

PARTICLE SIZE (μ)	% in Range*	EST. ESP EFFICIENCY [4,5]	EFFICIENCY IN RANGE
>44	9.1	1.00	9.1%
20 to 44	6.8	.995	6.8%
10 to 20	10.6	.97	10.3%
5 to 10	19.0	.95	18.0%
2.5 to 5	31.6	.90	28.4%
1 to 2.5	18.5	.85	15.4%
0 to 1	4.4	.60	2.6%
		ESP OVERALL EFFICIENCY	90.9%

*NOTE: CALCULATED FROM REMAINING PARTICLES EXITING CYCLONE. BREAKDOWN OF PARTICLE SIZE IN LOWER RANGE BASED ON THE ASSUPTION OF 0 to 5 μ PROPORTIONED AS FIGURE 1, i.e 58% in 2.5 to 5 μ RANGE, 34% in 1 to 2.5 μ RANGE AND 8% in 0 to 1 μ RANGE

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JOB [illegible]
SHEET NO. 2 OF 1
CALCULATED BY KT Hoskins DATE 5/24/77
CHECKED BY [illegible] DATE [illegible]
SCALE

OVERALL CYCLONE AND ESP EFFICIENCY:

$$\eta_{\%} = 86.8 + 0.909(100 - 86.8) = 86.8 + 11.9 = 98.8\%$$

- EFFICIENCY REQUIRED TO MEET REGULATED EMISSION LIMITATION (17-2.04(6)(a)1 F.A.C.)

BASED ON PREVIOUS CALCULATIONS: EMISSION LIMITATION IS 108.3 lbs/HR

NON-CONTROLLED EMISSION RATE CALCULATION:

$$112 \frac{\text{lbs PARTICULATE}}{\text{TON PULPED FUEL}} \times 78.2 \frac{\text{TONS PULPED FUEL MAX}}{\text{HR.}} = 8758 \frac{\text{lbs}}{\text{HR}}$$

REQUIRED EFFICIENCY:

$$100\% \left[8758 \frac{\text{lbs}}{\text{HR}} - 108.3 \text{ lbs/HR} \right] \Big/ 8758 \text{ lbs/Hr} = 98.8\%$$

- ALTERNATE EFFICIENCY CALCULATION

CYCLONE EFFICIENCY:

FOR A MEAN PARTICLE SIZE OF 30μ AND LOW RESISTANCE CYCLONE EFFICIENCY AT A MIDDLE RANGE IS 75%[6]

ELECTROSTATIC PRECIPITATOR EFFICIENCY:

DEUTCH-ANDERSON EQUATION RELATES ESP EFFICIENCY WITH PLATE AREA, FLOWRATE AND DRIFT VELOCITY, IN EQUATION FORM:[1,2,3]

$$\eta_{\%} = \left[1 - e^{-\left(\frac{A w}{Q}\right)}\right] 100\% \text{ WHERE:}$$

A = SURFACE AREA OF ESP $(ft)^2$

Q = FLOW RATE (CFM)

w = DRIFT VELOCITY $\left(\frac{ft}{min}\right)$

FROM SPECIFICATION BY FLÄKT $A = 99200\ ft^2$

$Q = 314{,}000$ ACFM

$w = 23.6 \frac{ft}{m}$ (U.S.EPA, 1972)[2] @ TEMP = 450°F

FORM 204 Available from NEBS INC. Townsend, Mass 01470

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(904) 372-3318

JOB Resource Recovery
SHEET NO. 3 OF 1
CALCULATED BY T.F. Hazlett DATE 5/24/77
CHECKED BY R.A. Nenhaus DATE 5/25/77
SCALE N.A.

$$\eta_{\%} = \left[1 - e^{-\frac{(23.6 \times 99200)}{314,000}}\right] 100\% = 99.9\%$$

OVERALL CYCLONE AND ESP EFFICIENCY:

$$\eta_{\%} = 75\% + 0.999(100-75)\% = 99.9\%$$

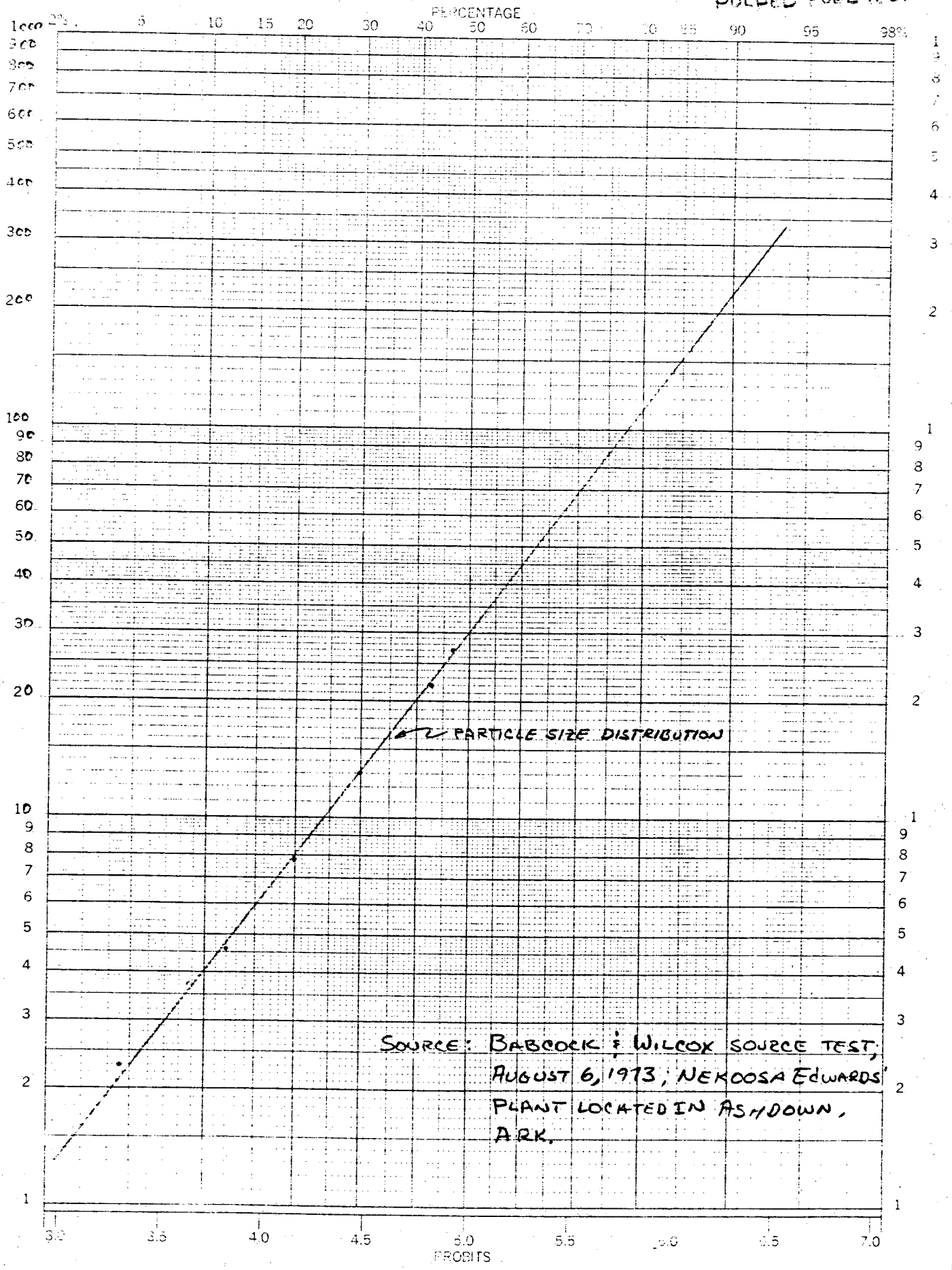
∴ OVERALL EFFICIENCY FOR CYCLONE AND ESP ON PULPED FUELED BOILER IS BETWEEN 98.8 AND 99.9%. THIS DESIGN WILL MEET REGULATED EMISSION LIMITATIONS.

REFERENCES:

1. STERN, A.C.; Air Pollution Volume III; Academic Press, 1967, pgs 391-455.
2. STEIN, A.; Guide to Engineering Permit Processing; U.S. Environmental Protection Agency, APTD-1164, pg 6.30
3. U.S. Environmental Protection Agency; Air Pollution Engineering Manual; A.P.-40; May, 1973; pgs. 91-99 and 135-156.
4. U.S. Environmental Protection Agency; Compilation of Air Pollutant Emission Factors; AP-42; April 1973; pg A-3.
5. Cisburd, M.I.; Field Operations and Enforcement Manual for Air Pollution Control Volume II: Control Technology and General Source Inspection; U.S. Environmental Protection Agency; APTD 1011; Aug. 1972; pgs 5.27 - 5.93
6. Sylvan, S.; "Range of Particle Sizes, Concentration & Collection Performance"; April 1972; American Air Filter Co., Inc.

Available from NERBS Inc. Townsend Mass. 01470

FIGURE 1 PARTICLE SIZE DISTRIBUTION - PULPED FUEL TEST



SOURCE: BABCOCK & WILCOX SOURCE TEST, AUGUST 6, 1973, NEKOOSA EDWARDS' PLANT LOCATED IN ASHDOWN, ARK.

46 8080

PROBABILITY X 3 LOG CYCLES
KEUFFEL & ESSER CO

Odor Control System

To eliminate emissions of odoriferous gases from the Resource Recovery Facility, an activated carbon adsorption system will be utilized. The specifications of this system are presented in Table C-1.

The activated carbon used in the odor control units will require replacement from time to time, depending upon the degree of use. This will occur under Modes 4, 7, 8, and 9 as a normal possibility (refer to Table C-2). It will occur less frequently, if at all, under Modes 11 to 15.

When the activated carbon used for these filters has lost its effectiveness, it will be replaced with regenerated activated carbon. The spent activated carbon will be returned to an accredited reactivation plant (Calgon, or other equivalent), where it is stripped with steam or any hot gas. There is a 10 percent loss in processing due to attrition from loss of fines. It costs approximately 30 to 40 cents a pound to reactivate carbon as compared to cost of fresh activated carbon of $0.85 to $1.00 per pound. Sufficient quantities of fresh activated carbon will be kept on hand to supply these filters at all times.

Table C-1. Proposed Specifications of Activated Carbon Adsorption System.

Quantity	Three Units
Flow Rate	30,000 CFM per unit at 80° F.
Dimensions	110" L x 140" H x 70" W
Carbon Bed	Carbon to be contained in perforated filter panels designed so that all air passes uniformly through 4" of carbon at a velocity of 60 ft/min. A vibrator must be included to facilitate manual filling and emptying.
Type Carbon	Pittsburg Type BPC
Construction	All areas of airflow where active carbon contacts metal surfaces must be 304 stainless steel.

Table C-2. AIR VENTILATION SYSTEM — DISTRIBUTION AND CAPACITY COMPILATION

Mode No.	Operating Conditions			Air Flow Through Areas*					Air Into Fuel Storage Area*						Relief Air*		Air Changes Per Hour					Make-up* Intake Moods
	Recv'g	Proc'g	Boiler	Process	Tipp'g	Pit	Press	Maint. & Cyclone	Blower	Dust Coll.	Dryer Exh.	Sorter Exh.	Tank Exh.	Pulper Exh.	To Boiler	To Filter	Process	Tipp'g	Pit	Press	Maint. & Cyclone	
1	Yes	Yes	4	94.6	104.0	198.6	9.8	44.6	24.4	4.0	14.0	6.0	1.0	4.0	308.0	0	3.0	4.6	6.0	1.8	3.0	2.0
2	No	Yes	4	94.6	104.0	198.6	9.8	44.6	24.4	4.0	14.0	6.0	1.0	4.0	308.0	0	3.0	4.6	6.0	1.8	3.0	2.0
3	No	No	4	94.6	104.0	198.6	9.8	44.6	0	0	0	0	1.0	4.0	308.0	0	3.0	4.6	6.0	0.6	3.0	50.1
4	Yes	Yes	3	94.6	104.0	198.6	9.8	44.6	24.4	4.0	14.0	6.0	1.0	4.0	231.0	75.3	3.0	4.6	6.0	1.8	3.0	0
5	No	Yes	3	94.6	44.0	138.6	9.8	29.3	24.4	4.0	14.0	6.0	1.0	4.0	231.0	0	3.0	1.9	4.2	1.8	2.0	0
6	No	No	3	94.6	44.0	138.6	9.8	44.6	0	0	0	0	1.0	4.0	231.0	0	3.0	1.9	4.2	0.6	3.0	33.1
7	Yes	Yes	2	62.4	76.2	138.6	0	44.6	24.4	4.0	14.0	6.0	1.0	4.0	154.0	82.5	2.0	3.4	4.2	1.3	3.0	0
8	No	Yes	2	94.6	34.7	129.3	0	29.3	24.4	4.0	14.0	6.0	1.0	4.0	154.0	58.0	3.0	1.5	3.9	1.3	2.0	0
9	No	No	2	62.4	66.9	129.3	0	29.3	0	0	0	0	1.0	4.0	154.0	9.6	2.0	2.7	3.9	0.2	2.0	0
10	Yes	Yes	1	31.2	38.1	69.3	0	14.8	24.4	4.0	14.0	6.0	1.0	4.0	77.0	60.5	1.0	1.7	2.1	1.3	1.0	0
11	No	Yes	1	31.2	28.8	60.0	0	14.8	24.4	4.0	14.0	6.0	1.0	4.0	77.0	51.2	1.0	1.3	1.8	1.3	1.0	0
12	No	No	1	31.2	28.8	60.0	0	14.8	0	0	0	0	1.0	4.0	77.0	2.8	1.0	1.3	1.8	0.2	1.0	0
13	Yes	Yes	0	31.2	8.8	40.0	0	14.8	24.4	4.0	0	0	1.0	4.0	0	88.2	1.0	0.4	1.2	1.3	1.0	0
14	No	Yes	0	31.2	8.8	40.0	0	14.8	24.4	4.0	0	0	1.0	4.0	0	88.2	1.0	0.4	1.2	1.3	1.0	0
15	No	No	0	31.2	8.8	40.0	0	14.8	0	0	0	0	1.0	4.0	0	59.8	1.0	0.4	1.2	0.2	1.0	0
				A	B	A & B	C	D	E	F	G	H	I	J	$\sum_{A}^{J}$							

*Air volumes must be multiplied by 10^3.

PITTSBURGH ACTIVATED CARBON

TYPE BPL GRANULAR CARBON

Pittsburgh Type BPL Activated Carbon is designed for use in vapor phase applications, and is available in several mesh sizes to suit specific design requirements. It is made from selected grades of bituminous coal combined with suitable binders. These binders impart the superior hardness that is necessary for the long life expected in such applications. Produced under rigidly controlled conditions by high temperature steam activation, BPL Carbon provides high surface area, fine pore structure, high density, high volume activity and ease of reactivation. Because of its unique raw material base, this adsorbent also offers unusual economy in use.

Applications of Type BPL cover the whole vapor adsorption field, typical of which is the familiar solvent recovery system. BPL is used for the adsorption and recovery of alcohols, chlorinated hydrocarbons, esters, ketones, ethers, hydrocarbons, and aromatics.

Pittsburgh Type BPL is used almost universally as the catalyst support in the acetylene process for the production of vinyl chloride and vinyl acetate monomers. Here, high conversion rates and exceedingly long life mark its performance. It is also used as a direct catalyst in the production of phosgene and other similar reactions.

In fixed-bed adsorbers, Type BPL is used for the separation of hydrocarbon gas streams, such as the recovery of C_3 and C_4 cuts from natural gas. Similarly, organic sulfur, COS, and higher hydrocarbons are stripped from methane and hydrogen for catalytic conversion processes.

Other applications include purification of carbon dioxide for beverage use and dry ice; removal of chlorine, chlorinated organics and aromatics from anhydrous hydrogen chloride; purification of acetylene, hydrogen, compressed air, etc.

Air sterilization for aerobic fermentation can be accomplished with deep beds of BPL. It is widely used in air conditioning systems and for abatement of air pollution where plant air exhausts are odorous or harmful.

Because of their unusual adsorptive powers and high volume activity, Pittsburgh vapor phase carbons are the accepted standard for military gas masks and industrial respirators.

PHYSICAL PROPERTIES

Total Surface Area (N_2, BET Method), m^2/g	1050-1150
Apparent Density (Bulk Density, dense packing), Typical, g/cc	0.48
lb/ft³	30.0
Particle Density (Hg Displacement), g/cc	0.85
Real Density (He Displacement), g/cc	2.1
Pore Volume (Within Particle), cc/g	0.7
Voids in Dense Packed Column, %	43
Specific Heat at 100°C	0.25

SPECIFICATIONS

Iodine Number, Minimum	1050
Carbon Tetrachloride Adsorption, Minimum, Weight %	60
Ash, Maximum, %	8
Moisture (as packed), Maximum, %	2
Hardness Number, Minimum	90-93
Apparent Density (Bulk Density, dense packing); g/cc, Minimum	0.47

COMMERCIAL INFORMATION

Shipping Points: Pittsburgh, Pennsylvania; Catlettsburg, Kentucky.

Mesh Sizes: 4 x 10, 6 x 16, and 12 x 30 U. S. Sieve Series.

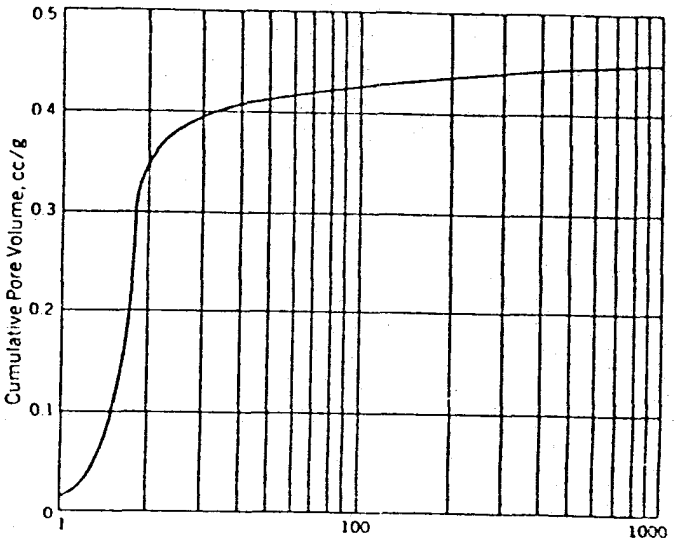
Packaging: Packed in 55 gallon Leverpak drums, 200 lb. net, 217 lb. gross weight.

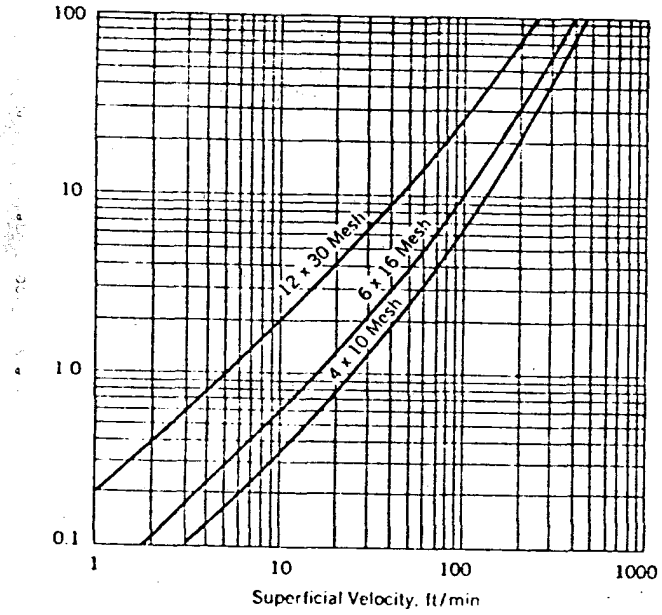
PORE STRUCTURE

The micropore structure of Type BPL carbon is illustrated at the right where the cumulative pore volume is plotted against pore diameter. The pore size distribution data are obtained from the water adsorption isotherm.[1] Examination of the curve indicates that a large portion of this micropore volume is in pores of 15 to 20 Angstrom units in diameter. These small pores are accessible to all common gases and vapors, and therefore provide the maximum surface area for adsorption. The structure of the pores provides good retention of the adsorbed molecules while at the same time allowing high working capacities in systems providing for reactivation of the carbon.

In addition to the microscope structure, Type BPL is permeated by a system of macropores (pores larger than 1000 Angstroms in diameter) which serve as avenues for the rapid diffusion of gases to and from the micropore surfaces. This enhances both adsorption and reactivation characteristics.

[1] Dubinin and Wiig: J. Am. Chem. Soc. 71, 2069 (1949)





PRESSURE DROP CHARACTERISTICS

Pressure drop, in inches of water per foot of bed depth, measured in air at 70° F. and 1 ATM, can be read above for standard mesh sizes of BPL Carbon. These data were obtained with a dense packing arrangement (30 lbs./ft.^{3}) and should be used for design purposes.

Loose packed beds (26 lbs./ft.^{3}) give a pressure drop approximately one-third of a dense bed. In making adsorption calculations a bulk density (of 30 lbs./ft.^{3}) should be used.

SCREEN SIZE SPECIFICATIONS, U.S. SIEVE SERIES TYPE BPL STANDARD MESH SIZES

4 x 10	
Sieve No.	**% Retained**
+4	0-5
4 x 6	30-50
6 x 8	30-50
8 x 10	5-20
-10	0-3

6 x 16	
Sieve No.	**% Retained**
+6	0-5
6 x 8	30-50
8 x 12	30-50
12 x 16	10-25
-16	0-5

12 x 30	
Sieve No.	**% Retained**
+12	0-5
12 x 16	10-30
16 x 20	40-65
20 x 30	10-35
-30	0-5

For samples and technical information write or call:

PITTSBURGH ACTIVATED CARBON
DIVISION OF CALGON CORPORATION
SUBSIDIARY OF MERCK & CO., INC.
CALGON CENTER, BOX 1346, PITTSBURGH, PA. 15230
(412) 923-2345

Printed in U.S.A.

APPENDIX D

RELATIVE WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL

WIND DIRECTION	WIND SPEED CLASS(KTS) 0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	0.00733	0.02564	0.01099	0.0	0.0	0.0	0.04396
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.00733	0.0	0.0	0.0	0.0	0.00733
ESE	0.00366	0.00733	0.0	0.0	0.0	0.0	0.01099
SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.00366	0.00366	0.0	0.0	0.0	0.0	0.00733
S	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.00366	0.0	0.0	0.0	0.0	0.0	0.00366
SW	0.00366	0.0	0.0	0.0	0.0	0.0	0.00366
WSW	0.00366	0.00733	0.0	0.0	0.0	0.0	0.01099
W	0.00733	0.00733	0.0	0.0	0.0	0.0	0.01465
WNW	0.01099	0.02930	0.00366	0.0	0.0	0.0	0.04396
NW	0.00366	0.02198	0.00366	0.0	0.0	0.0	0.02930
NNW	0.01465	0.04762	0.00733	0.00366	0.0	0.0	0.07326
CALM	0.01465						0.01465

SEA=SON

HOURS WITH HEAVY FOG (3/8 MILE OR LESS VISIBILITY) = 1

HOURS OF SATURATION DEFICIT LESS THAN OR EQUAL TO 0.4 G/CU. METER = 73

MAXIMUM FOGGING POTENTIAL HOURS = 72

WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL
WIND SPEED CLASS(KTS)

WIND DIRECTION	0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	2	7	3	0	0	0	12
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	2	0	0	0	0	2
ESE	1	2	0	0	0	0	3
SE	0	0	0	0	0	0	0
SSE	1	1	0	0	0	0	2
S	0	0	0	0	0	0	0
SSW	1	0	0	0	0	0	1
SW	1	0	0	0	0	0	1
WSW	1	2	0	0	0	0	3
W	2	2	0	0	0	0	4
WNW	3	8	1	0	0	0	12
NW	1	6	1	0	0	0	8
NNW	4	13	2	1	0	0	20
CALM	4						4

RELATIVE WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL

WIND DIRECTION	WIND SPEED CLASS(KTS) 0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	0.01099	0.00733	0.0	0.0	0.0	0.0	0.01832
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.00366	0.0	0.0	0.0	0.0	0.00366
E	0.00366	0.00366	0.00366	0.00366	0.0	0.0	0.01465
ESE	0.0	0.0	0.0	0.0	0.00366	0.0	0.00366
SE	0.00366	0.0	0.0	0.0	0.0	0.0	0.00366
SSE	0.0	0.00366	0.0	0.0	0.0	0.0	0.00366
S	0.0	0.01099	0.0	0.00366	0.0	0.0	0.01465
SSW	0.00366	0.00366	0.0	0.0	0.0	0.0	0.00733
SW	0.00366	0.00733	0.0	0.0	0.0	0.0	0.01099
WSW	0.0	0.01465	0.0	0.0	0.0	0.0	0.01465
W	0.01099	0.01465	0.0	0.0	0.0	0.0	0.02564
WNW	0.00366	0.00366	0.0	0.0	0.0	0.0	0.00733
NW	0.00366	0.00366	0.0	0.0	0.0	0.0	0.00733
NNW	0.00366	0.00366	0.00366	0.0	0.0	0.0	0.01099
CALM	0.01832						0.01832

SEA=JJA

HOURS WITH HEAVY FOG (3/8 MILE OR LESS VISIBILITY) = 0

HOURS OF SATURATION DEFICIT LESS THAN OR EQUAL TO 0.4 G/CU. METER = 45

MAXIMUM FOGGING POTENTIAL HOURS = 45

WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL
WIND SPEED CLASS(KTS)

WIND DIRECTION	0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	3	2	0	0	0	0	5
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	1	0	0	0	0	1
E	1	1	1	1	0	0	4
ESE	0	0	0	0	1	0	1
SE	1	0	0	0	0	0	1
SSE	0	1	0	0	0	0	1
S	0	3	0	1	0	0	4
SSW	1	1	0	0	0	0	2
SW	1	2	0	0	0	0	3
WSW	0	4	0	0	0	0	4
W	3	4	0	0	0	0	7
WNW	1	1	0	0	0	0	2
NW	1	1	0	0	0	0	2
NNW	1	1	1	0	0	0	3
CALM	5						5

RELATIVE WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL

WIND DIRECTION	WIND SPEED CLASS(KTS) 0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	0.0	0.0	0.00733	0.0	0.0	0.0	0.00733
NNE	0.0	0.0	0.0	0.00366	0.0	0.0	0.00366
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.00366	0.00366	0.00366	0.0	0.0	0.01099
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.00733	0.0	0.0	0.0	0.0	0.00733
SSE	0.00366	0.0	0.0	0.0	0.0	0.0	0.00366
S	0.0	0.0	0.00733	0.0	0.0	0.0	0.00733
SSW	0.00733	0.00733	0.0	0.0	0.0	0.0	0.01465
SW	0.0	0.01099	0.00733	0.0	0.0	0.0	0.01832
WSW	0.0	0.02930	0.00366	0.0	0.0	0.0	0.03297
W	0.00366	0.01465	0.00366	0.0	0.0	0.0	0.02198
WNW	0.00733	0.03297	0.00366	0.0	0.0	0.0	0.04396
NW	0.0	0.00733	0.00366	0.0	0.0	0.0	0.01099
NNW	0.00366	0.01465	0.00366	0.0	0.0	0.0	0.02198
CALM	0.00366						0.00366

SEA=MAM

HOURS WITH HEAVY FOG (3/8 MILE OR LESS VISIBILITY) = 7

HOURS OF SATURATION DEFICIT LESS THAN OR EQUAL TO 0.4 G/CU. METER = 64

MAXIMUM FOGGING POTENTIAL HOURS = 57

WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL
WIND SPEED CLASS(KTS)

WIND DIRECTION	0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	0	0	2	0	0	0	2
NNE	0	0	0	1	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	1	1	1	0	0	3
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	2	0	0	0	0	2
SSE	1	0	0	0	0	0	1
S	0	0	2	0	0	0	2
SSW	2	2	0	0	0	0	4
SW	0	3	2	0	0	0	5
WSW	0	8	1	0	0	0	9
W	1	4	1	0	0	0	6
WNW	2	9	1	0	0	0	12
NW	0	2	1	0	0	0	3
NNW	1	4	1	0	0	0	6
CALM	1						1

RELATIVE WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL

WIND DIRECTION	WIND SPEED CLASS(KTS) 0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	0.00733	0.01099	0.00733	0.00366	0.0	0.0	0.02930
NNE	0.0	0.00366	0.0	0.0	0.0	0.0	0.00366
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.00366	0.00366	0.0	0.0	0.0	0.0	0.00733
ESE	0.0	0.00366	0.0	0.0	0.0	0.0	0.00366
SE	0.0	0.00733	0.0	0.0	0.0	0.0	0.00733
SSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S	0.00733	0.01099	0.0	0.0	0.0	0.0	0.01832
SSW	0.00733	0.00733	0.0	0.0	0.0	0.0	0.01465
SW	0.00366	0.01099	0.00366	0.0	0.0	0.0	0.01832
WSW	0.00366	0.01099	0.0	0.00733	0.0	0.0	0.02198
W	0.01099	0.01832	0.0	0.0	0.0	0.0	0.02930
WNW	0.00733	0.03297	0.00366	0.0	0.0	0.0	0.04396
NW	0.00733	0.05861	0.00733	0.00733	0.0	0.0	0.08059
NNW	0.02564	0.04762	0.00366	0.00366	0.0	0.0	0.08059
CALM	0.00366						0.00366

SEA=DJF

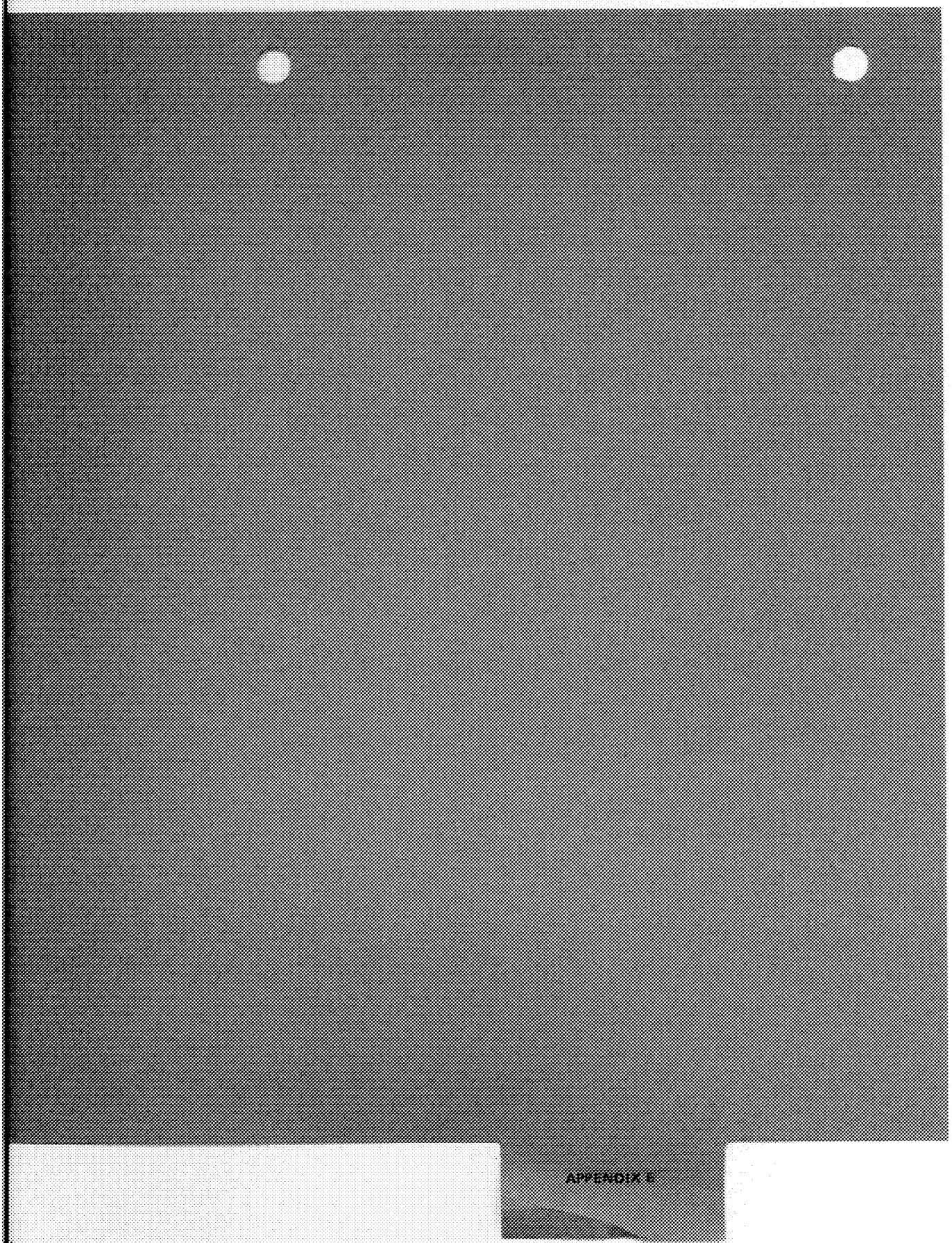
HOURS WITH HEAVY FOG (3/8 MILE OR LESS VISIBILITY) = 7

HOURS OF SATURATION DEFICIT LESS THAN OR EQUAL TO 0.4 G/CU. METER = 106

MAXIMUM FOGGING POTENTIAL HOURS = 99

WIND DISTRIBUTION OF MAXIMUM FOGGING POTENTIAL

WIND DIRECTION	WIND SPEED CLASS(KTS) 0-3	4-6	7-10	11-16	17-21	GT21	TOTAL
N	2	3	2	1	0	0	8
NNE	0	1	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	1	1	0	0	0	0	2
ESE	0	1	0	0	0	0	1
SE	0	2	0	0	0	0	2
SSE	0	0	0	0	0	0	0
S	2	3	0	0	0	0	5
SSW	2	2	0	0	0	0	4
SW	1	3	1	0	0	0	5
WSW	1	3	0	2	0	0	6
W	3	5	0	0	0	0	8
WNW	2	9	1	0	0	0	12
NW	2	16	2	2	0	0	22
NNW	7	13	1	1	0	0	22
CALM	1						1



APPENDIX E

APPENDIX E

COOLING TOWER DRIFT DEPOSITION

Cooling tower drift is that component of the cooling water which is mechanically, rather than evaporatively, entrained into the air flowing through the cooling tower. For the proposed facility, 1.4 percent of the cooling waters will be evaporatively entrained into the air stream, as contrasted with 0.008 percent through mechanical means. The evaporative process results in pure water being released into the atmosphere. Drift, on the other hand, contains the same proportion of chemical constituents as the cooling waters. The cooling water constituents are shown in Table E-1. The deposition of these particles on the surrounding terrain thus may adversely affect the environment.

The behavior of drift in the atmosphere will depend on droplet size, meteorological conditions, and on effective release heights of the droplets into the atmosphere.

The release heights are a function of plume rise and particle size fall velocities. Under conditions of downwash, the release height will be at ground level. Slight downwash may occur if the ratio of tower exit air velocity to wind velocity is less than 1.5. This situation occurs 20 percent of the time in Miami. Substantial downwash may occur if this ratio is less than 1.0, which occurs approximately 3 percent of the time in Miami.

For a number of reasons, wet cooling tower plumes may behave differently than dry plumes. As water vapor condenses and releases latent heat, buoyancy may be increased. This effect was incorporated into Briggs' dry plume equations by using "virtual" temperatures in the equations. The virtual temperature is:

$$T_v = T(1 + 0.61q)$$

where "q" is the specific humidity. The virtual temperature was approximated as

$$T_v \simeq T + \text{mixing ratio (grams } H_2O\text{/kg dry air)}$$

Otherwise, the cooling tower plume rise was calculated as a dry plume. This should be accurate, according to Briggs.

For trajectory analysis, these plume rise considerations are important because they determine the upward momentum of the drift droplets, and, for those particles small enough to be dispersed as a gas, these considerations influence gaseous dispersion. The size range of drift from a

Table E-1. Concentration of Blowdown Constituents.

Blowdown Constituents	Concentration (ppm)
Total Solids	425[a]
Methyl orange alkalinity (as $CaCO_3$)	225
Calcium (as $CaCO_3$)	225
Sulfates	200
Chlorides	125
Silica (as SiO_2)	30
Chromate (as $CrO_4^{=}$)	10
Organic phosphates	10
Nonoxidizing biocide	0.5

a. The solids consist primarily of calcium salts such as calcium carbonate, calcium bicarbonate, calcium chloride, and calcium sulfate; some sodium and magnesium salts will also be present.

mechanical draft cooling tower is typically such that a small number of very large droplets will dominate the total mass of drift. The expected size distribution at the proposed facility is shown in Table E-2. The larger droplets generally have terminal fall speeds of several meters per second. For particles with diameters larger than 200 micrometers, trajectory rather than dispersion equations need to be utilized to estimate drift deposition. Since 78 percent of the drift mass was in this range, the deposition calculations have all been made utilizing trajectory techniques.

The effective rise of the droplets was estimated as:

$$h_r = h_s + \Delta h_D$$

$$\Delta h_D \simeq 1.3 \frac{F}{uV_D^2}$$

where

h_s = height of tower

F = plume buoyancy factor = $\frac{gW_0D_T^2}{4} \times \frac{T_{vo} - T_{va}}{T_{vo}}$

g = gravitational constant

W_0 = tower exit velocity

D_T = tower effective diameter

T_{vo}, T_{va} = exit and ambient virtual temperature, respectively

u = wind speed, and

V_D = terminal velocity of the particle at its initial size.

A number of studies have been performed to determine droplet fall speeds. For droplets with a diameter less than 50 μm, Stokes' flow was assumed so that

$$V = 3.0 \times 10^5 \, Pd^2$$

where P = density of droplet ≃ 1 gr/cm^3 and d = diameter. For droplets with diameters in the range of 50 - 600 μm, experimental values of Beard and Pruppacher were utilized. For the range of 600 - 2000 μm, fall velocities made available by a cooling tower manufacturer were utilized. Droplets with diameters greater than 1200 μm are flattened by falling, for such sizes an equivalent diameter of a sphere of the same volume was used in the calculations.

It is significant that the droplets will change in size in the atmosphere due to condensation and evaporation. For estimating effective

Table E-2. Size and Mass Distribution of Drift Particles (HI - V Drift Eliminators).

Droplet Diameter (Micron)	% of Sample By Number	% Mass By Droplet Size
22	24.0	0.43
29	36.0	1.49
44	26.0	3.76
58	6.3	2.09
65	4.0	1.86
87	1.4	1.56
108	0.67	1.43
120	0.43	1.26
132	0.28	1.09
144	0.26	1.32
174	0.65	5.81
300	0.11	5.04
450	0.027	4.17
600	0.011	4.01
750	0.0055	4.00
900	0.0033	4.03
1050	0.0024	4.57
1200	0.0019	5.46
1350	0.0016	6.80
2250	0.00095	17.99
2400	0.0010	21.83

heights, only the initial size was considered because the droplets will largely be entrained in the plume for this period when the initial conditions of temperature and humidity will be largely unchanged. Evaporation is more significant for droplet settling.

The size of the droplet, and thus the fall speed, will change at a rate which is a function of atmospheric temperature and humidity, solute concentration in the droplet and the vapor pressure at the droplet surface. A drift droplet with a given concentration of solute will evaporate to an equilibrium size radius over a certain height of fall, h_e. The h_e values were determined for average meteorological conditions prevailing in Miami from graphs by Hosler and Pena. The equilibrium diameter for these average conditions is

$$d_e = 1.479 d_0 \ (P_0 c_0)^{1/3}$$

where the subscripts e and o refer to equilibrium and initial starting conditions, respectively, and c is the solute concentration in gr. solute/gr. solution. With this information, it is possible to calculate average fall velocities where

$$\overline{v} = v_0 - \frac{h_r}{h_e} (v_0 - v_e)$$

if $h_r > h_e$

$$\text{or } \overline{v} = v_e + \frac{h_e}{h_r} \frac{v_0 - v_e}{2}$$

if $h_e > h_r$

where h_r = height of release

h_e = height of fall to equilibrium

The distance from the tower where a drift particle of a given initial size will strike the ground as a projectile is then

$$x_0 = \frac{h_r u}{\overline{v}}$$

where the variables are as previously defined. Figure E-1 shows these fall distances under average meteorological conditions in Miami, for the proposed cooling tower. As shown, approximately 80 percent of the drift can be expected to fall out within 200 meters of the tower.

TRAJECTORY STRIKING DISTANCES FOR AVERAGE METEROLOGICAL CONDITIONS IN MIAMI

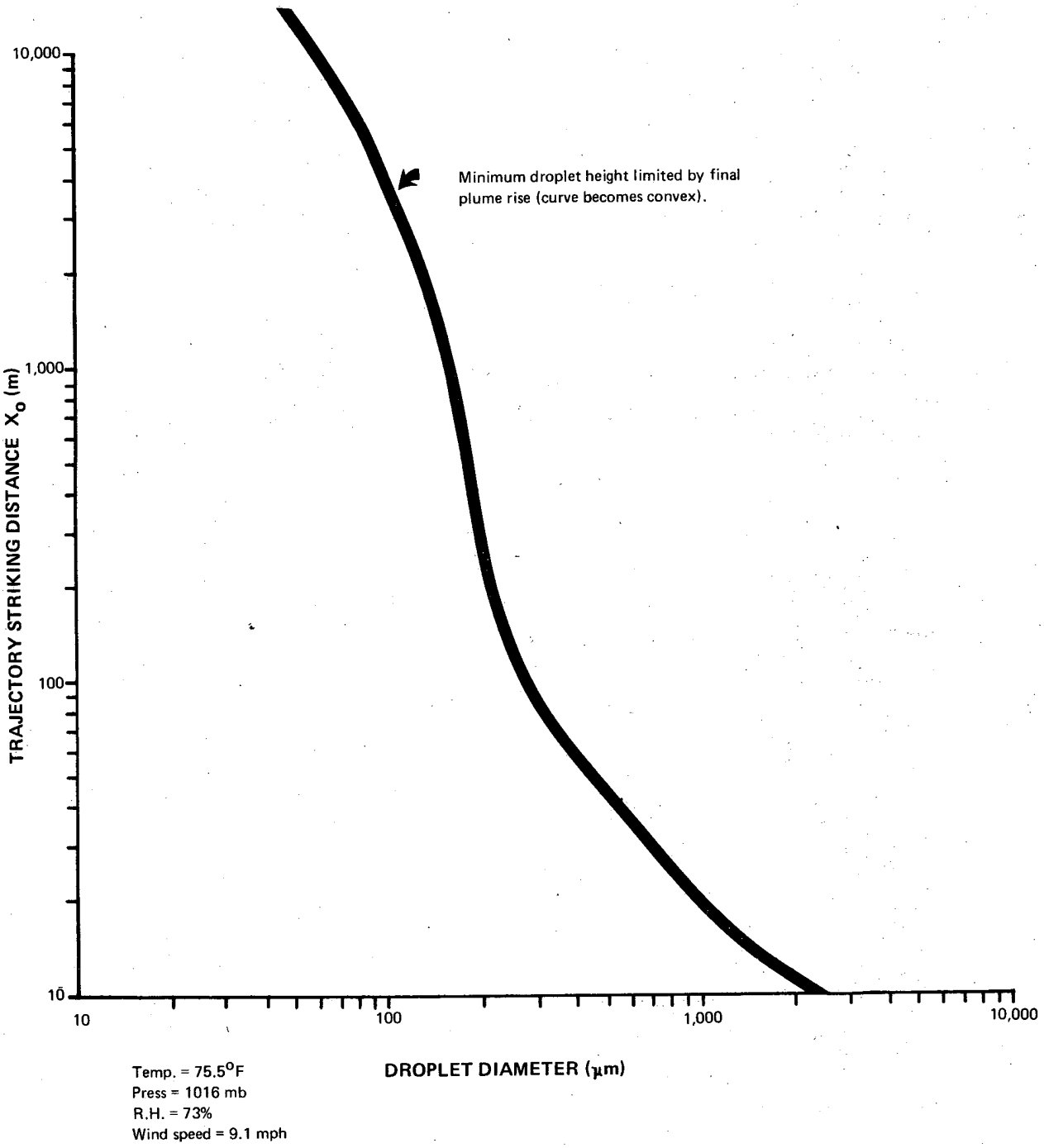


Figure E-1

Deposition can be calculated by dividing the droplet spectrum into intervals. The endpoints of the intervals were assumed to correspond to the midpoints of the diameters shown in Table E-2, above. Deposition was calculated by spreading the solute emission evenly over an area of an annulus whose radii are given by the values of x_0 over the particle size interval, and then by ratioing this value upwards for a 22.5-degree sector corresponding to the most frequent wind direction (approximately 20 percent frequency of easterly winds). The results are shown in Section 5.2. As can be seen, the maximum long-term average deposition rates decrease more than 4 orders of magnitude within the first 200 meters from the tower.

Any adverse impact from the cooling tower drift deposition will thus be largely confined to the plant site.

APPENDIX F

AN AIR QUALITY IMPACT ASSESSMENT OF THE OPERATION OF A PROPOSED RESOURCE RECOVERY PLANT IN DADE COUNTY, FLORIDA

Prepared for Resource Recovery (Dade County) Inc.

March, 1977.

Kennard F. Kosky
Steven R. Marks

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1.0 SUMMARY

Environmental Science and Engineering, Inc. (ESE) has completed a dispersion modeling study for Resource Recovery, Inc. to determine the air quality impact of their proposed resource recovery facility. Using the most pertinent EPA-approved dispersion models, in conjunction with available ambient air quality data collected by Dade County Environmental Resources Management, the incremental and total impact of the new facility could be determined.

This report concludes that the proposed Resource Recovery facility which is a source of sulfur dioxide and total suspended matter particulate will not cause a violation of the State or Federal ambient Air Quality Standards for those pollutants. Total suspended particulate matter concentrations have been decreasing in Miami proper and, except for two stations, are now in compliance with State ambient standards. The predicted sulfur dioxide concentrations were calculated to have increased above the 1976 air quality levels. However, the additional impact of the proposed facility will not contribute significantly to those predicted concentrations.

2.0 INTRODUCTION

Resource Recover, Inc., has retained Environmental Science and Engineering, Inc. (ESE), to determine the ambient air impact of their proposed solid waste resource recovery facility. This facility, designed by Resource Recovery, Inc., will be capable of disposing of 3,000 tons per day or 18,000 tons per week of residential and commercial rubbish and trash, and will have the capability of (1) classifying and screening the inorganic and organic materials for recycling; (2) generating electricity from steam produced by burning recovered combustible organic matter in boilers; (3) recovering and separating ferrous and non-ferrous metals, clear, amber and green glass for resale; (4) incinerating dead animals and other pathological waste in a separate pathological incinerator at a rate up to 8,000 pounds per day; and (5) employing a sanitary landfill operation adjacent to the plant for solid waste. The location of the proposed facility is just north of N.W. 58th Street and south of the Medley City limits, or approximately four miles northwest of Miami International Airport (see Figure 2-1).

As part of the implementation of the Federal Clean Air Act, the U.S. Environmental Protection agency (EPA) promulgated Primary and Secondary Ambient Air Quality Standards (AAQS) for six major air contaminants: total suspended particulate matter (TSP), sulfur dioxide (SO_2), nitrogen oxides, hydrocarbons, oxidants and carbon monoxide. Primary standards are promulgated to protect health while secondary standards are to protect both human health and welfare. Since emissions of TSP and SO_2 are expected to be the only primary contaminant emissions from the proposed

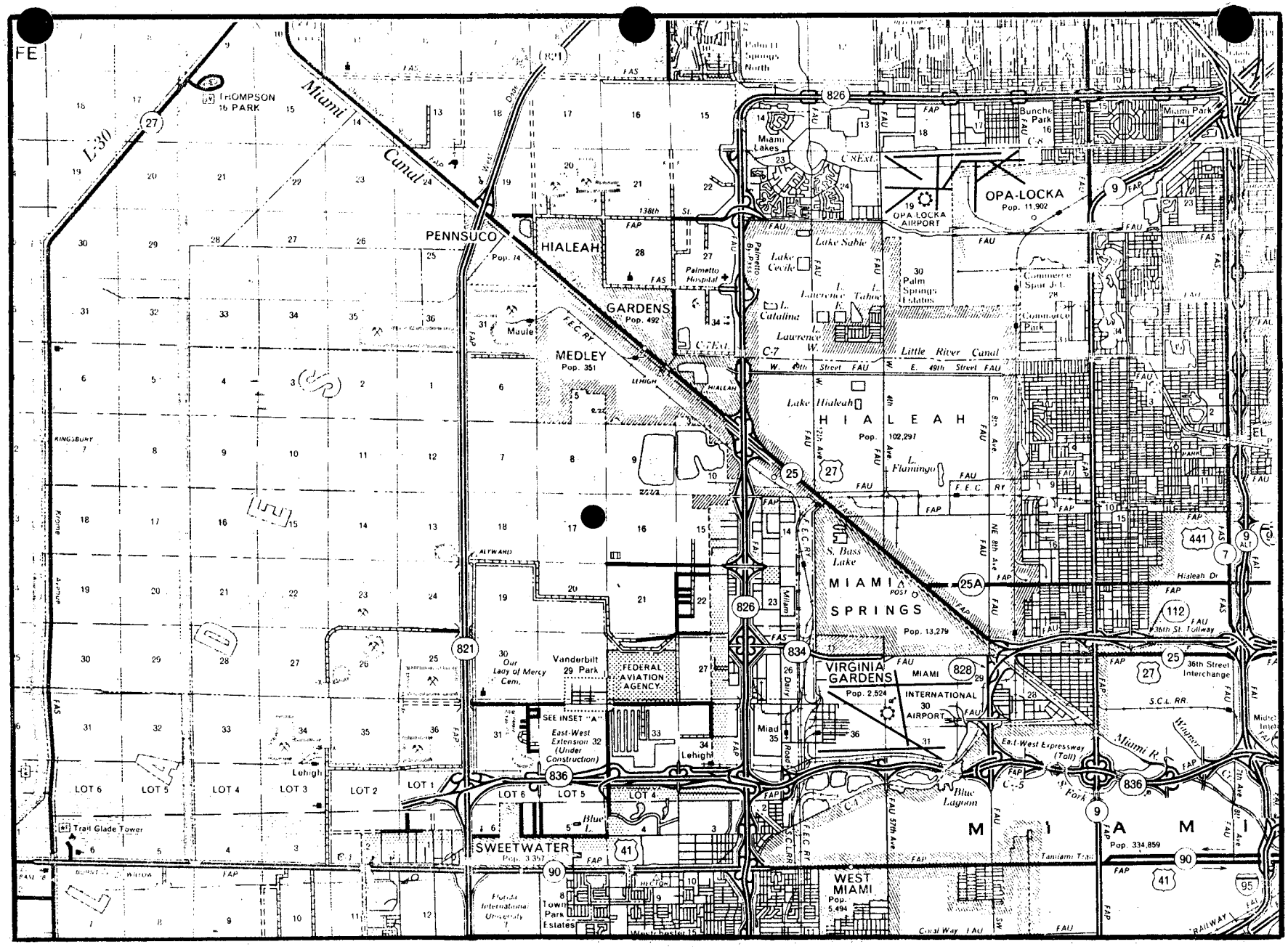


Figure 2-1. New Resource Recovery Facility Site Location. (Blacked-in circle).

resource recovery facility, this study addresses only those emissions and their projected effects on the ambient air quality in the vicinity of the plant. The applicable Ambient Air Quality Standards are discussed In Section 5.1.

The impact evaluation was conducted using atmospheric dispersion models as recommended by the Florida Department of Environmental Regulation (FDER) and the U.S. EPA. Implicit in demonstrating compliance with the applicable AAQS is an evaluation of both the long-term environmental impact (an estimation of annual average contaminant levels) and a short-term impact evaluation (an estimation of contaminant levels averaged over a period of time from 1 hour to 24 hours). The methodology of dispersion modeling is further discussed in Section 3-1.

3.0 METHODOLOGY

3.1 ATMOSPHERIC DISPERSION MODELS

A dispersion model is a useful tool for calculating, at any point, the SO_2 and TSP concentrations which may result from various emissions. It can also be manipulated to estimate ground-level concentrations under various meteorological conditions.

By compiling emission, meteorological, and air quality data, a mathematical model can be used to simulate the spatial distribution of contaminant contaminants. Once calibrated, emissions and meteorological impact parameters can be adjusted to demonstrate future changes in air quality.

For the purposes of this study, ground-level concentrations of TSP and SO_2 were estimated using the Air Quality Display Model (AQDM), Power Plant Model (CRS-1), and Point Multiple (PTMTP-W), each developed and widely used by the U.S. Environmental Protection Agency.

The AQDM estimates annual average concentration levels from annual average emissions and meteorological data and was used for the long-term impact evaluation. Both the CRS-1 and PTMTP-W are utilized for an averaging time of not more than 24 hours. Each utilizes the hourly meteorological variables of wind speed and direction, ambient temperature, atmospheric stability class, and mixing height. A more thorough description of these models is appended as Appendix A to this report.

The maximum 24-hour short-term concentrations were first calculated with the CRS-1. The same meterology was then used in the PTMPT-W in order to vary the averaging times and to calculate the maximum 4-, 3-, and 1-hour concentrations. For both the 4- and 3-hour concentrations the winds were varied within a 10-degree sector to be more realistic. The one hour incremental concentration was determined in both the PTMPT-W and the CRS-1. All interactions were determined utilizing the most influential SO_2 and TSP sources to the proposed facility from the 1980 AQDM runs.

Since it is not within the scope of this report to calibrate these models, calibration factors were selected, based on ESE's past experience. To be conservative (overprediction of concentrations) calibration factors for the long-term impact (AQDM) utilized were 0.5 for SO_2 and 1.0 for TSP. All short-term models employed a 1.0 calibration factors. These factors represent an upper bound to all estimated ground-level concentrations.

3.2 DEVELOPMENT OF EMISSION INVENTORIES

The 1974 Dade and Broward Counties' emission inventory was used as the "baseline" air quality model since it was more complete than the 1973 inventory. Data on point and area sources were received from the Department of Environmental Regulation. All point source emissions and stack parameters, as well as area source emissions, were developed by Dade County and an independent consulting firm.[1,2]

Using various projecting techniques, the 1980 emission inventory was created in a similar manner. ESE also acquired these data from the DER to estimate future air quality levels near the proposed facility.

Emission rates for the proposed facility were acquired through Resource Recovery, Inc., and were modeled at the maximum allowable emissions under existing regulations. The only significant sources of SO_2 or TSP are from boilers (2 stacks), a pathological incinerator, and a rotary dryer used in the glass drying operation. The emissions for each were determined as follows:

(1) For the boilers, the maximum allowable TSP rate of $0.2\#/10^6$ MMBTU heat input for new sources of 30 million BTU or greater.

(2) For the boilers, the SO_2 emission rate was determined by assuming an 0.1 percent sulfur content of the carbonaceous waste.

(3) Pathological incinerator emissions were obtained from emission factors.[3]

(4) The rotary dryer uses a distillate fuel oil with a sulfur content of about 0.5 percent. The emissions were determined from emission factors. The rate of fuel used was supplied by Resource Recovery, Inc.

The emission inventories which were used to estimate baseline and future ambient air quality in the vicinity of the proposed plant, along with the inventory for the plant itself, can be found in Appendix B.

Both the 1974 and 1980 emission inventories contained a number of sources which represented fugitive dust emissions at point locations. These sources alone have a very significant impact on the air quality nearby the proposed facility, causing ambient concentrations to be well above

that measured by air ambient air quality monitoring. It is ESE's conclusion that such sources cannot be modeled with a large degree of accuracy. Similarly, ESE's vast experience in modeling throughout Florida indicates backgrounds of nearly thirty and zero $\mu g/m^3$ for TSP and SO_2, respectively. This will be borne out later in the modeling results.

4.0 CLIMATOLOGY AND DISPERSION METEOROLOGY

4.1 DATA SOURCES

All climatological records are obtained from Miami's International Airport for several reasons:

(1) It is the most representative of the new facility's site climatology.

(2) The similar urban surrounding and close proximity of the airport to the site, makes for a high degree of representativeness.

(3) The Miami Weather Office is the primary one in the lower S.E. Florida region; it includes upper air observations and has the most readily available data.

All climatological data is acquired by ESE on subscription from the National Climatic Center, NOAA/EDS, Asheville, North Carolina.

4.2 CLIMATOLOGY

The City of Miami experiences a tropical climate under the marine influence of Biscayne Bay and the Atlantic Ocean. Temperature means and extremes are modified greatly at coastal locations but less so further inland. The mean monthly temperature at the airport varies from near 83 degrees in August to just over 67 degrees in January. Freezes seldom occur in Miami proper, but are experienced further inland. A temperature of 100 degrees was recorded only once, but not at the current weather observation site. Precipitation and temperature means and extremes are shown in Table 4-1. Over 75 percent of the annual mean precipitation falls during the six warmest months, May through October. In an average

Table 4-1. Temperature and Precipitation Means and Extremes, Miami International Airport, Miami, Florida.

Month	Temperature (°F)[a]			Precipitation (inches)		
	Mean	Average Maximum	Average Minimum	Mean[a]	Maximum[b]	Minimum[b]
January	67.2	75.6	58.7	2.15	6.66	0.04
February	67.8	76.6	59.0	1.95	6.56	0.01
March	71.3	79.5	63.0	2.07	7.22	0.02
April	75.0	82.7	67.3	3.60	10.21	0.07
May	78.0	85.3	70.7	6.12	18.54	0.44
June	81.0	88.0	73.9	9.00	22.36	1.81
July	82.3	89.1	75.5	6.91	13.51	1.77
August	82.9	89.9	75.8	6.72	16.88	1.65
September	81.7	88.3	75.0	8.74	24.40	2.63
October	77.8	84.6	71.0	8.18	21.08	1.50
November	72.2	79.9	64.5	2.72	13.15	0.09
December	68.3	76.6	60.0	1.64	6.39	0.13
ANNUAL	75.5	83.0	67.9	59.80	89.33	37.00

[a] 30-year average, 1941-1970
[b] 33-year average, 1943-1975

year there are 185 days that experience at least a trace of rain, but only 30 percent of these receive more than one-quarter of an inch. The mean annual precipitation is 60 inches, but this has varied from as little as 37 inches up to over 89 inches within the last 30 years. Since the majority of rains are short-lived convection-type showers, fed by copious amounts of heat and moisture into the area, the amount of subsidance over Miami in a given year determines the randomness of the mean annual precipitation.

In a mean year, both the surface and upper air wind patterns are dominated by the seasonal shifting of the trade wind circulation (which in turn positions the "Bermuda High"). The trade winds prevail throughout all but the average winter season. Table 4-2 shows the monthly prevailing direction and average wind speed at Miami. Surface wind roses for 1974 and 1969-74 are displayed as Figures 4-1 and 4-2, respectively.

4.3 DISPERSION METEOROLOGY

The three-dimensional dispersion potential of an area is generally associated with its frequency of inversions or episodes. Several types of inversions are experienced in south-central Florida, some to a greater degree than others.

The most frequent of inversions are nocturnal or radiation inversions. These emerge from the radiative cooling of the surface on clear and calm nights. Since air is a poor heat conductor, heat radiated from the surface will be emitted directly into space. The coldest air forms at the surface first and the inversion then deepens to higher levels. In this

Table 4-2. Monthly Prevailing Winds and Average Speed, Miami International Airport, Miami, Florida.

Month	Prevailing[a] Direction	Mean Wind[b] Speed (mph)
January	NNW	6.3
February	ESE	4.1
March	SE	3.5
April	ESE	5.4
May	ESE	3.0
June	SE	2.4
July	SE	4.3
August	SE	6.2
September	ESE	6.1
October	ENE	5.8
November	N	7.9
December	N	4.6
ANNUAL	ESE	4.5

[a] 15-year average, 1961-1975
[b] 26-year average, 1950-1975

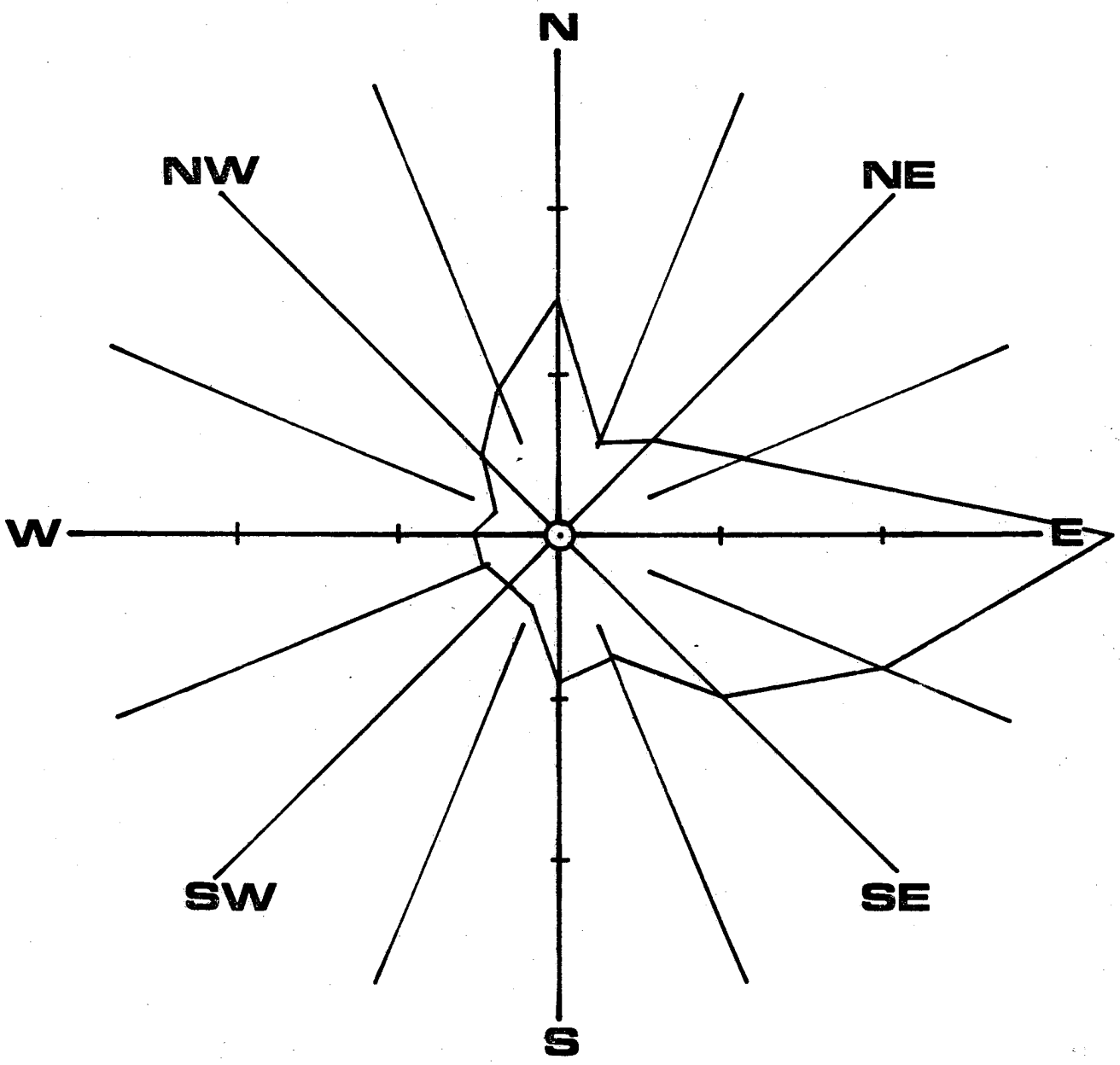


Figure 4-1. Annual averaged windrose for Miami, Florida, 1974.
Scale: 1" = 6%. Calm = 1.90%

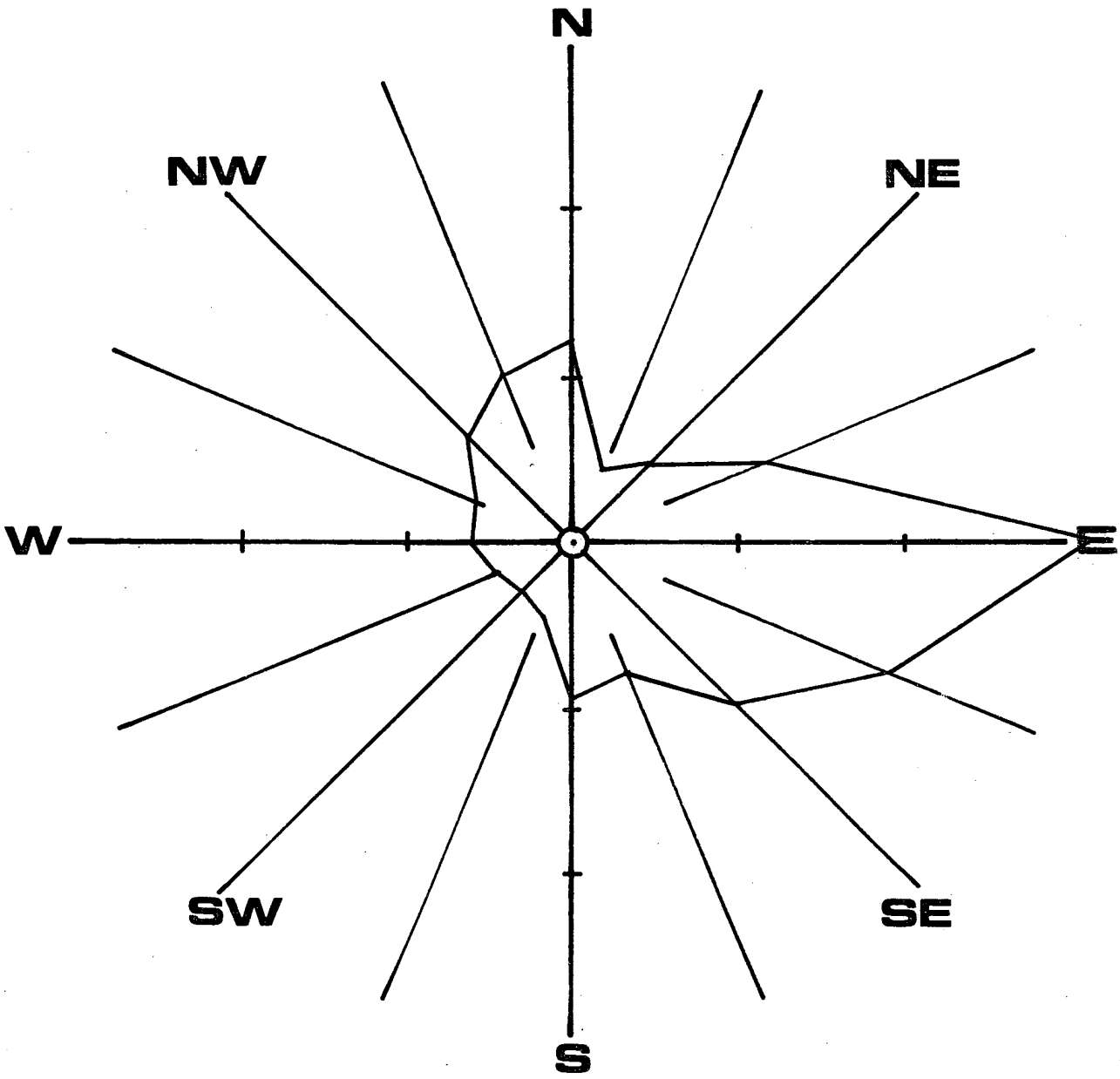


Figure 4-2. Six-year averaged annual wind rose for Miami, Florida, 1969-74. Scale: 1" = 6%. Calm = 1.34%

way, the most stable layers begin as only a few meters thick. If effluents are released above this shallow layer, high concentrations will be unable to penetrate through it until inversion break-up. If the stable layer rises above the effluent release point, the plume will fan out horizontally within it. South Florida has many noctural inversions, with the most severe ones (greatest negative lapse rate) occurring during the wintertime. Without this inversion the plume would loft, loop, or cone from the source (see Figure 4-3), depending upon the existing temperature stratification of the atmosphere.

Holzworth discusses the relationship between episode potential and stationary high pressure areas (anticyclones) . These systems are usually stable with air slowly descending in layers through its center at high levels. Increased stabilization will occur in those layers which "shrink" vertically more than others. When this occurs, a subsidence inversion is formed in the upper air. This type of inversion is hazardous since the air below the inversion is not as stable, and downward mixing will occur. Consequently the inversion, since it is formed at high altitude, will act as a thermodynamic lid on upwards mixing of effluents, and concentrations will increase from below. Unlike nocturnal inversions which are broken up by sunshine, subsidence inversions, as resulting from anticyclones, may persist for days and increasingly fumigate a region. Figure 4-4 represents the meteorological potential for air pollution in a five year period. The sparsity of subsidence inversions (or stagnation anticyclones) in Florida, as compared with other regions, is reflected through the emergence of a "zero" isopleth across the northern peninsula area.

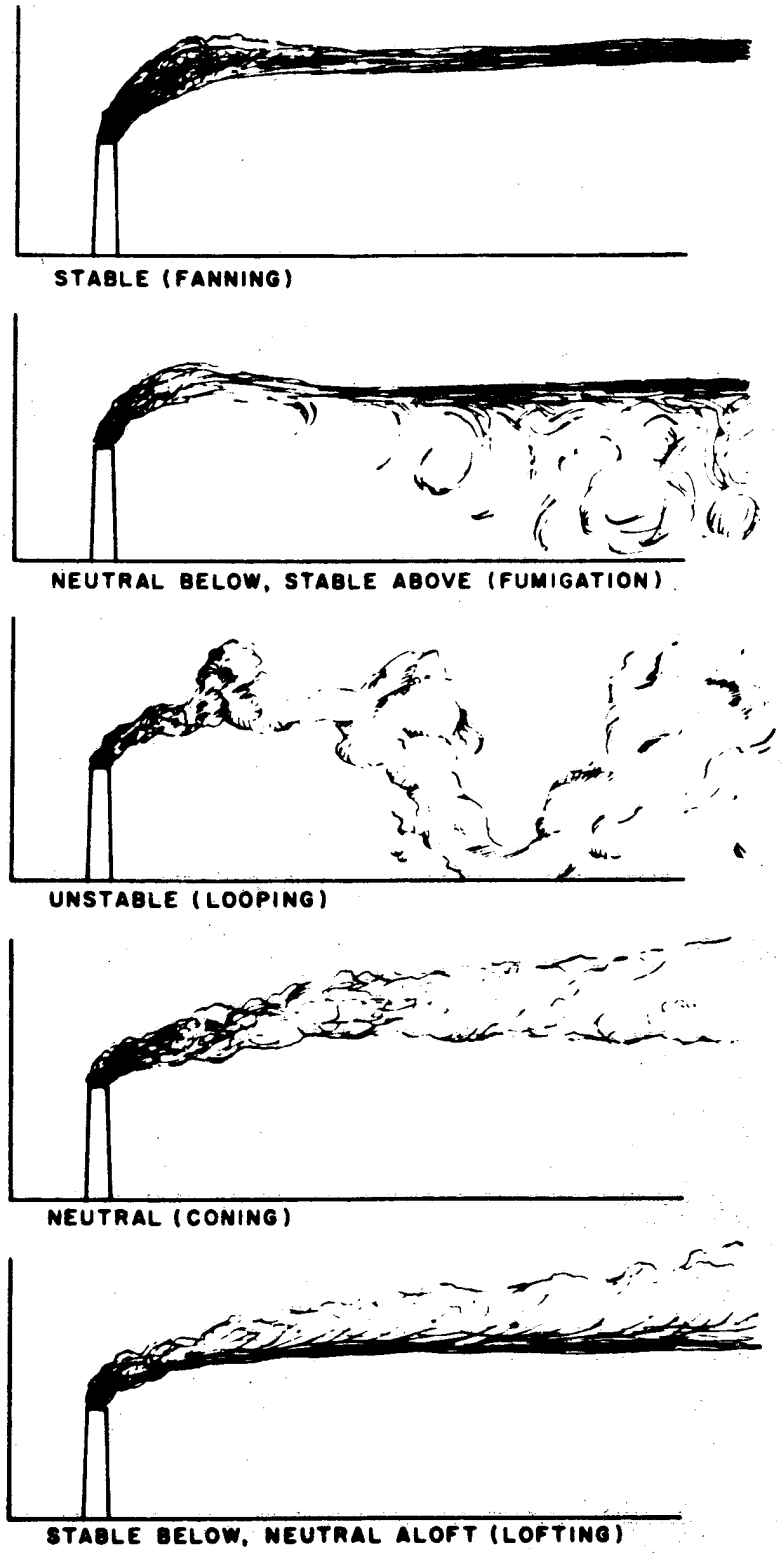


Figure 4-3. Different types of observed plumes (U.S. AEC).

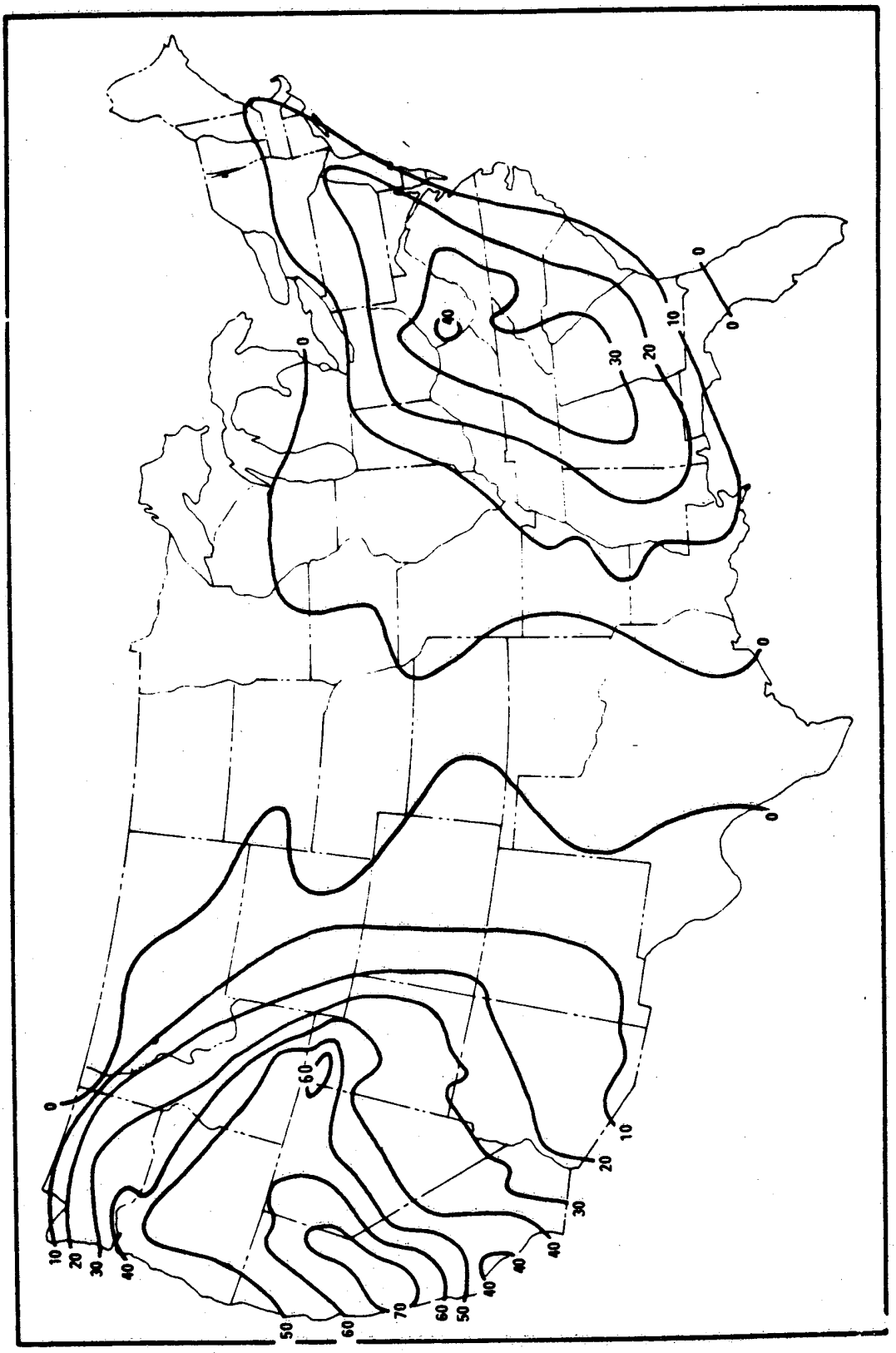


Figure 4-4. Pollution potential in a 5-year period (after Holzworth).

Other inversions are observed in Florida, either to a lesser degree or for brief periods of time. A frontal system may cause a build-up of effluent concentrations for a few hours. This is called trapping and is experienced only during the late fall or winter when cooler air masses invade the state. Such inversions, when they occur, yield high concentrations for very brief periods.

To summarize, there are inversions which form at ground-level, and in the lower to middle atmosphere. Because of a paucity of nighttime cloud cover coupled with low wind speeds, the former type occurs often in the state.[4] However, higher-level "lid" type inversions which can remain for days, as observed on the west coast (see Figure 4-4), are a rare occurrence in Florida.[5]

The Tennessee Valley Authority (TVA) presented a study concerning the high ground-level concentrations of effluents immediately after or during inversion break-up[6]. Figure 4-5 portrays the sequence of events leading up to a surface fumigation. During a hot day, land areas will heat up to a greater extent than sea areas. At some point downwind of the established seabreeze, the atmosphere will first become conditionally unstable and then adiabatic or super adiabatic, the latter of which is often observed mid-day in Florida. Initial instability will occur when the atmosphere is conditionally unstable; the exact point is dependent upon how long the air remains saturated (if it was saturated originally).

In Holzworth's study of nationwide pollution potential[5], annual morning and evening mixing depths were determined from radiosonde data collected

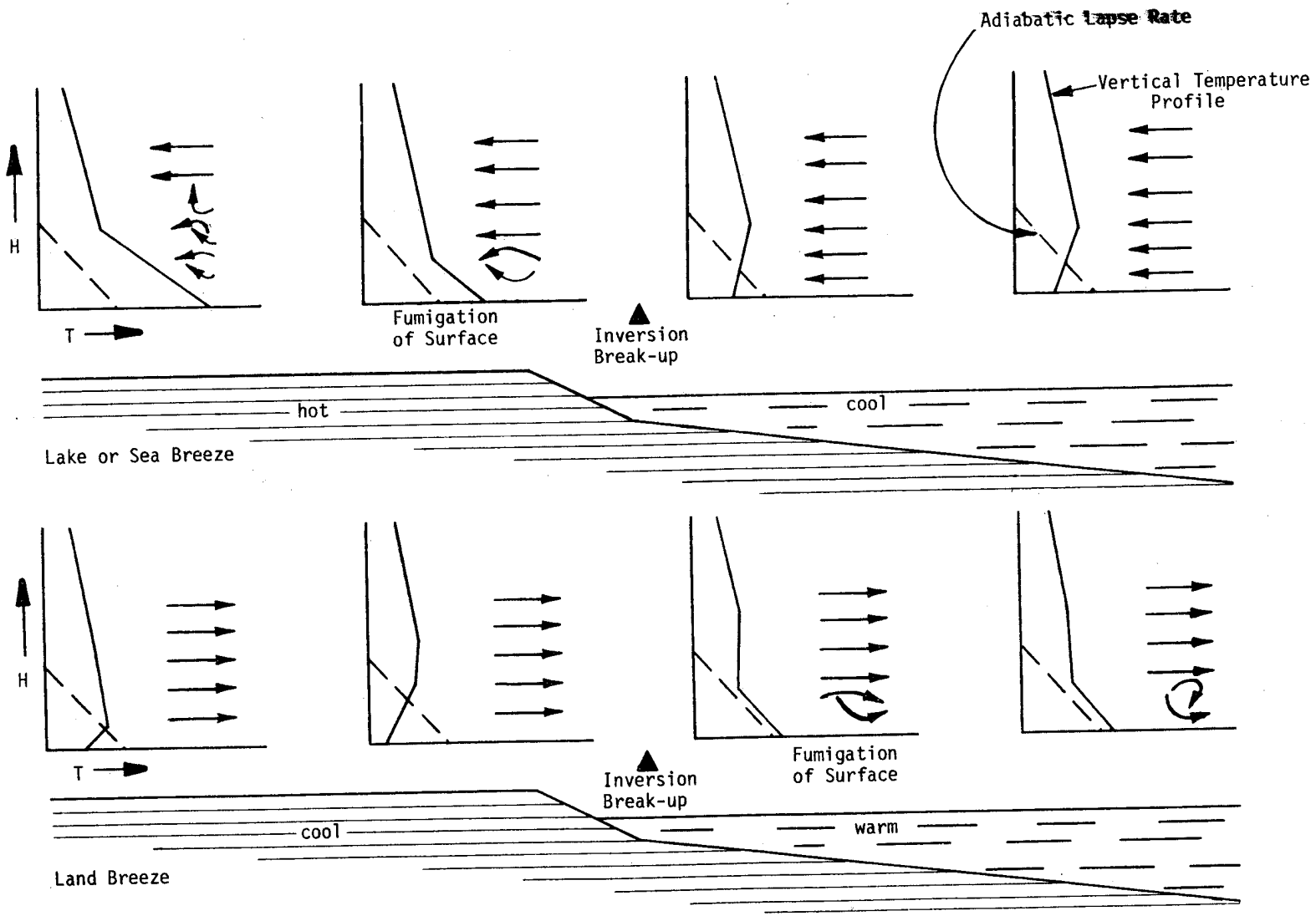


Figure 4-5. Schematic Representation of inversion break-up (after Turner).[7,8]

twice per day. The mixing height is the height of the first stable layer or inversion to which effluents can mix. Low mixing heights represent small ventilation areas above stacks. Figure 4-6 is a representation of early morning mixing heights. The abundance of moisture from the oceans around Florida creates high humidities and low-level cloudiness which absorb heat and inhibit mixing depth subsidence below 500 meters throughout the state. As mixing depths are dependent upon surface temperatures, afternoon levels reach about 1,400 meters under intense solar insolation (see Figure 4-7). The moderating effect of the oceans, as compared with the dryer regions of the country, is clearly evident. Florida, too, has greater diurnal mixing depth fluctuations at inland stations than at coastal locations.

Figure 4-6. Representation of early morning mixing heights (meters x 100) (after Holzworth).

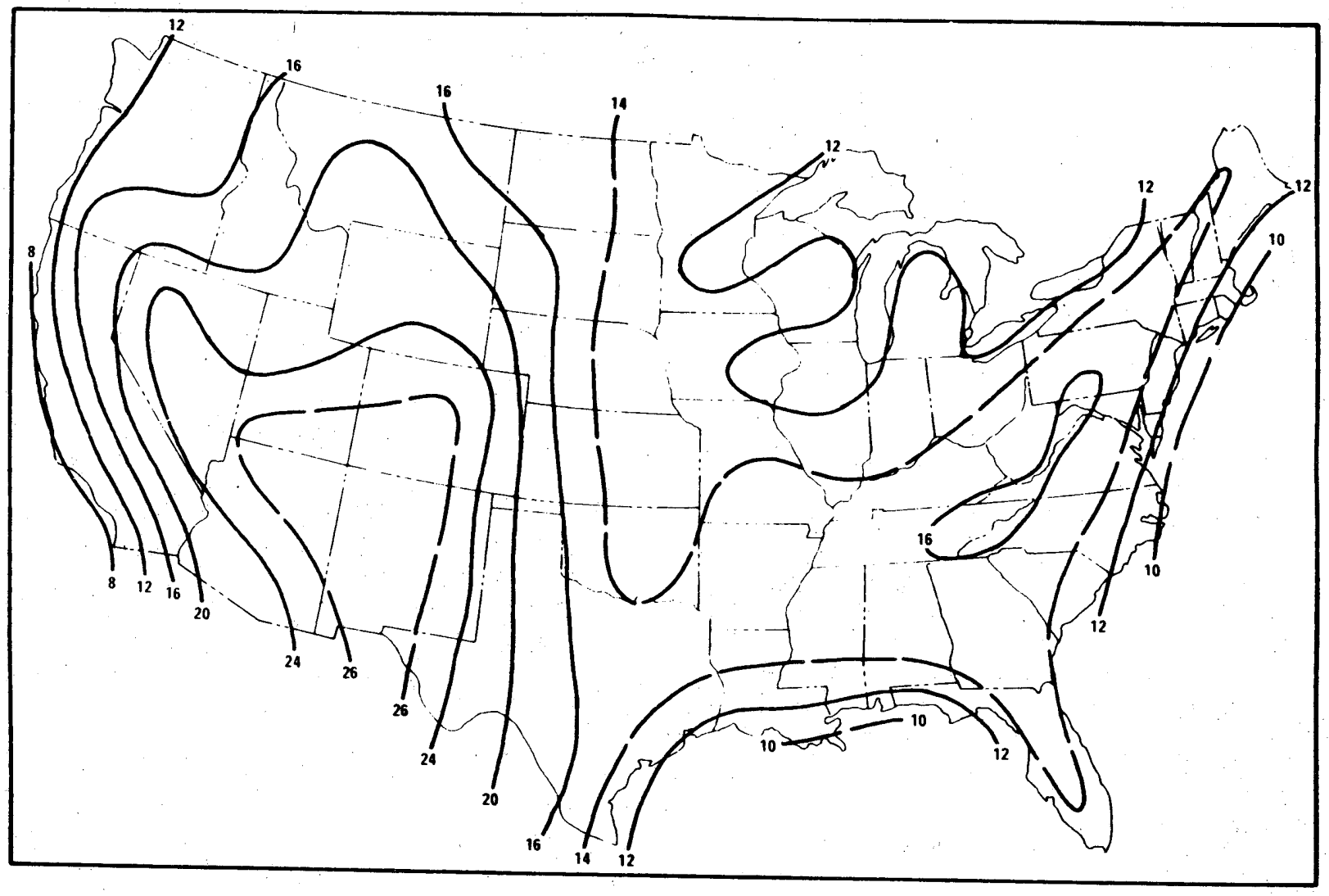


Figure 4-7. Representation of afternoon mixing depths (meters x 100) (after Holzworth).

5.0 EXISTING AIR QUALITY

5.1 APPLICABLE AMBIENT AIR QUALITY STANDARDS

As part of its Air Quality Implementation Plant, the State of Florida adopted federal secondary AAQS to be achieved by July 1, 1975. Emission regulations were promulgated in order to assure compliance with these standards. The federal, State of Florida, and Dade County sulfur dioxide and particulate standards are listed in Table 5-1. While the annual average particulate standard is a geometric mean, it should be noted that dispersion models predict an annual arithmetic mean which is generally higher than the gemoetric mean. From a statistical analysis of particulate ambient air quality data throughout the state of Florida, an arithmetic mean of 65 $\mu g/m^3$ was found to be nearly equivalent to a geometric mean of 60 $\mu g/m^3$, and will be referred to as such in the dispersion modeling results.

5.2 AIR QUALITY DATA

From 1974 through 1976, the State of Florida and Dade County operated 17 hi-volume sampling sites and increased the number of SO_2 bubblers from 5 to 8. The closest stations to the new plant are numbers 12, 13, and 20 (see Figure 5-1). Station 12 records only particulates while 13 and 20 record both sulfur dioxide and particulate samples.

Twenty-four hour particulate samples for 1974 and 1976 are summarized in Table 5-2. Evidenced is a marked reduction in mean ambient levels at all stations from 1974 to 1976. This reduction ranges from 7 to 41 percent at all stations. In 1976, two stations have annual values over the State of Florida standard of 60 $\mu g/m^3$. The two stations over 60 $\mu g/m^3$ are very

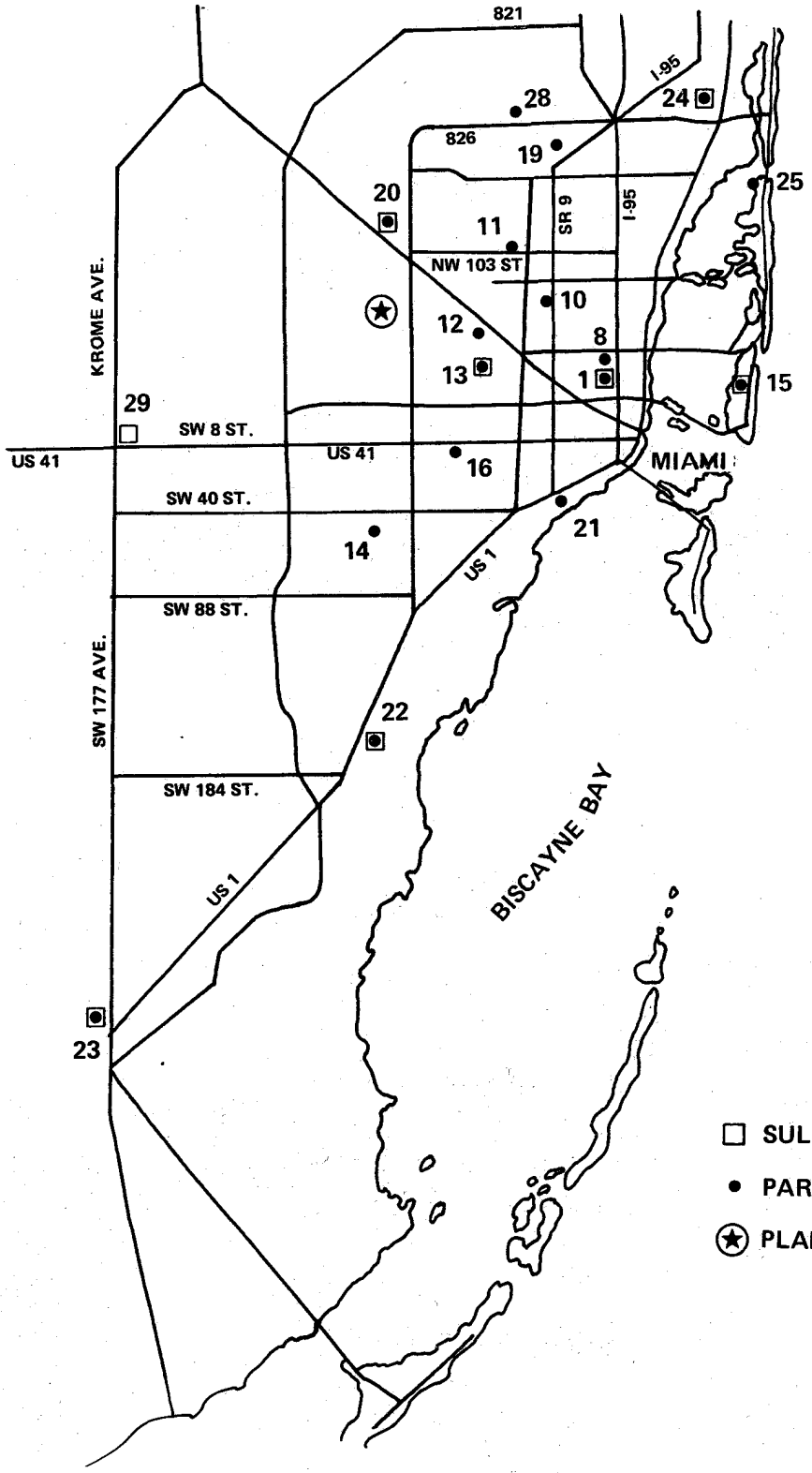
Table 5-1. Federal EPA, State of Florida, and Dade County[9,10,11] Ambient Air Quality Standards for Sulfur Dioxide and Total Suspended Particulate Matter ($\mu g/m^3$).

Limiting Standard	Averaging Time				
	1-Hour	3-Hour	4-Hour	24-Hour	Annual
EPA Primary					
Sulfur Dioxide	NA	NA	NA	365*	80
Particulate Matter	NA	NA	NA	260*	75***
EPA Secondary					
Sulfur Dioxide	NA	1,300*	NA	NA	NA
Particulate Matter	NA	NA	NA	150*	60***
State of Florida					
Sulfur Dioxide	NA	1,300*	NA	260*	60
Particulate Matter	NA	NA	NA	150*	60***
Dade County					
Sulfur Dioxide	286	NA	57.2	28.6	8.6
Particulate Matter	NA	NA	NA	180**	50***

*Not to be exceeded more than once per year
**Maximum concentration not to be exceeded
***Annual geometric mean

NA = Not applicable

SAMPLING SITE LOCATION MAP



LEGEND

- ☐ SULFER DIOXIDE BUBBLER SITES
- • PARTICULATE SAMPLING SITES
- ⊛ PLANT SITE

Figure 5-1

Table 5-2 1974 and 1976 Total Suspended Particulate* Ambient Concentrations ($\mu g/m^3$) by Station**

Station Number	Highest 24-Hour Concentration		Second Highest 24-Hour Concentration		Annual Geometric Mean	
	1974	1976	1974	1976	1974	1976
1	382	160	132	104	69	55
8	157	87	131	87	73	56
10	150	102	118	83	75	55
11	187	224	117	106	54	50
12	175	98	140	79	69	50
13	138	105	87	102	56	55
14	135	89	93	52	44	28
15	88	70	84	64	42	34
16	268	142	182	122	56	39
19	189	126	156	120	86	62
20	254	102	203	100	79	51
21	145	58	119	58	55	32
22	134	79	132	72	57	38
23	87	78	80	72	48	41
24	111	66	70	59	42	35
25	89	182	84	95	50	45
28	144	106	142	102	70	64

*Sampling performed by Hi-Volume FRM every sixth day.
**Data courtesy of Environmental Resources Management, Dade County.

close to one another on the northern part of the county outside of Miami. Seven stations exceeded the county annual TSP standard of 50 $\mu g/m^3$ while two more were at the standard. In 1974, five particulate stations exceeded the county 24-hour standard of 180 $\mu g/m^3$ while one exceeded the state 24-hour standard pertaining to the second highest observation. In 1976, there was one county violation and no state or federal violations.

Sulfur dioxide observations for 1976 only are summarized in Table 5-3. All stations are well in compliance with state 24-hour and annual standards of 260 and 60 $\mu g/m^3$ respectively, but seven stations exceeded the 24-hour Dade County standard (28.6 $\mu g/m^3$) and three the annual county standard of 8.6 $\mu g/m^3$.

Since 1973 any attempt to determine TSP and sulfur dioxide background, if any, was not validated by Dade County. ESE generally employs a background of 30 $\mu g/m^3$ for TSP modeling and zero for SO_2 depending on air quality data.

Prior to August, 1976, the SO_2 samples were taken by a non-temperature-controlled Federal Reference Method. Under sustained elevated temperatures, some of the SO_2 was lost, causing an undercalculation of the ambient air quality.[12]

Table 5-3 Sulfur Dioxide* Ambient Concentration ($\mu g/m^3$) by Station**, 1976

Station Number	Highest 24-Hour Concentration	Second Highest 24-Hour Concentration	Annual Arithmetic Mean
1	20	20	6
13	37	16	5
15	55	52	9
20	37	37	12
22	49	39	8
23	36	28	7
24	33	23	6
29***	68	37	15

*Sampling performed by FRM 24-Hour Gas Bubbler, Temperature Regulated, August through December, 1976.
**Data courtesy of Environmental Resources Management, Dade County.
***Started August, 1976.

5.3 AIR QUALITY MODELING RESULTS

Annual

The AQDM results for both sulfur dioxide and TSP concentrations in 1974 are shown in Figures 5-2 and 5-3. The subsequent SO_2 and TSP AQDM results for 1980, with the new facility, are portrayed in Figures 5-4 and 5-5. The SO_2 and TSP incremental impact of the new facility on the 1980 air quality is shown as Figures 5-6 and 5-7, respectively. The new facility is located near the center of each map. Table 5-4 summarizes the results of the annual modeling. It can be observed that the maximum predicted SO_2 concentrations have increased from 1974 level, while the TSP predicted maximum has dropped nearly 50 percent. It is noteworthy that the incremental impact of the proposed facility at the maximum predicted concentration is approximately one microgram per cubic meter. All results are uncalibrated, so that while the percentage increase or decrease is realistic, the actual peak value may be inaccurate.

Short-Term

From ESE's past SO_2 modeling in Dade County, the short-term baseline concentrations for both 24 and 3-hour averaging periods are 80 and 450 $\mu g/m^3$ respectively.[13] These concentrations were not obtained in the vicinity of the proposed plant. In 1976, the levels of SO_2 found in Dade County met the State's ambient standards but not the County's. The 1980 annual model predicts an increase in SO_2 concentrations which can be related to a maximum short-term impact in Dade County.

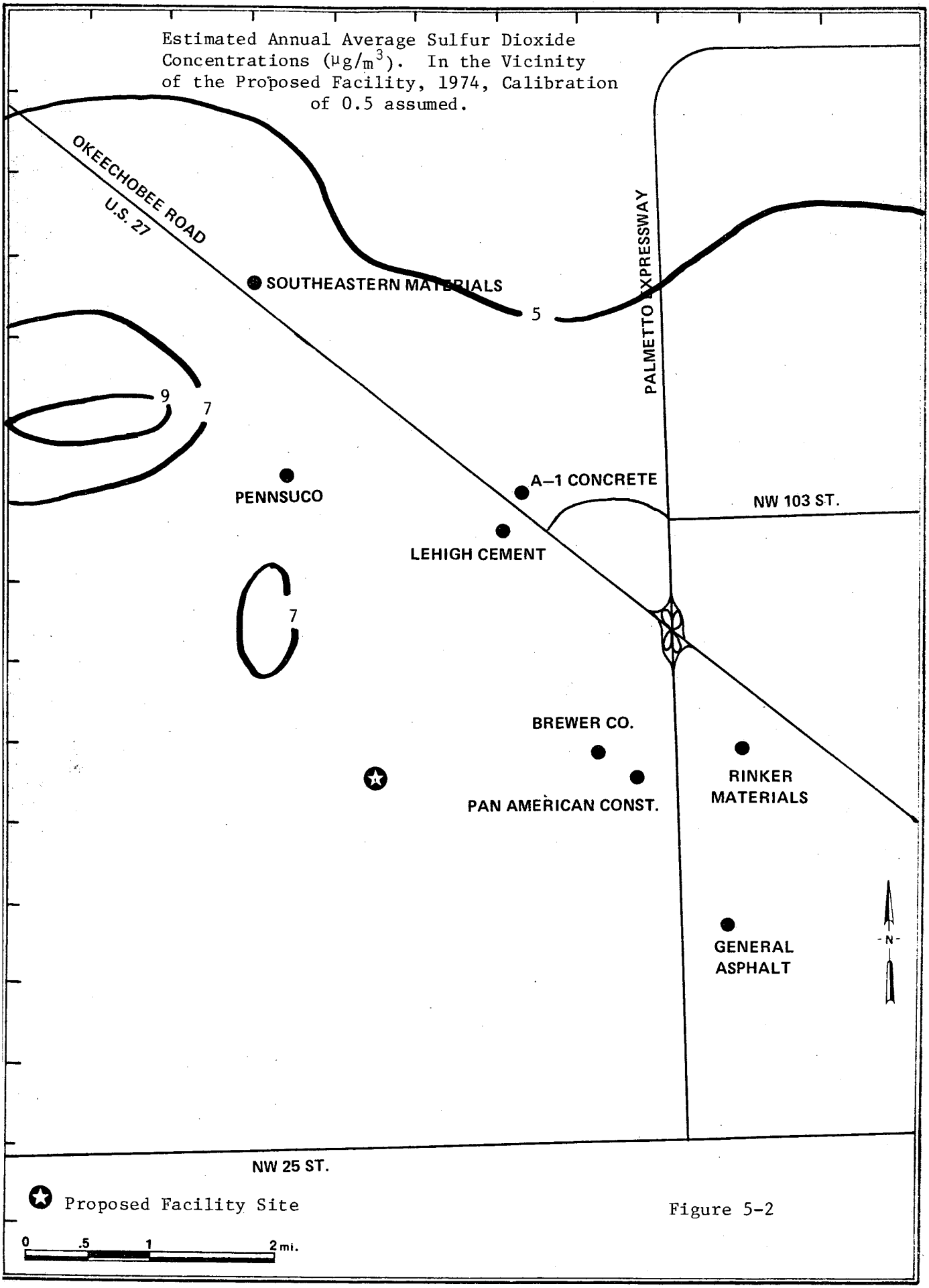

Estimated Annual Average Sulfur Dioxide Concentrations (μg/m³). In the Vicinity of the Proposed Facility, 1974, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
PALMETTO EXPRESSWAY
SOUTHEASTERN MATERIALS
5
9
7
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
7
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-2

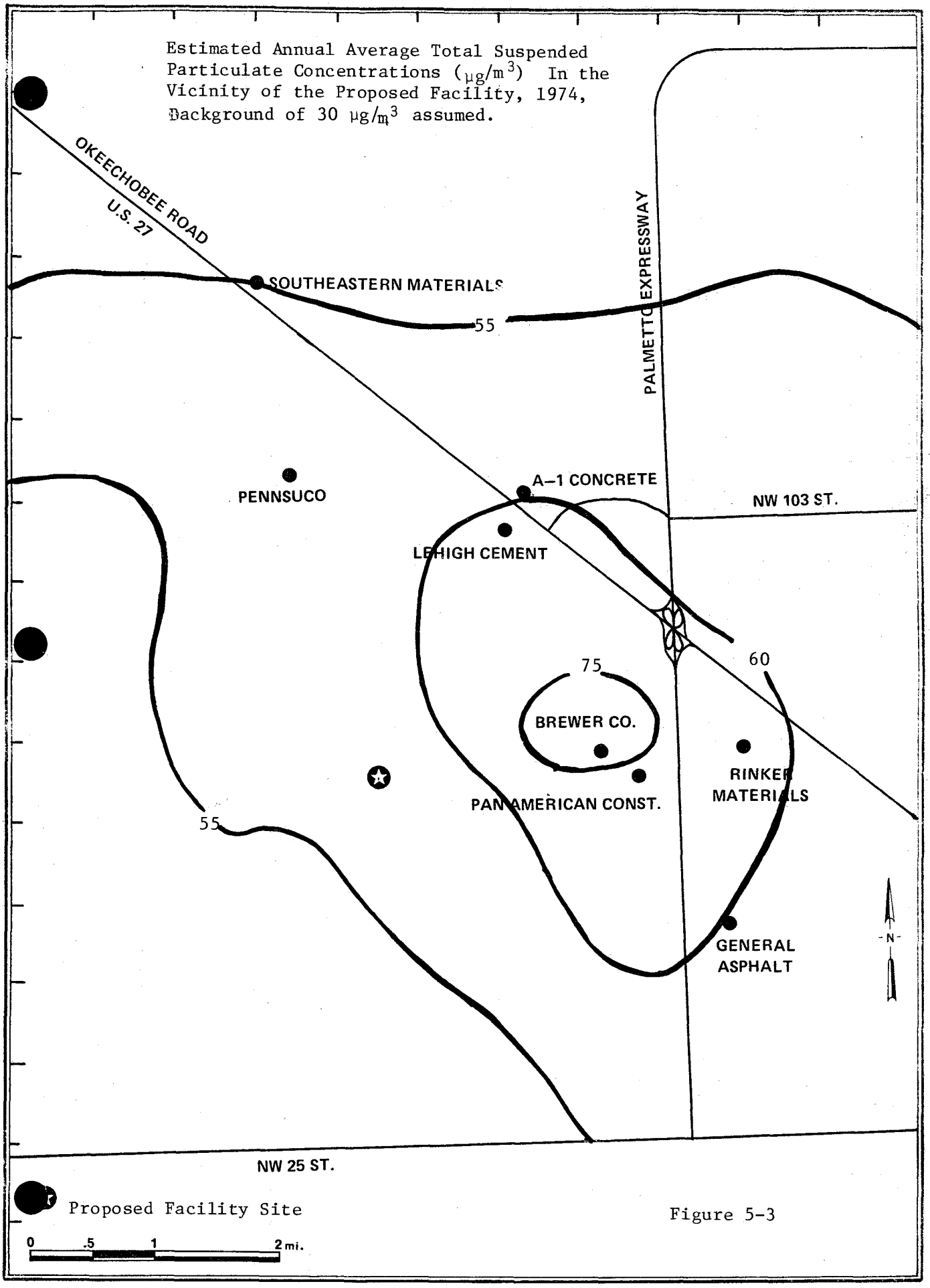

Estimated Annual Average Total Suspended Particulate Concentrations (μg/m³) In the Vicinity of the Proposed Facility, 1974, Background of 30 μg/m³ assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
55
PALMETTO EXPRESSWAY
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
75
60
BREWER CO.
RINKER MATERIALS
PAN AMERICAN CONST.
55
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-3

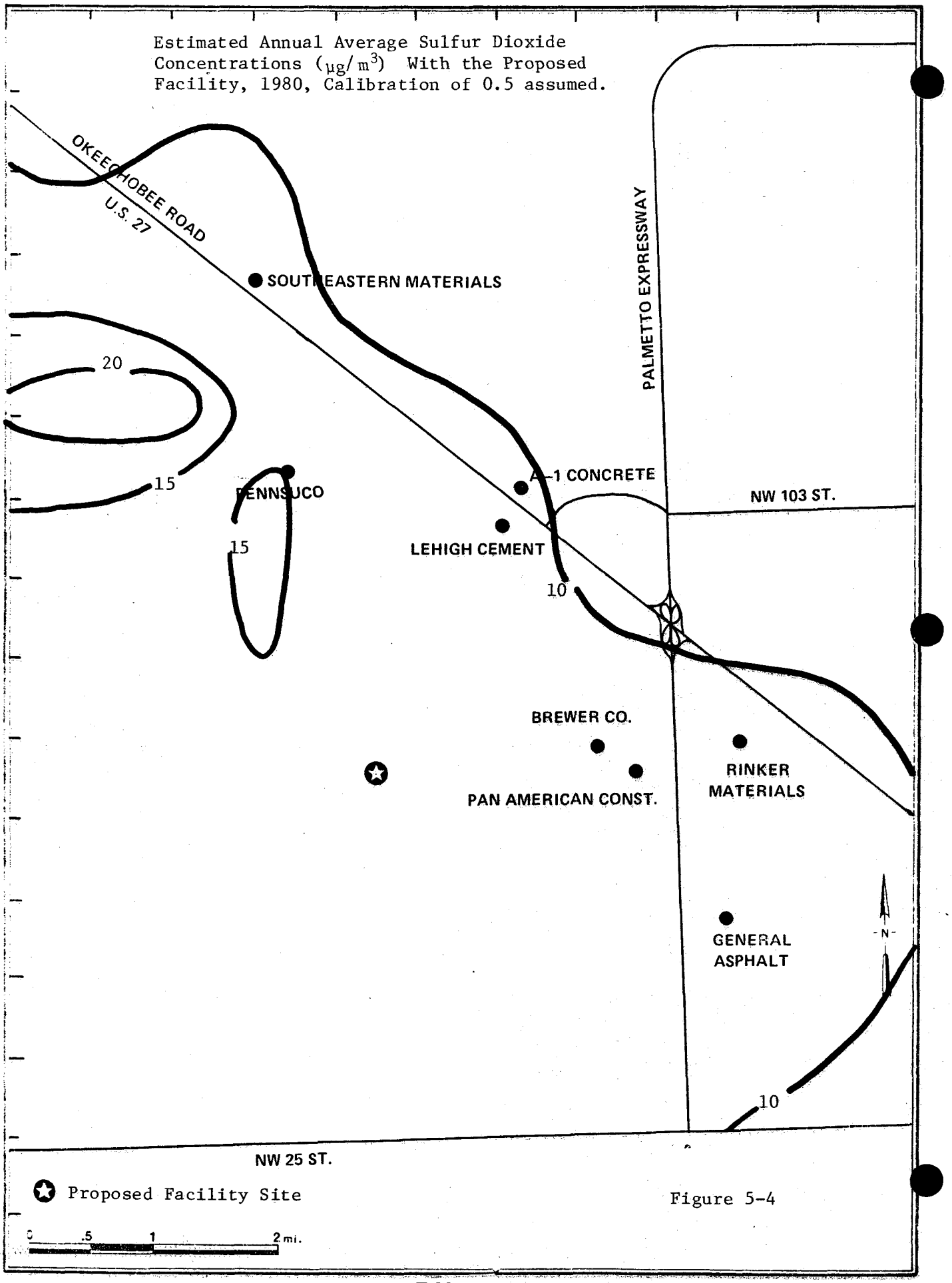

Estimated Annual Average Sulfur Dioxide Concentrations (μg/m³) With the Proposed Facility, 1980, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
20
15
PENNSUCO
15
A-1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
10
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
GENERAL ASPHALT
N
10
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-4

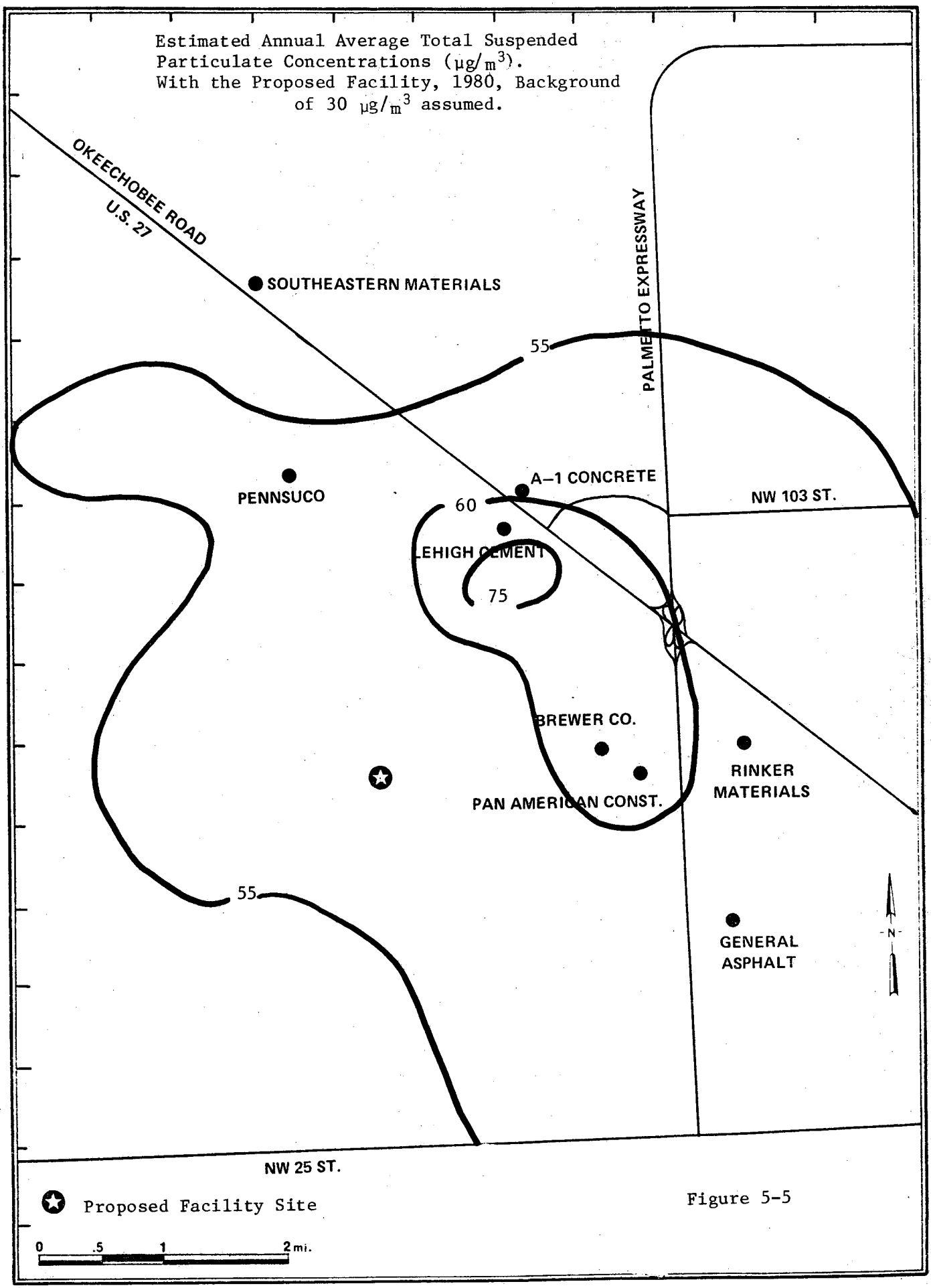

Estimated Annual Average Total Suspended Particulate Concentrations (µg/m³).
With the Proposed Facility, 1980, Background of 30 µg/m³ assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
55
PENNSUCO
A–1 CONCRETE
NW 103 ST.
60
LEHIGH CEMENT
75
BREWER CO.
PAN AMERICAN CONST.
RINKER MATERIALS
55
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-5

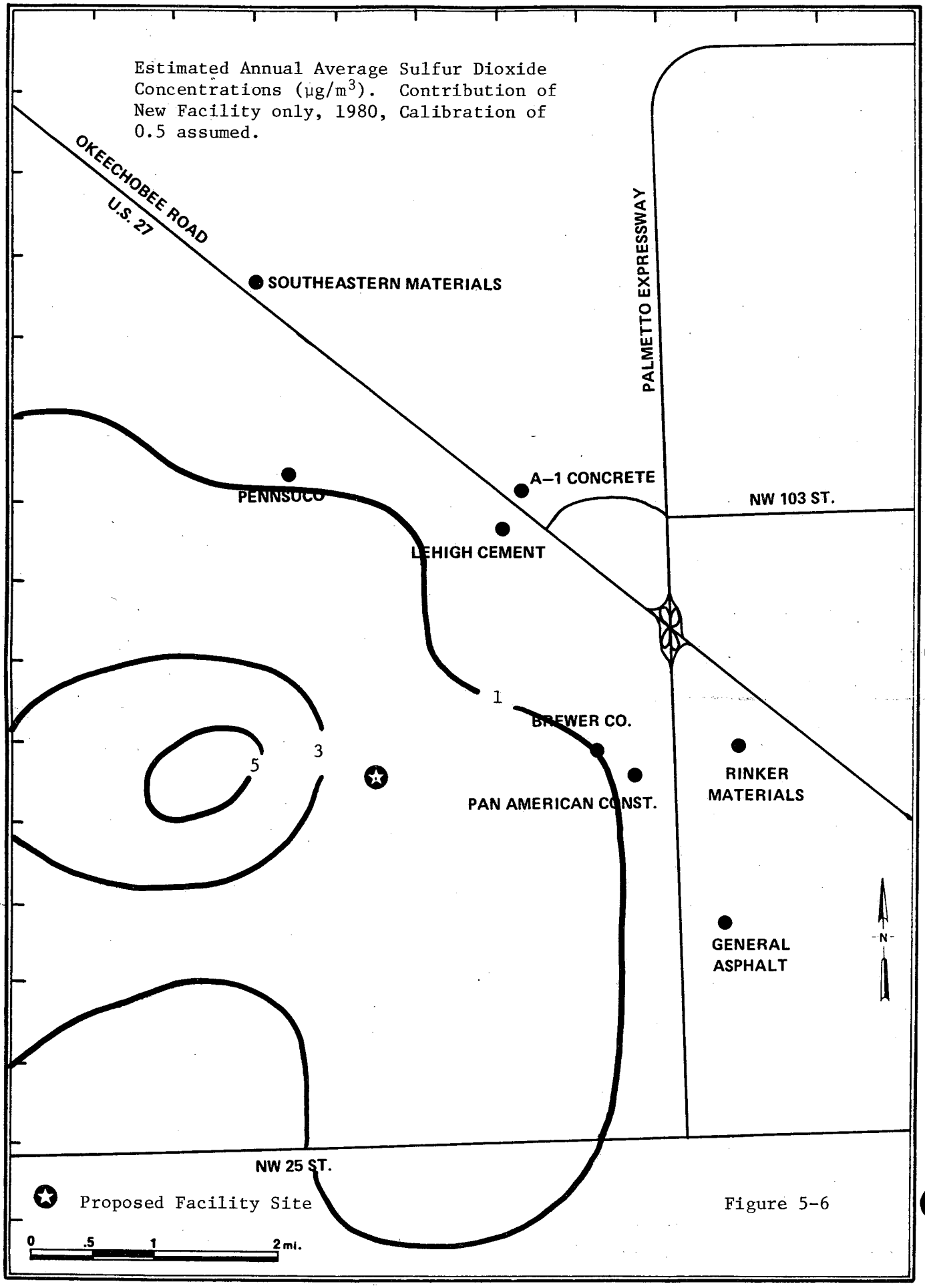

Estimated Annual Average Sulfur Dioxide Concentrations (μg/m³). Contribution of New Facility only, 1980, Calibration of 0.5 assumed.
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
1
BREWER CO.
3
5
RINKER MATERIALS
PAN AMERICAN CONST.
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.

Figure 5-6

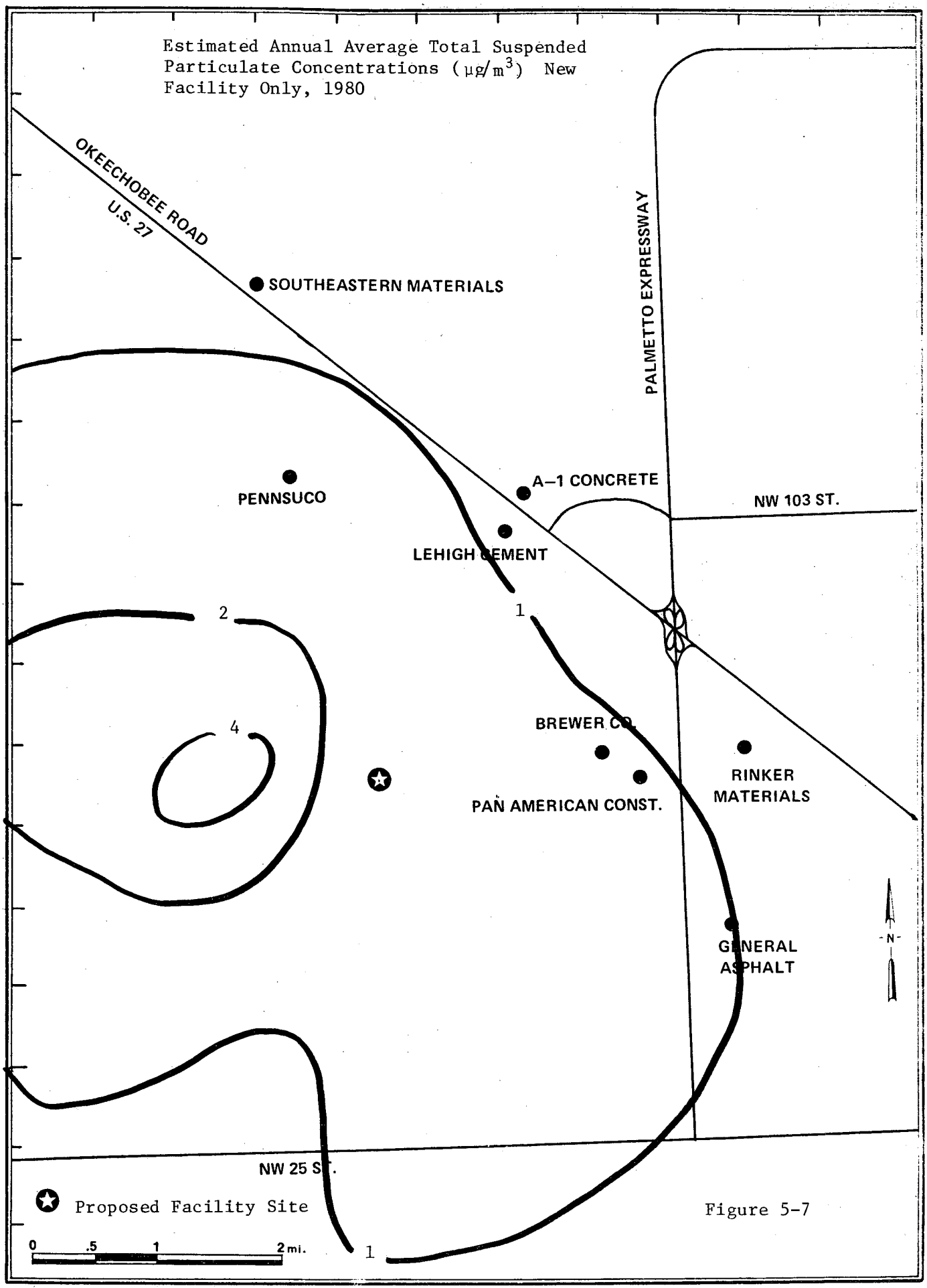

Estimated Annual Average Total Suspended Particulate Concentrations (μg/m³) New Facility Only, 1980
OKEECHOBEE ROAD
U.S. 27
SOUTHEASTERN MATERIALS
PALMETTO EXPRESSWAY
PENNSUCO
A–1 CONCRETE
NW 103 ST.
LEHIGH CEMENT
2
1
4
BREWER CO.
RINKER MATERIALS
PAN AMERICAN CONST.
GENERAL ASPHALT
N
NW 25 ST.
Proposed Facility Site
0 .5 1 2 mi.
1

Figure 5-7

Table 5-4. Maximum Estimated Annual Average SO_2 and TSP Concentrations ($\mu g/m^3$) 1974 and 1980

	1974	1980	Increment[a]
Sulfur Dioxide[b]	9	27	1
Particulate[c]	166	94	1

a. New facility incremental impact at maximum.

b. Calibration of 0.5 used for SO_2.

c. Includes 30 $\mu g/m^3$ background, annual arithmetic mean calibration of 1.0.

The maximum SO_2 short-term impact of the proposed facility is presented in Table 5-5. Included are the maximum interaction and incremental values for the new plant. As with the annual results, the proposed facility is not a significant SO_2 source in itself and the maximum interaction concentrations are still within the State (although not the county) ambient standards.

Short-term TSP concentrations from the proposed facility are shown in Table 5-6. Since the 1974 particulate standards were exceeded, significant deterioration does not apply. However, the short-term TSP impact of the plant is very small (11.0 % of AAQS's), even when compared to an improving TSP air quality overall.

Table 5-5. Maximum Estimated Short-term Sulfur Dioxide Concentrations ($\mu g/m^3$) for the Proposed Facility, 1980. (A calibration of 1.0 is assumed.)

Maximum Concentration	Averaging Time			
	24-Hour	3-Hour	4-Hour	1-Hour
Interaction [a]	120	298	283	325
Incremental [a]	29	95	90	114
Ambient Standards				
EPA Primary	365 [b]	NA [c]	NA	NA
State of Florida	260 [b]	1300 [b]	NA	NA
Dade County	28.6 [d]	NA	57.2 [d]	286 [d]

a. Interaction with most influential source.

Incremental Maximum Concentration from proposed facility.

b. Not to be exceeded more than once per year.

c. NA = Not applicable.

d. Maximum concentration, not to be exceeded.

Table 5-6. Maximum Short-term Particulate Concentrations ($\mu g/m^3$) for the Proposed Facility, 1980. (A calibration of 1.0 is assumed.)

Maximum Concentration	Averaging Time
	24-Hour
Interaction [a]	39
Incremental [a]	10
Ambient Standards	
EPA Primary	260 [b]
State of Florida	150 [b]
Dade County	180 [c]

a. Interaction with most influential source.

Incremental Maximum Concentration from proposed facility.

b. Not to be exceeded more than once per year.

c. Maximum concentration, not to be exceeded.

6.0 CONCLUSIONS

The results presented in the previous section were performed in accordance with atmospheric dispersion modeling procedures approved by the Florida Department of Environmental Regulation and the Environmental Protection Agency. It should be noted that these procedures assume that actual atmospheric dispersion is based upon empirical mathematical formulations for which no adjustments are made. The use of these empirical models as a predictive tool in a different meteorological regime and/or in an area with different topography as compared to their development requires adjustment (i.e. calibration). As a consequence, while the calculated impact of the resource recovery facility was presented as uncalibrated, there are many reasons why these calculated concentrations are much greater than actual observations. Such factors would include:

(1) The fact that SO_2 may be removed in the atmosphere is ignored. Removal mechanisms for SO_2 have been determined which limit the residence time of this pollutant in the atmosphere from 20 minutes to 7 days. Rain, ocean absorption, dry deposition (absorption by soil and rocks), vegetal absorption and chemical conversion all have a significant influence on sulfur dioxide removal from the atmosphere.[14]

(2) From previous studies performed by ESE and others, the long-term model generally overpredicts ground-level concentrations by four to ten times, i.e., a calibration factor of 0.25 to 0.10. Experience with short-term models indicates that they tend to over-predict by two to ten times with the most probable factor being four (calibration factor of 0.25). These studies,

while not conclusive, have been performed in many areas by the State. The knowledge obtained from these model calibration attempts add useful information in applying and deriving conclusions from model calculations.[15,16,17]

(3) For source interaction, i.e., adding calculated ground-level impact from one source to the calculated impact of another or several sources, the assumption is made that the "worst case" meteorology will occur to cause such lining up. The probability of such an occurrence is generally rare.

(4) Meteorology utilized in short-term models assumes the wind direction is constant with no varying for a one-hour period. In the "real world" wind fluctuates constantly in the near-surface boundary layer primarily due to turbulence. Preliminary estimates indicate that the models should be adjusted by a factor of 0.74 to correct for this wind variance.[18]

(5) The emissions from the resource recovery facility are assumed as a maximum. For short-term models it is assumed that 24-hour periods could occur when "worst case" meteorology occur. Such probabilities are not likely.

Based upon the atmospheric dispersion modeling results found in Section 5.0 and the above, the following conclusions are made:

1. The resource recovery facility will not violate the Federal or State AAQS's.
2. The maximum calculated contribution of the proposed facility will not exceed 11% of the State of Florida AAQS's.

3. The maximum calculated contribution of the proposed resource recovery facility to areas of maximum impact in the area will not exceed 2% of the State of Florida Annual AAQS's.

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3. Compilation of Air Pollutant Emission Factors, Second Edition, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, Publication No. AP-42, March, 1975.

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5. Holzworth, G. C., AP-101, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, pp. 36-45 and 96.

6. Tennessee Valley Authority, "Full-Scale Study of Plume Rise at Large Electric Generating Stations," Muscle Shoals, Alabama, September, 1968, pp. 62-63.

7. Various lectures on micrometeorology, unpublished documents, and notes, U.S. Environmental Protection Agency, 1971.

8. Turner, D. B., Journal of Applied Meteorology, February, 1964.

9. Federal Register, Vol. 39, Number 235, Part III, "Prevention of Significant Air Quality Deterioration," December 5, 1974.

10. Chapter 17-2, Florida Administrative Code.

11. Chapter 24, Metropolitan Dade County Pollution Control Ordinance.

12. Effect of Temperature on Stability of Sulfur Dioxide Samples Collected by the Federal Reference Method, U.S. Environmental Protection Agency, Office of Research and Development, Research Triangle Park, North Carolina, Pub. No. EPA-600/4-76-024, May, 1976.

13. Environmental Science and Engineering, Inc. Sulfur Dioxide Control Strategy Evaluations for Fossil Fuel Steam Generators, Gainesville, Florida, February 24, 1975.

14. Rasmussen, K. H., Taheri, M. and Kasel, R. L.; "Sources and Natural Removal Processes for some Atmospheric Pollutants." Prepared for National Environmental Research Center, June, 1974.

15. Environmental Science and Engineering, Inc. Impact Evaluation of a Proposed Sulfur Dioxide Emission Rule Change, Oxychem Florida, Inc., November 6, 1974, Gainesville, Florida.

16. Environmental Science and Engineering, Inc., Sulfur Dioxide and Suspended Particulate Air Quality Impact Evaluation of Northside Unit No. 4, for Jacksonville Electric Authority, 1973.

17. Environmental Science and Engineering, Inc., Sulfur Dioxide Control Strategy Evaluations for Fossil Fuel Steam Generators, February 24, 1975.

18. Turner, D. B., "Workbook of Atmospheric Dispersion Estimates;" PHS No. 99-AP-26 (NTIS PB 191 482), Office of Technical Information and Publications, U. S. EPA, Research Triangle Park, N. C., 1969. Page 7.

Appendix A

Dispersion Models

for: $A = \exp\left[-\frac{1}{2}(z-H/\sigma_z)^2\right] + \exp\left[-\frac{1}{2}(z+H/\sigma_z)^2\right]$

where:

$C(x, y, z; H)$ = pollutant concentration (grams/meter^3) at point x, y, z for an effective stack height, H

Q = emission rate (grams/sec)

u = mean wind speed (meters/sec)

σ_y, σ_z = standard deviation of the plume concentration distribution in the cross plume and vertical directions (meters). (σ_y and σ_z are given as functions of downwind distance and atmospheric stability.)

In the AQDM, the effective stack height, H, is computed from the Holland plume rise equation according to the relation:

$$H = h + \frac{V_s d}{u} \left[1.5 + 2.68 \times 10^{-3} \; p(T_s - T_a/T_s)d\right]$$

where:

H = effective stack height (meters)

h = actual stack height (meters)

V_s = exit velocity of stack gases (meters/sec)

d = inside diameter of stack (meters)

u = mean wind speed (meters/sec)

p = atmospheric pressure (mb)

T_s = exit temperature of stack gases (^oK)

T_a = ambient air temperature (^oK)

Appendix B

Emission Inventories

DADE CO. RESOURCE RECOVERY FACILITY, INCREMENTAL 1980

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG.K)	
1	564.3	2857.4	0.0	3.456	1.200	45.7	2.7	14.0	489.	RFS.REC.BLRS 1&2
2	564.3	2857.4	0.0	3.456	1.200	45.7	2.7	14.0	489.	RFS.REC.BLRS 3&4
3	564.3	2857.4	0.0	0.0	0.014	6.5	0.6	8.1	977.	RFS.REC.PATH.INC
4	564.3	2857.4	0.0	0.011	0.002	4.6	0.6	0.7	394.	RES.REC.R. DRYER

DADE CO, POINT SOURCES EXCEPT FUGITIVE SOURCES, 1974

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG K)	
1	584.5	2898.5	0.0	0.0	0.025	9.1	2.7	1.5	338.	JOHNSTON
2	584.6	2907.8	0.0	0.0	0.014	11.6	1.2	24.0	392.	MOUDAILLE
3	562.6	2873.0	0.0	0.0	0.038	12.2	3.0	2.1	321.	JSG ASPHALT
4	587.0	2904.8	0.0	0.0	0.003	12.8	5.2	0.1	298.	RINKER MATERIALS
5	583.3	2879.4	0.0	0.0	0.003	11.6	5.1	0.1	298.	RINKER MATERIALS
6	586.0	2885.0	0.0	0.0	0.003	12.8	5.2	0.1	298.	RINKER MATERIALS
7	581.5	2891.5	0.0	0.036	0.027	30.5	2.7	3.0	344.	FT.LALD.INCINER.
8	581.5	2891.5	0.0	0.036	0.027	30.5	2.7	3.0	344.	FT.LALD.INCINER.
9	581.0	2891.0	0.0	0.134	0.203	29.3	1.5	10.9	306.	FT.LALD.INCINER.
10	581.0	2891.0	0.0	0.134	0.134	29.3	1.5	10.4	306.	FT.LALD.INCINER.
11	583.3	2893.4	0.0	0.0	0.022	7.6	1.2	13.0	323.	EAST COAST ASPLT
12	584.9	2909.2	0.0	0.0	0.038	6.1	1.5	8.3	406.	EAST COAST ASPLT
13	584.7	2909.0	0.0	0.0	0.003	7.6	0.3	3.9	298.	MEEKINS,INC.
14	573.7	2875.0	0.0	0.0	0.003	7.6	0.3	3.9	298.	MEEKINS,INC.
15	584.9	2905.2	0.0	0.082	0.241	23.2	2.7	7.4	350.	BROWARD INCINER.
16	584.8	2905.2	0.0	0.082	0.241	23.2	2.7	7.4	350.	BROWARD INCINER.
17	584.8	2905.2	0.0	0.082	0.145	23.2	2.7	12.1	478.	BROWARD INCINER.
18	584.8	2905.2	0.0	0.082	0.145	23.2	2.7	12.1	478.	BROWARD INCINER.
19	586.8	2893.4	0.0	0.0	0.003	15.2	0.5	1.9	298.	MAULE INCINER.
20	585.8	2902.4	0.0	0.0	0.003	24.4	0.2	10.7	317.	MAULE INCINER.
21	585.8	2902.4	0.0	0.0	0.003	24.4	0.2	10.7	317.	MAULE INCINER.
22	584.6	2896.3	0.0	0.0	0.003	18.3	4.9	0.1	298.	RINKER MATERIALS
23	587.5	2885.0	0.0	0.0	0.014	22.9	0.9	19.8	298.	RINKER MATERIALS
24	586.1	2891.1	0.0	0.0	0.027	15.2	0.5	1.3	298.	RINKER MATERIALS
25	587.0	2886.4	0.0	0.126	0.049	10.7	0.4	25.2	620.	TRUMBULL
26	587.5	2885.3	0.0	9.184	0.674	104.9	4.3	21.8	439.	FP&L-EVERGLADES
27	587.5	2885.3	0.0	9.797	0.715	104.9	4.3	22.9	439.	FP&L-EVERGLADES
28	587.4	2885.3	0.0	21.132	1.548	106.1	4.1	35.0	425.	FP&L-EVERGLADES
29	587.4	2885.3	0.0	21.132	1.548	106.1	4.1	35.0	428.	FP&L-EVERGLADES
30	587.4	2885.6	0.0	0.805	0.151	16.8	5.5	19.2	692.	FP&L-EVERGLADES
31	580.0	2883.3	0.0	5.499	0.359	46.0	4.3	16.2	444.	FP&L-DANIA
32	580.0	2883.3	0.0	5.079	0.334	46.0	4.3	18.2	456.	FP&L-DANIA
33	580.3	2883.4	0.0	0.134	0.052	16.8	5.5	19.2	692.	FP&L-DANIA
34	580.3	2883.4	0.0	0.134	0.052	16.8	5.5	19.2	692.	FP&L-DANIA
35	560.3	2875.0	0.0	0.0	0.052	12.2	1.5	8.8	322.	WEEKLY ASPHALT
36	566.1	2883.3	0.0	0.159	0.685	30.5	1.8	21.3	378.	BROWARD INCINER.
37	566.1	2883.3	0.0	0.159	0.685	30.5	1.8	21.3	378.	BROWARD INCINER.
38	584.8	2910.0	0.0	0.0	0.099	9.1	2.5	3.8	340.	DIXIE ASPHALT
39	576.9	2886.1	0.0	0.0	0.027	10.4	3.0	3.9	328.	HOLLYWOOD
40	576.5	2885.5	0.0	0.0	0.003	9.1	0.1	0.1	298.	BANAZAK CONC.
41	579.0	2884.2	0.0	0.0	0.055	9.8	0.4	2.3	307.	READY MIX
42	586.8	2903.0	0.0	0.0	0.055	9.8	0.4	2.3	307.	READY MIX
43	585.3	2874.3	0.0	0.0	0.003	4.0	0.1	0.1	298.	AQUACHEM
44	583.3	2875.0	0.0	0.0	0.003	13.7	0.6	0.8	298.	BANAZAC CONC.
45	584.9	2890.3	0.0	0.0	0.055	9.1	0.1	0.1	298.	C/B MATERIALS
46	584.7	2909.9	0.0	0.0	0.005	9.1	0.1	0.1	298.	CEN CON.
47	576.3	2886.3	0.0	0.0	0.003	9.1	0.1	0.1	298.	DAVIE CONC.
48	577.1	2912.7	0.0	0.0	0.005	4.0	0.3	5.8	298.	MACK INDUSTRIES
49	584.5	2899.0	0.0	0.0	0.011	17.7	0.3	5.8	298.	MACK INDUSTRIES
50	584.8	2904.5	0.0	0.0	0.008	14.6	0.3	2.6	298.	POWER MIX
51	570.3	2834.8	0.0	0.359	0.049	45.7	3.3	12.2	403.	FP&L CUTLER
52	570.3	2834.8	0.0	0.693	0.093	45.7	4.6	12.3	453.	FP&L CUTLER
53	570.3	2834.8	0.0	0.592	0.079	45.7	4.6	10.2	435.	FP&L CUTLER

54	570.3	2834.8	0.0	0.923	0.126	45.7	4.6	16.0	430.	FP&L CUTLER
55	580.5	2850.4	0.0	0.082	0.005	46.0	3.7	4.4	449.	FP&L MIAMI
56	567.2	2813.0	0.0	23.381	1.348	122.0	5.5	22.0	447.	FP&L TURKEY PT.
57	567.2	2813.0	0.0	23.381	1.348	122.0	5.5	22.0	447.	FP&L TURKEY PT.
58	551.6	2843.4	0.0	14.447	0.992	76.2	4.4	5.0	476.	GENERAL PORTLAND
59	551.6	2843.4	0.0	14.447	0.992	16.8	0.9	11.3	476.	GENERAL PORTLAND
60	568.7	2855.6	0.0	0.0	0.384	15.2	3.0	4.2	325.	GENERAL ASPHALT
61	567.4	2858.0	0.0	0.0	0.438	6.1	3.0	1.9	333.	PAN AMERICAN
62	567.4	2858.0	0.0	0.0	0.422	6.1	3.0	2.2	327.	PAN AMERICAN
63	581.4	2851.0	0.0	0.038	0.003	73.2	0.7	5.7	333.	EVERGLADES HOTEL
64	551.3	2817.0	0.0	0.364	0.173	15.2	0.9	19.0	589.	HOME ELECTR.
65	558.1	2851.8	0.0	3.603	1.912	41.8	4.6	3.4	399.	LEHIGH PC.
66	558.1	2851.8	0.0	0.737	0.392	18.3	2.1	2.7	343.	LEHIGH PC.
67	566.2	2860.7	0.0	0.025	0.003	18.3	0.5	5.7	406.	LEHIGH PC.
68	566.2	2860.7	0.0	0.025	0.003	12.2	0.2	20.7	303.	LEHIGH PC.
69	574.2	2853.8	0.0	0.0	0.011	18.3	1.6	6.2	589.	SIMKINS
70	562.5	2861.8	0.0	0.455	0.296	29.0	1.8	10.1	425.	MAULE INDUSTRIES
71	562.5	2861.8	0.0	0.403	0.258	29.0	1.8	8.9	387.	MAULE INDUSTRIES
72	562.5	2861.8	0.0	0.885	0.567	61.0	3.4	5.2	463.	MAULE INDUSTRIES
73	562.5	2861.8	0.0	0.937	0.603	61.0	3.4	5.8	452.	MAULE INDUSTRIES
74	567.3	2859.8	0.0	0.0	0.014	15.2	0.7	12.6	350.	US FOUNDRY
75	555.6	2808.0	0.0	0.008	0.033	7.6	3.0	5.4	328.	US ASPHALT
76	563.6	2862.4	0.0	0.0	0.241	13.7	1.5	20.3	370.	ASPHALT M
77	578.2	2866.9	0.0	0.030	0.003	9.1	0.5	6.0	339.	SHEFFIELD
78	580.9	2851.0	0.0	0.140	0.008	33.5	0.8	8.2	561.	M. MACINTOSH
79	580.5	2853.2	0.0	0.041	0.003	13.4	0.6	12.0	422.	MECH. UNIF
80	580.5	2853.2	0.0	0.030	0.003	13.4	0.6	8.4	422.	MECH. UNIF
81	568.0	2851.6	0.0	0.005	0.0	10.4	0.4	7.5	450.	THOMPSONA
82	568.5	2855.0	0.0	0.0	0.011	10.7	0.6	20.2	339.	US VEG&GAL
83	583.4	2871.9	0.0	0.005	0.008	7.6	0.5	24.4	645.	MR.RONSAL
84	573.1	2854.3	0.0	0.008	0.008	17.7	11.7	0.5	422.	EASTERN AIRLINES
85	573.1	2854.3	0.0	0.008	0.005	16.8	6.9	1.0	526.	EASTERN AIRLINES
86	566.3	2840.7	0.0	0.164	0.011	12.2	1.2	2.3	478.	BAPTIST HOSPITAL
87	578.6	2852.9	0.0	0.238	0.288	76.2	3.0	7.1	478.	MIAMI D.S.
88	578.6	2852.9	0.0	0.238	0.288	76.2	3.0	7.1	478.	MIAMI D.S.
89	551.0	2816.8	0.0	0.233	0.263	9.1	0.9	8.6	333.	BREWER CO.
90	587.8	2863.6	0.0	0.005	0.0	18.3	0.7	1.5	408.	BEAURIVAG.
91	574.5	2856.5	0.0	0.0	0.184	15.2	1.2	6.1	422.	RUSSELL M.
92	587.6	2853.8	0.0	0.047	0.003	37.2	0.9	2.4	328.	ALGIERS
93	569.9	2858.0	0.0	0.082	0.005	9.1	0.5	10.0	492.	ALTON BOX
94	587.8	2863.9	0.0	0.011	0.003	45.7	0.3	12.8	339.	CAMELOT
95	588.0	2869.6	0.0	0.005	0.0	9.1	0.4	8.5	478.	COLONIAL
96	588.0	2856.6	0.0	0.016	0.0	43.3	1.0	1.0	339.	CRYSTAL
97	587.8	2863.5	0.0	0.008	0.0	22.9	0.9	1.5	333.	BALMORALH
98	576.2	2857.7	0.0	0.041	0.003	6.1	0.4	12.8	478.	HOWARD JOHNSONS
99	585.8	2852.2	0.0	0.030	0.003	48.8	0.9	2.1	339.	MORTON TO.
100	585.8	2852.2	0.0	0.030	0.003	48.8	0.9	2.1	339.	MORTON TO.
101	588.0	2857.0	0.0	0.019	0.003	64.0	0.7	2.9	339.	CARRIAGE
102	580.2	2853.8	0.0	0.0	0.005	18.3	0.6	9.6	365.	ORANGE BOWL
103	580.6	2850.7	0.0	0.016	0.0	14.9	0.6	1.5	478.	PARISIAN
104	588.1	2856.8	0.0	0.016	0.003	56.4	0.7	3.6	339.	SEACOAST
105	588.0	2856.9	0.0	0.008	0.003	56.4	0.6	3.2	339.	SEACOAST
106	588.1	2856.9	0.0	0.005	0.0	56.4	0.6	3.2	339.	SEACOAST
107	597.9	5867.3	0.0	0.005	0.0	7.6	0.6	3.8	478.	AZTEC MOTEL
108	580.9	2957.8	0.0	0.005	0.0	10.7	0.8	3.4	478.	BORDEN
109	573.2	2853.2	0.0	0.019	0.005	7.6	0.5	8.6	478.	NATIONALAIRLINES
110	573.2	2853.2	0.0	0.008	0.003	10.7	0.6	1.9	478.	NATIONALAIRLINES
111	573.2	2853.2	0.0	0.003	0.003	7.3	0.3	3.9	478.	NATIONALAIRLINES
112	573.2	2853.2	0.0	0.008	0.003	9.1	0.5	2.7	478.	NATIONALAIRLINES
113	574.3	2860.2	0.0	0.022	0.005	7.6	0.6	11.4	478.	SEABOARD
114	571.5	2856.6	0.0	1.041	0.466	24.4	0.9	7.6	318.	M.D.WATER

115	566.4	2860.0	0.0	0.0	0.375	9.1	0.9	12.9	350.	BREWER CO.
116	581.2	2869.9	0.0	0.227	1.268	29.0	3.0	15.4	522.	DADECO.PK
117	578.1	2867.3	0.0	0.063	0.003	6.1	0.6	16.2	422.	ANODYNE
118	567.4	2859.3	0.0	0.0	0.096	11.6	1.2	10.8	336.	INTERALUM
119	566.6	2842.4	0.0	0.014	0.003	8.5	0.3	19.4	394.	MIAMI DADE
120	580.9	2857.7	0.0	0.014	0.003	9.8	0.4	12.2	520.	MCARTHER
121	588.0	2857.3	0.0	0.008	0.003	56.4	0.6	4.2	339.	SEACOASTN
122	588.0	2857.5	0.0	0.005	0.0	56.4	0.6	3.2	339.	SEACOASTN
123	579.4	2853.2	0.0	0.014	0.0	10.7	0.8	8.7	478.	EXPERT DS
124	587.6	2853.7	0.0	0.030	0.003	44.2	0.9	2.4	339.	SOUTHGATE
125	579.4	2868.2	0.0	0.0	0.044	8.5	0.9	11.6	362.	GOLDEN GL.
126	560.3	2825.6	0.0	0.003	0.0	6.1	3.0	0.2	298.	PARKMAN K
127	560.3	2825.6	0.0	0.019	0.0	6.1	3.0	2.2	298.	PARKMAN K
128	584.6	2842.4	0.0	0.052	0.008	45.7	0.7	2.4	339.	IS=HOUSEAPT
129	588.1	2859.2	0.0	0.008	0.003	53.4	1.0	4.5	339.	DEAUVILLE
130	587.9	2867.9	0.0	0.011	0.003	15.2	0.9	1.4	478.	CASTAWAYS
131	580.6	2862.3	0.0	0.005	0.0	15.2	0.6	6.8	478.	BARRY COLLEGE
132	581.0	2854.4	0.0	0.011	0.003	42.7	0.5	6.2	339.	BAY PARK
133	587.0	2850.3	0.0	0.005	0.0	27.4	0.2	3.7	408.	ATLANTIC
134	560.7	2819.5	0.0	0.241	0.068	7.6	0.4	0.1	520.	HOMESTEAD
135	579.4	2868.2	0.0	0.0	0.118	8.5	0.9	11.6	362.	OKEEFE AP

DADE CO AREA SOURCES, 1974

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG.K)	
1	582.5	2912.5	25.00	0.082	0.732	6.1	0.0	0.0	0.	AREA SOURCE
2	577.5	2907.5	25.00	0.082	0.800	6.1	0.0	0.0	0.	AREA SOURCE
3	582.5	2907.5	25.00	0.219	1.488	6.1	0.0	0.0	0.	AREA SOURCE
4	587.5	2907.5	25.00	0.137	0.951	6.1	0.0	0.0	0.	AREA SOURCE
5	592.5	2907.5	25.00	0.060	0.304	6.1	0.0	0.0	0.	AREA SOURCE
6	586.3	2903.8	6.25	0.036	0.195	6.1	0.0	0.0	0.	AREA SOURCE
7	588.8	2903.8	6.25	0.044	0.178	6.1	0.0	0.0	0.	AREA SOURCE
8	591.3	2903.8	6.25	0.019	0.049	6.1	0.0	0.0	0.	AREA SOURCE
9	593.8	2903.8	6.25	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
10	560.0	2905.0	100.00	0.0	0.162	6.1	0.0	0.0	0.	AREA SOURCE
11	570.0	2905.0	100.00	0.016	0.378	6.1	0.0	0.0	0.	AREA SOURCE
12	577.5	2902.5	25.00	0.132	0.986	6.1	0.0	0.0	0.	AREA SOURCE
13	585.5	2902.5	25.00	0.219	1.603	6.1	0.0	0.0	0.	AREA SOURCE
14	586.3	2901.3	6.25	0.047	0.170	6.1	0.0	0.0	0.	AREA SOURCE
15	588.8	2901.3	6.25	0.027	0.118	6.1	0.0	0.0	0.	AREA SOURCE
16	591.3	2901.3	6.25	0.019	0.049	6.1	0.0	0.0	0.	AREA SOURCE
17	593.8	2901.3	6.25	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
18	586.3	2898.8	6.25	0.055	0.236	6.1	0.0	0.0	0.	AREA SOURCE
19	588.8	2898.8	6.25	0.038	0.047	6.1	0.0	0.0	0.	AREA SOURCE
20	591.3	2898.8	6.25	0.022	0.077	6.1	0.0	0.0	0.	AREA SOURCE
21	593.8	2898.8	6.25	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
22	567.5	2897.5	25.00	0.0	0.052	6.1	0.0	0.0	0.	AREA SOURCE
23	575.5	2897.5	25.00	0.014	0.148	6.1	0.0	0.0	0.	AREA SOURCE
24	577.5	2897.5	25.00	0.175	1.140	6.1	0.0	0.0	0.	AREA SOURCE
25	582.5	2897.5	25.00	0.115	0.742	6.1	0.0	0.0	0.	AREA SOURCE
26	586.3	2896.3	6.25	0.055	0.312	6.1	0.0	0.0	0.	AREA SOURCE
27	588.8	2896.3	6.25	0.027	0.049	6.1	0.0	0.0	0.	AREA SOURCE
28	591.3	2896.3	6.25	0.011	0.027	6.1	0.0	0.0	0.	AREA SOURCE
29	593.8	2896.3	6.25	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
30	581.3	2893.8	6.25	0.022	0.102	6.1	0.0	0.0	0.	AREA SOURCE
31	583.8	2893.8	6.25	0.027	0.140	6.1	0.0	0.0	0.	AREA SOURCE
32	586.3	2893.8	6.25	0.027	0.085	6.1	0.0	0.0	0.	AREA SOURCE
33	588.8	2893.8	6.25	0.014	0.074	6.1	0.0	0.0	0.	AREA SOURCE
34	525.0	2900.0	400.00	0.0	0.647	6.1	0.0	0.0	0.	AREA SOURCE
35	545.0	2900.0	400.00	0.0	0.647	6.1	0.0	0.0	0.	AREA SOURCE
36	560.0	2895.0	100.00	0.0	0.162	6.1	0.0	0.0	0.	AREA SOURCE
37	567.5	2892.5	25.00	0.005	0.129	6.1	0.0	0.0	0.	AREA SOURCE
38	572.5	2892.5	25.00	0.044	0.159	6.1	0.0	0.0	0.	AREA SOURCE
39	577.5	2892.5	25.00	0.186	0.852	6.1	0.0	0.0	0.	AREA SOURCE
40	581.3	2891.3	6.25	0.063	0.332	6.1	0.0	0.0	0.	AREA SOURCE
41	583.8	2891.3	6.25	0.022	0.049	6.1	0.0	0.0	0.	AREA SOURCE
42	586.3	2891.3	6.25	0.027	0.118	6.1	0.0	0.0	0.	AREA SOURCE
43	588.8	2891.3	6.25	0.003	0.019	6.1	0.0	0.0	0.	AREA SOURCE
44	592.5	2892.5	25.00	0.033	0.011	6.1	0.0	0.0	0.	AREA SOURCE
45	581.3	2888.8	6.25	0.077	0.414	6.1	0.0	0.0	0.	AREA SOURCE
46	583.8	2888.8	6.25	0.022	0.058	6.1	0.0	0.0	0.	AREA SOURCE
47	586.3	2888.8	6.25	0.036	0.099	6.1	0.0	0.0	0.	AREA SOURCE
48	588.8	2888.8	6.25	0.014	0.047	6.1	0.0	0.0	0.	AREA SOURCE
49	567.5	2887.5	25.00	0.008	0.184	6.1	0.0	0.0	0.	AREA SOURCE
50	572.5	2887.5	25.00	0.016	0.142	6.1	0.0	0.0	0.	AREA SOURCE
51	577.5	2887.5	25.00	0.145	0.800	6.1	0.0	0.0	0.	AREA SOURCE
52	581.3	2886.3	6.25	0.060	0.321	6.1	0.0	0.0	0.	AREA SOURCE
53	583.8	2886.3	6.25	0.049	0.104	6.1	0.0	0.0	0.	AREA SOURCE

54	586.3	2886.3	6.25	0.058	0.079	6.1	0.0	0.0	0.	AREA SOURCE
55	588.8	2886.3	6.25	0.359	0.063	6.1	0.0	0.0	0.	AREA SOURCE
56	592.5	2887.5	6.25	0.033	0.011	6.1	0.0	0.0	0.	AREA SOURCE
57	581.3	2883.8	6.25	0.079	0.271	6.1	0.0	0.0	0.	AREA SOURCE
58	583.8	2883.8	6.25	0.195	0.474	6.1	0.0	0.0	0.	AREA SOURCE
59	586.3	2883.8	6.25	0.162	0.244	6.1	0.0	0.0	0.	AREA SOURCE
60	588.8	2883.8	6.25	0.052	0.082	6.1	0.0	0.0	0.	AREA SOURCE
61	560.0	2885.0	100.00	0.378	3.214	6.1	0.0	0.0	0.	AREA SOURCE
62	567.5	2882.5	25.00	0.142	1.153	6.1	0.0	0.0	0.	AREA SOURCE
63	572.5	2882.5	25.00	0.104	0.899	6.1	0.0	0.0	0.	AREA SOURCE
64	577.5	2882.5	25.00	0.170	1.258	6.1	0.0	0.0	0.	AREA SOURCE
65	581.3	2881.3	6.25	0.016	0.121	6.1	0.0	0.0	0.	AREA SOURCE
66	583.8	2881.3	6.25	0.074	0.353	6.1	0.0	0.0	0.	AREA SOURCE
67	586.3	2881.3	6.25	0.055	0.088	6.1	0.0	0.0	0.	AREA SOURCE
68	588.8	2881.3	6.25	0.005	0.047	6.1	0.0	0.0	0.	AREA SOURCE
69	592.5	2882.5	25.00	0.033	0.011	6.1	0.0	0.0	0.	AREA SOURCE
70	576.3	2878.8	6.25	0.052	0.230	6.1	0.0	0.0	0.	AREA SOURCE
71	578.8	2878.8	6.25	0.049	0.222	6.1	0.0	0.0	0.	AREA SOURCE
72	581.3	2878.8	6.25	0.019	0.044	6.1	0.0	0.0	0.	AREA SOURCE
73	583.8	2878.8	6.25	0.047	0.236	6.1	0.0	0.0	0.	AREA SOURCE
74	586.3	2878.8	6.25	0.033	0.079	6.1	0.0	0.0	0.	AREA SOURCE
75	588.8	2878.8	6.25	0.011	0.044	6.1	0.0	0.0	0.	AREA SOURCE
76	576.3	2876.3	6.25	0.055	0.244	6.1	0.0	0.0	0.	AREA SOURCE
77	578.8	2876.3	6.25	0.079	0.378	6.1	0.0	0.0	0.	AREA SOURCE
78	581.3	2876.3	6.25	0.030	0.107	6.1	0.0	0.0	0.	AREA SOURCE
79	583.8	2876.3	6.25	0.055	0.238	6.1	0.0	0.0	0.	AREA SOURCE
80	586.3	2876.3	6.25	0.033	0.063	6.1	0.0	0.0	0.	AREA SOURCE
81	588.8	2876.3	6.25	0.016	0.052	6.1	0.0	0.0	0.	AREA SOURCE
82	592.5	2877.5	25.00	0.033	0.011	6.1	0.0	0.0	0.	AREA SOURCE
83	576.3	2873.8	6.25	0.055	0.238	6.1	0.0	0.0	0.	AREA SOURCE
84	578.8	2873.8	6.25	0.071	0.403	6.1	0.0	0.0	0.	AREA SOURCE
85	581.3	2873.8	6.25	0.068	0.419	6.1	0.0	0.0	0.	AREA SOURCE
86	583.8	2873.8	6.25	0.025	0.060	6.1	0.0	0.0	0.	AREA SOURCE
87	586.3	2873.8	6.25	0.033	0.101	6.1	0.0	0.0	0.	AREA SOURCE
88	588.8	2873.8	6.25	0.011	0.038	6.1	0.0	0.0	0.	AREA SOURCE
89	525.0	2880.0	400.00	0.0	0.647	6.1	0.0	0.0	0.	AREA SOURCE
90	545.0	2880.0	400.00	0.0	0.647	6.1	0.0	0.0	0.	AREA SOURCE
91	560.0	2875.0	100.00	0.162	1.279	6.1	0.0	0.0	0.	AREA SOURCE
92	570.0	2875.0	100.00	0.159	1.584	6.1	0.0	0.0	0.	AREA SOURCE
93	576.3	2871.3	6.25	0.082	0.564	6.1	0.0	0.0	0.	AREA SOURCE
94	578.8	2871.3	6.25	0.088	0.427	6.1	0.0	0.0	0.	AREA SOURCE
95	581.3	2871.3	6.25	0.077	0.482	6.1	0.0	0.0	0.	AREA SOURCE
96	583.8	2871.3	6.25	0.130	0.630	6.1	0.0	0.0	0.	AREA SOURCE
97	586.3	2871.3	6.25	0.033	0.121	6.1	0.0	0.0	0.	AREA SOURCE
98	588.8	2871.3	6.25	0.022	0.063	6.1	0.0	0.0	0.	AREA SOURCE
99	581.3	2868.8	6.25	0.090	0.405	6.1	0.0	0.0	0.	AREA SOURCE
100	583.8	2868.8	6.25	0.074	0.205	6.1	0.0	0.0	0.	AREA SOURCE
101	567.5	2867.5	25.00	0.175	1.162	6.1	0.0	0.0	0.	AREA SOURCE
102	575.5	2867.5	25.00	0.225	1.173	6.1	0.0	0.0	0.	AREA SOURCE
103	577.5	2867.5	25.00	0.329	1.293	6.1	0.0	0.0	0.	AREA SOURCE
104	581.3	2866.3	6.25	0.060	0.197	6.1	0.0	0.0	0.	AREA SOURCE
105	583.8	2866.3	6.25	0.055	0.151	6.1	0.0	0.0	0.	AREA SOURCE
106	587.5	2867.5	25.00	0.066	0.137	6.1	0.0	0.0	0.	AREA SOURCE
107	581.3	2863.8	6.25	0.068	0.203	6.1	0.0	0.0	0.	AREA SOURCE
108	583.8	2863.8	6.25	0.074	0.208	6.1	0.0	0.0	0.	AREA SOURCE
109	586.3	2863.8	6.25	0.036	0.110	6.1	0.0	0.0	0.	AREA SOURCE
110	588.8	2863.8	6.25	0.027	0.052	6.1	0.0	0.0	0.	AREA SOURCE
111	560.0	2865.0	100.00	0.145	1.562	6.1	0.0	0.0	0.	AREA SOURCE
112	567.5	2862.5	25.00	0.153	0.827	6.1	0.0	0.0	0.	AREA SOURCE
113	572.5	2862.5	25.00	0.258	0.978	6.1	0.0	0.0	0.	AREA SOURCE
114	577.5	2862.5	25.00	0.222	0.753	6.1	0.0	0.0	0.	AREA SOURCE

115	581.3	2861.3	6.25	0.060	0.195	6.1	0.0	0.0	0.	AREA SOURCE
116	583.8	2861.3	6.25	0.027	0.096	6.1	0.0	0.0	0.	AREA SOURCE
117	586.3	2861.3	6.25	0.041	0.121	6.1	0.0	0.0	0.	AREA SOURCE
118	588.8	2861.3	6.25	0.044	0.071	6.1	0.0	0.0	0.	AREA SOURCE
119	576.0	2859.0	4.00	0.047	0.153	6.1	0.0	0.0	0.	AREA SOURCE
120	578.0	2858.8	4.00	0.072	0.170	6.1	0.0	0.0	0.	AREA SOURCE
121	580.0	2859.0	4.00	0.074	0.271	6.1	0.0	0.0	0.	AREA SOURCE
122	582.0	2859.0	4.00	0.052	0.156	6.1	0.0	0.0	0.	AREA SOURCE
123	584.0	2859.0	4.00	0.019	0.038	6.1	0.0	0.0	0.	AREA SOURCE
124	571.3	2858.8	6.25	0.126	0.438	6.1	0.0	0.0	0.	AREA SOURCE
125	573.8	2858.8	6.25	0.129	0.441	6.1	0.0	0.0	0.	AREA SOURCE
126	586.3	2858.8	6.25	0.036	0.074	6.1	0.0	0.0	0.	AREA SOURCE
127	588.8	2858.8	6.25	0.044	0.074	6.1	0.0	0.0	0.	AREA SOURCE
128	576.0	2857.0	4.00	0.052	0.159	6.1	0.0	0.0	0.	AREA SOURCE
129	578.0	2857.0	4.00	0.110	0.192	6.1	0.0	0.0	0.	AREA SOURCE
130	580.0	2857.0	4.00	0.044	0.274	6.1	0.0	0.0	0.	AREA SOURCE
131	582.0	2857.0	4.00	0.033	0.082	6.1	0.0	0.0	0.	AREA SOURCE
132	584.0	2857.0	4.00	0.0	0.003	6.1	0.0	0.0	0.	AREA SOURCE
133	567.5	2857.5	25.00	0.162	0.756	6.1	0.0	0.0	0.	AREA SOURCE
134	571.3	2856.3	6.25	0.110	0.430	6.1	0.0	0.0	0.	AREA SOURCE
135	573.8	2856.3	6.25	0.107	0.375	6.1	0.0	0.0	0.	AREA SOURCE
136	586.3	2856.3	6.25	0.022	0.066	6.1	0.0	0.0	0.	AREA SOURCE
137	588.8	2856.3	6.25	0.022	0.052	6.1	0.0	0.0	0.	AREA SOURCE
138	576.0	2855.0	4.00	0.068	0.266	6.1	0.0	0.0	0.	AREA SOURCE
139	578.0	2855.0	4.00	0.077	0.268	6.1	0.0	0.0	0.	AREA SOURCE
140	580.0	2855.0	4.00	0.145	0.502	6.1	0.0	0.0	0.	AREA SOURCE
141	582.0	2855.0	4.00	0.047	0.247	6.1	0.0	0.0	0.	AREA SOURCE
142	584.0	2855.0	4.00	0.016	0.110	6.1	0.0	0.0	0.	AREA SOURCE
143	586.3	2853.8	6.25	0.066	0.252	6.1	0.0	0.0	0.	AREA SOURCE
144	588.8	2853.8	6.25	0.027	0.038	6.1	0.0	0.0	0.	AREA SOURCE
145	576.0	2853.0	4.00	0.077	0.175	6.1	0.0	0.0	0.	AREA SOURCE
146	578.0	2853.0	4.00	0.055	0.178	6.1	0.0	0.0	0.	AREA SOURCE
147	580.0	2853.0	4.00	0.121	0.367	6.1	0.0	0.0	0.	AREA SOURCE
148	582.0	2853.0	4.00	0.016	0.055	6.1	0.0	0.0	0.	AREA SOURCE
149	584.0	2853.0	4.00	0.027	0.153	6.1	0.0	0.0	0.	AREA SOURCE
150	525.0	2860.0	400.00	0.252	6.667	6.1	0.0	0.0	0.	AREA SOURCE
151	545.0	2860.0	400.00	0.134	5.855	6.1	0.0	0.0	0.	AREA SOURCE
152	560.0	2855.0	100.00	0.126	1.405	6.1	0.0	0.0	0.	AREA SOURCE
153	567.5	2852.5	25.00	0.307	1.052	6.1	0.0	0.0	0.	AREA SOURCE
154	572.5	2852.5	25.00	1.137	1.532	6.1	0.0	0.0	0.	AREA SOURCE
155	576.0	2851.0	4.00	0.205	0.351	6.1	0.0	0.0	0.	AREA SOURCE
156	578.0	2851.0	4.00	0.101	0.279	6.1	0.0	0.0	0.	AREA SOURCE
157	580.0	2851.0	4.00	0.129	0.351	6.1	0.0	0.0	0.	AREA SOURCE
158	582.0	2851.0	4.00	0.140	0.096	6.1	0.0	0.0	0.	AREA SOURCE
159	584.0	2851.0	4.00	0.148	0.178	6.1	0.0	0.0	0.	AREA SOURCE
160	586.3	2851.3	6.25	0.156	0.214	6.1	0.0	0.0	0.	AREA SOURCE
161	588.8	2851.3	6.25	0.022	0.011	6.1	0.0	0.0	0.	AREA SOURCE
162	576.0	2849.0	4.00	0.060	0.162	6.1	0.0	0.0	0.	AREA SOURCE
163	578.0	2849.0	4.00	0.071	0.170	6.1	0.0	0.0	0.	AREA SOURCE
164	580.0	2849.0	4.00	0.088	0.266	6.1	0.0	0.0	0.	AREA SOURCE
165	582.0	2849.0	4.00	0.014	0.030	6.1	0.0	0.0	0.	AREA SOURCE
166	584.0	2849.0	4.00	0.003	0.003	6.1	0.0	0.0	0.	AREA SOURCE
167	571.3	2848.8	6.25	0.079	0.208	6.1	0.0	0.0	0.	AREA SOURCE
168	573.8	2848.8	6.25	0.030	0.216	6.1	0.0	0.0	0.	AREA SOURCE
169	586.3	2848.8	6.25	0.077	0.027	6.1	0.0	0.0	0.	AREA SOURCE
170	588.8	2848.8	6.25	0.074	0.008	6.1	0.0	0.0	0.	AREA SOURCE
171	576.0	2847.0	4.00	0.074	0.170	6.1	0.0	0.0	0.	AREA SOURCE
172	578.0	2847.0	4.00	0.033	0.112	6.1	0.0	0.0	0.	AREA SOURCE
173	580.0	2847.0	4.00	0.022	0.142	6.1	0.0	0.0	0.	AREA SOURCE
174	582.0	2847.0	4.00	0.027	0.164	6.1	0.0	0.0	0.	AREA SOURCE
175	584.0	2847.0	4.00	0.041	0.271	6.1	0.0	0.0	0.	AREA SOURCE

176	557.5	2847.5	25.00	0.027	0.373	6.1	0.0	0.0	0.	AREA SOURCE
177	562.5	2847.5	25.00	0.151	0.666	6.1	0.0	0.0	0.	AREA SOURCE
178	567.5	2847.5	25.00	0.310	1.142	6.1	0.0	0.0	0.	AREA SOURCE
179	571.3	2846.3	6.25	0.058	0.195	6.1	0.0	0.0	0.	AREA SOURCE
180	571.2	2846.3	6.25	0.063	0.200	6.1	0.0	0.0	0.	AREA SOURCE
181	586.3	2846.3	6.25	0.014	0.066	6.1	0.0	0.0	0.	AREA SOURCE
182	588.8	2846.3	6.25	0.011	0.005	6.1	0.0	0.0	0.	AREA SOURCE
183	576.0	2845.0	4.00	0.030	0.022	6.1	0.0	0.0	0.	AREA SOURCE
184	578.0	2845.0	4.00	0.003	0.003	6.1	0.0	0.0	0.	AREA SOURCE
185	557.5	2842.5	25.00	0.022	0.348	6.1	0.0	0.0	0.	AREA SOURCE
186	562.5	2842.5	25.00	0.129	0.827	6.1	0.0	0.0	0.	AREA SOURCE
187	567.5	2842.5	25.00	0.200	0.877	6.1	0.0	0.0	0.	AREA SOURCE
188	572.5	2842.5	25.00	0.156	0.416	6.1	0.0	0.0	0.	AREA SOURCE
189	577.0	2842.0	16.00	0.015	0.063	6.1	0.0	0.0	0.	AREA SOURCE
190	582.0	2843.0	36.00	0.060	0.274	6.1	0.0	0.0	0.	AREA SOURCE
191	557.5	2837.5	25.00	0.022	0.468	6.1	0.0	0.0	0.	AREA SOURCE
192	562.5	2837.5	25.00	0.126	0.879	6.1	0.0	0.0	0.	AREA SOURCE
193	567.5	2837.5	25.00	0.121	0.458	6.1	0.0	0.0	0.	AREA SOURCE
194	572.5	2837.5	25.00	0.044	0.244	6.1	0.0	0.0	0.	AREA SOURCE
195	525.0	2840.0	400.00	0.175	5.096	6.1	0.0	0.0	0.	AREA SOURCE
196	545.0	2840.0	400.00	0.063	6.611	6.1	0.0	0.0	0.	AREA SOURCE
197	557.5	2832.5	25.00	0.033	0.737	6.1	0.0	0.0	0.	AREA SOURCE
198	562.5	2832.5	25.00	0.140	0.696	6.1	0.0	0.0	0.	AREA SOURCE
199	567.5	2832.5	25.00	0.079	0.392	6.1	0.0	0.0	0.	AREA SOURCE
200	572.5	2832.5	25.00	0.010	0.027	6.1	0.0	0.0	0.	AREA SOURCE
201	557.5	2827.5	25.00	0.025	0.652	6.1	0.0	0.0	0.	AREA SOURCE
202	562.5	2827.5	25.00	0.162	0.937	6.1	0.0	0.0	0.	AREA SOURCE
203	557.5	2822.5	25.00	0.153	0.918	6.1	0.0	0.0	0.	AREA SOURCE
204	562.5	2822.5	25.00	0.175	1.230	6.1	0.0	0.0	0.	AREA SOURCE
205	570.0	2825.0	100.00	0.058	0.436	6.1	0.0	0.0	0.	AREA SOURCE
206	525.0	2820.0	400.00	0.175	6.093	6.1	0.0	0.0	0.	AREA SOURCE
207	545.0	2820.0	400.00	0.285	7.293	6.1	0.0	0.0	0.	AREA SOURCE
208	560.0	2815.0	100.00	0.126	1.844	6.1	0.0	0.0	0.	AREA SOURCE
209	525.0	2800.0	400.00	0.104	5.545	6.1	0.0	0.0	0.	AREA SOURCE
210	545.0	2800.0	400.00	0.011	4.203	6.1	0.0	0.0	0.	AREA SOURCE

DADE CO, POINT SOURCES EXCEPT FUGITIVE SOURCES, 1980

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG.K)	
1	584.5	2898.5	0.0	0.0	0.030	9.1	2.7	1.5	338.	JOHNSTON
2	584.6	2907.8	0.0	0.0	0.016	11.6	1.2	24.0	391.	HOUDAILLE
3	562.6	2873.0	0.0	0.0	0.047	12.2	3.0	2.1	321.	JSG ASPHAL
4	587.0	2904.8	0.0	0.0	0.003	12.8	5.2	0.0	298.	RINKER MAT
5	583.3	2879.4	0.0	0.0	0.003	11.6	5.1	0.0	298.	RINKER MAT
6	586.0	2885.0	0.0	0.0	0.003	12.8	5.2	0.0	298.	RINKER MAT
7	576.5	2885.5	0.0	0.0	0.003	9.1	0.1	0.1	298.	BANAZAK CONC
8	560.5	2874.9	0.0	0.0	0.066	10.7	2.3	4.5	322.	WEEKLY ASPHA
9	585.3	2874.3	0.0	0.0	0.005	4.0	0.1	0.1	298.	AQUACHEM
10	583.3	2875.0	0.0	0.0	0.003	13.7	0.6	0.8	298.	BANAZAK CONC
11	584.9	2890.3	0.0	0.0	0.033	9.1	0.1	0.1	298.	C/B MAT
12	584.7	2909.9	0.0	0.0	0.005	9.1	0.1	0.1	298.	CEN CON
13	576.3	2886.3	0.0	0.0	0.003	9.1	0.1	0.1	298.	DAVIE CONC
14	577.1	2912.7	0.0	0.0	0.030	4.0	0.3	5.8	298.	MACK IND
15	584.5	2899.0	0.0	0.0	0.014	17.7	0.1	0.1	298.	MACKIND
16	584.8	2904.5	0.0	0.0	0.011	14.6	3.0	0.0	298.	POWER MIX
17	581.5	2891.5	0.0	0.033	0.044	30.5	2.7	1.3	344.	FT.LAUD.INCI
18	581.5	2891.5	0.0	0.033	0.044	30.5	2.7	1.3	344.	FT.LAUD.INCI
19	581.0	2891.0	0.0	0.162	0.244	29.3	2.0	8.2	346.	FT.LAUD.INCI
20	581.0	2891.0	0.0	0.162	0.162	29.3	2.0	8.2	346.	FT.LAUD.INCI
21	583.3	2893.4	0.0	0.0	0.027	7.6	1.2	13.0	323.	E COAST AS
22	584.9	2909.2	0.0	0.0	0.047	3.0	0.3	24.7	405.	E.COAST AS
23	584.7	2909.0	0.0	0.0	0.003	7.6	0.3	3.9	298.	MEE KINSINC
24	573.7	2875.0	0.0	0.0	0.003	7.6	0.3	3.9	298.	MEEKINS INC
25	584.9	2905.2	0.0	0.112	0.321	23.2	2.7	10.1	350.	BROW INCIN
26	584.8	2905.2	0.0	0.112	0.321	23.2	2.7	11.7	350.	BROW INCIN
27	584.8	2905.2	0.0	0.112	0.197	23.2	2.7	20.5	477.	BROW INCIN
28	584.8	2905.2	0.0	0.112	0.197	23.2	2.7	20.5	477.	BROW INCIN
29	580.3	2897.0	0.0	0.0	0.003	16.3	0.5	1.9	298.	MAULE IND.
30	586.8	2893.4	0.0	0.0	0.003	15.2	0.5	1.9	298.	
31	585.8	2902.4	0.0	0.0	0.003	24.4	0.2	10.7	316.	MAULE IND.
32	585.8	2902.4	0.0	0.0	0.003	24.4	0.2	10.7	316.	MAULE IND.
33	584.6	2896.3	0.0	0.0	0.003	18.3	4.9	0.0	298.	RINKER MAT
34	587.5	2885.0	0.0	0.0	0.016	22.9	0.9	19.8	298.	RINKER MAT
35	586.1	2891.1	0.0	0.0	0.025	15.2	0.5	1.3	298.	RINKER MAT
36	587.0	2886.4	0.0	0.022	0.060	10.7	0.4	22.3	619.	TRUMBLLL
37	587.5	2885.3	0.0	4.090	0.252	104.9	4.3	21.8	439.	FLEPEVERGLAD
38	587.5	2885.3	0.0	3.129	0.214	104.9	4.3	22.9	439.	FL+PEVERGLAD
39	587.4	2885.3	0.0	20.803	1.729	106.1	4.1	15.1	425.	FL+PEVERGLAD
40	587.4	2885.3	0.0	19.997	1.995	106.1	4.1	8.1	428.	FL+PEVERGLAD
41	587.4	2885.6	0.0	0.384	0.195	16.8	5.5	19.2	691.	FL+PEVERGLAD
42	580.0	2883.3	0.0	2.019	0.132	46.0	4.3	16.2	444.	FL+PDANIA
43	580.0	2883.3	0.0	1.863	0.156	46.0	4.3	18.2	456.	FL+PDANIA
44	560.3	2875.0	0.0	0.0	0.063	12.2	1.5	8.8	322.	WEEKLY ASPHA
45	584.8	2910.0	0.0	0.0	0.058	9.1	2.5	3.8	340.	DIXIE ASP
46	576.9	2886.1	0.0	0.0	0.033	10.4	3.0	3.9	327.	HOLLYWOOD
47	570.3	2834.8	0.0	0.427	0.110	45.7	3.3	12.2	443.	FPL.CUTLR
48	570.3	2834.8	0.0	0.899	0.296	45.7	4.6	12.3	453.	FPL.CUTLR
49	570.3	2834.8	0.0	1.090	0.304	45.7	4.6	10.2	435.	FPL.CUTLR
50	570.3	2834.8	0.0	1.482	0.616	45.7	4.6	16.0	430.	FPL.CUTLR
51	580.5	2850.4	0.0	0.126	0.008	46.0	3.7	4.4	409.	FPL.MIAMI
52	567.2	2813.0	0.0	36.655	5.455	121.9	5.5	22.0	447.	F L.TURKY
53	567.2	2813.0	0.0	34.422	4.959	121.9	5.5	22.0	447.	F L.TURKY

54	551.6	2843.4	0.0	23.836	1.134	76.2	4.4	5.0	476.	GEN.PORTL
55	551.6	2843.4	0.0	23.836	1.134	16.8	0.9	10.4	476.	GEN.PORTL
56	568.7	2855.6	0.0	0.0	0.052	15.2	3.0	4.2	325.	GEN.ASPH.
57	567.4	2858.0	0.0	0.0	0.663	6.1	3.0	1.9	331.	PAN AMERI
58	567.4	2858.0	0.0	0.0	0.049	6.1	3.0	2.2	327.	PAN AMERI
59	581.4	2851.0	0.0	0.047	0.005	73.2	0.7	5.7	333.	EVERG HOTEL
60	558.1	2851.0	0.0	2.729	1.216	41.8	4.6	3.4	399.	LEHIGH PC
61	558.1	2851.8	0.0	2.729	1.216	18.3	2.1	2.7	399.	LEHIGH PC
62	566.2	2860.7	0.0	0.030	0.003	18.3	0.5	5.7	408.	LEHIGH PC
63	566.2	2860.7	0.0	0.030	0.003	12.2	0.2	20.6	302.	LEHIGH PC
64	574.2	2853.8	0.0	0.0	0.014	18.3	1.6	8.2	589.	SIMKINS
65	562.5	2861.8	0.0	4.556	0.419	29.0	1.8	10.1	463.	MAULE IND
66	562.5	2861.8	0.0	0.0	0.208	29.0	1.8	8.9	425.	MAULE IND
67	562.5	2861.8	0.0	4.556	0.115	61.0	3.4	5.2	454.	MAULE IND
68	562.5	2861.8	0.0	0.0	0.255	61.0	3.4	5.8	386.	MAULE IND
69	567.3	2859.8	0.0	0.0	0.016	15.2	0.7	12.6	350.	USFOUNDRY
70	555.8	2808.0	0.0	0.011	0.132	7.6	3.0	5.4	327.	USASPHALT
71	563.6	2862.4	0.0	0.0	0.019	13.7	1.5	20.3	370.	ASPHALT M
72	578.2	2866.9	0.0	0.036	0.003	9.1	0.5	6.0	339.	SHEFFIELD
73	580.9	2851.0	0.0	0.167	0.011	33.5	0.8	8.2	561.	M.MACINTOSH
74	580.5	2853.2	0.0	0.049	0.003	13.4	0.6	12.0	422.	MECH.UNIF
75	580.5	2853.2	0.0	0.036	0.003	13.4	0.6	8.6	422.	MECH.UNIF
76	568.0	2851.6	0.0	0.005	0.003	10.4	0.4	7.5	450.	THOMPSONA
77	568.5	2855.0	0.0	0.0	0.011	10.7	0.6	20.2	339.	USMFG+GAL
78	583.4	2871.9	0.0	0.005	0.011	7.6	0.5	20.4	600.	WR.ROWSAL
79	573.1	2854.3	0.0	0.005	0.005	17.7	11.7	0.5	422.	EASTERN A
80	573.1	2854.3	0.0	0.014	0.014	16.8	6.9	1.0	526.	EASTERN A
81	566.3	2860.7	0.0	0.197	0.011	12.2	1.2	3.9	477.	BAPTIST H
82	551.0	2816.8	0.0	0.279	0.315	9.1	0.9	8.6	333.	BREWER CO
83	587.8	2863.6	0.0	0.005	0.0	18.3	0.7	1.5	408.	BEAURIVAG
84	574.5	2856.5	0.0	0.0	0.216	15.2	1.2	6.1	422.	RUSSELL M
85	587.6	2853.8	0.0	0.055	0.005	37.2	0.9	2.4	327.	ALGIERS
86	569.2	2858.0	0.0	0.099	0.005	9.1	0.5	10.0	491.	ALTON BOX
87	587.8	2863.9	0.0	0.014	0.003	45.7	0.3	12.8	339.	CAMELOT
88	588.0	2869.6	0.0	0.005	0.0	9.1	0.4	8.5	477.	COLONIAL
89	588.0	2856.6	0.0	0.019	0.0	43.3	1.0	1.0	339.	CRYSTAL H
90	587.8	2863.5	0.0	0.011	0.0	22.9	0.9	1.5	333.	BALMORALH
91	576.2	2857.7	0.0	0.049	0.003	6.1	0.4	12.8	477.	HOWARD JO
92	585.8	2852.2	0.0	0.036	0.003	48.8	0.9	2.1	339.	MORTON TO
93	585.8	2852.2	0.0	0.036	0.003	48.8	0.9	2.1	339.	MORTON TO
94	588.0	2857.0	0.0	0.022	0.003	64.0	0.7	2.9	339.	CARRIAGE
95	580.2	2853.8	0.0	0.0	0.066	18.3	0.6	9.6	365.	ORANGE BL
96	580.6	2850.7	0.0	0.019	0.0	10.9	0.6	1.5	477.	PARISIAN
97	588.1	2856.8	0.0	0.019	0.003	56.4	0.7	3.6	339.	SEACOAST
98	588.0	2856.9	0.0	0.011	0.003	56.4	0.6	3.2	339.	SEACOASTS.
99	588.1	2856.9	0.0	0.005	0.0	56.4	0.6	3.2	339.	SEACOAST
100	587.9	2867.3	0.0	0.003	0.0	7.6	0.3	11.6	477.	AZTEC MOT
101	587.9	2867.3	0.0	0.003	0.0	10.7	0.6	2.9	477.	AZTEC MOT
102	580.9	2857.8	0.0	0.005	0.003	10.7	0.8	3.4	477.	BORDEN DS
103	573.2	2853.2	0.0	0.014	0.003	7.6	0.5	8.6	477.	NAT.AIRLI
104	573.2	2853.2	0.0	0.008	0.003	10.7	0.6	1.9	477.	NAT.AIRLI
105	573.2	2853.2	0.0	0.005	0.003	7.3	0.3	3.9	477.	NAT.AIRLI
106	573.2	2853.2	0.0	0.014	0.003	9.1	0.5	2.7	477.	NAT.AIRLI
107	574.3	2860.0	0.0	0.025	0.005	7.6	0.6	11.4	477.	SEARCARD
108	571.5	2856.6	0.0	1.041	0.466	24.4	0.9	7.6	317.	M.D.WATER
109	566.4	2860.0	0.0	0.0	0.449	9.1	0.9	12.9	350.	BREWER CO
110	581.2	2869.9	0.0	0.227	1.268	29.0	3.0	15.4	522.	DADECO.PK
111	578.1	2867.3	0.0	0.074	0.003	6.1	0.6	16.2	422.	ANODYNE
112	567.4	2859.3	0.0	0.0	0.112	11.6	1.2	10.8	336.	INTERLAUM
113	566.6	2842.4	0.0	0.016	0.003	8.5	0.3	19.4	394.	MIAMICADE
114	580.9	2857.7	0.0	0.016	0.003	9.8	0.4	12.2	519.	MCARTHUR

115	588.0	2857.3	0.0	0.011	0.003	56.4	0.6	4.2	339.	SEACCASTN
116	588.0	2857.5	0.0	0.005	0.0	56.4	0.6	3.2	339.	SEACCAST5
117	579.4	2853.2	0.0	0.016	0.0	10.7	0.8	8.7	477.	EXPERT DS
118	587.6	2853.7	0.0	0.036	0.003	44.2	0.9	2.4	339.	SOUTHGATE
119	579.4	2868.2	0.0	0.0	0.052	8.5	0.9	11.6	362.	GOLDEN GL
120	560.3	2825.6	0.0	0.014	0.0	6.1	3.0	0.2	298.	PARKMAN K
121	560.3	2825.6	0.0	0.014	0.0	6.1	3.0	2.2	298.	PARKMAN K
122	584.6	2842.4	0.0	0.060	0.008	45.7	0.7	2.4	339.	IS,HOLSEAPT
123	588.1	2859.2	0.0	0.011	0.003	53.3	1.0	4.5	339.	DEAUVILLE
124	587.9	2867.9	0.0	0.014	0.003	15.2	0.9	1.4	477.	CASTAWAYS
125	580.6	2862.3	0.0	0.005	0.0	15.2	0.6	6.8	477.	BARRY COL
126	581.0	2854.4	0.0	0.014	0.003	42.7	0.5	6.2	339.	BAY PARK
127	587.0	2850.3	0.0	0.005	0.0	27.4	0.2	3.7	408.	ATLANTIC
128	560.7	2819.5	0.0	0.241	0.068	7.6	0.4	0.1	519.	HOMESTEAD
129	579.4	2868.2	0.0	0.0	0.102	8.5	0.9	11.6	362.	OKEEFE AP

DADE CO. AREA SOURCES ONLY, 1980

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG K)	
1	582.5	2912.5	25.00	0.140	0.797	6.1	0.0	0.0	0.	AREA SOURCE
2	577.5	2907.5	25.00	0.110	0.792	6.1	0.0	0.0	0.	AREA SOURCE
3	582.5	2907.5	25.00	0.433	1.515	6.1	0.0	0.0	0.	AREA SOURCE
4	587.5	2907.5	25.00	0.170	1.222	6.1	0.0	0.0	0.	AREA SOURCE
5	592.5	2907.5	25.00	0.074	0.340	6.1	0.0	0.0	0.	AREA SOURCE
6	586.3	2903.8	6.30	0.077	0.208	6.1	0.0	0.0	0.	AREA SOURCE
7	588.8	2903.8	6.30	0.071	0.296	6.1	0.0	0.0	0.	AREA SOURCE
8	591.3	2903.8	6.30	0.036	0.055	6.1	0.0	0.0	0.	AREA SOURCE
9	593.8	2903.8	6.30	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
10	560.0	2905.0	100.00	0.0	0.145	6.1	0.0	0.0	0.	AREA SOURCE
11	570.0	2905.0	100.00	0.030	0.490	6.1	0.0	0.0	0.	AREA SOURCE
12	577.5	2902.5	25.00	0.200	1.093	6.1	0.0	0.0	0.	AREA SOURCE
13	582.5	2902.5	25.00	0.332	1.773	6.1	0.0	0.0	0.	AREA SOURCE
14	586.3	2901.3	6.30	0.068	0.340	6.1	0.0	0.0	0.	AREA SOURCE
15	588.8	2901.3	6.30	0.049	0.142	6.1	0.0	0.0	0.	AREA SOURCE
16	591.3	2901.3	6.30	0.038	0.058	6.1	0.0	0.0	0.	AREA SOURCE
17	593.8	2901.3	6.30	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
18	586.3	2898.8	6.30	0.104	0.340	6.1	0.0	0.0	0.	AREA SOURCE
19	588.8	2898.8	6.30	0.088	0.052	6.1	0.0	0.0	0.	AREA SOURCE
20	591.3	2898.8	6.30	0.036	0.088	6.1	0.0	0.0	0.	AREA SOURCE
21	593.8	2898.8	6.30	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
22	567.5	2897.5	25.00	0.0	0.047	6.1	0.0	0.0	0.	AREA SOURCE
23	572.5	2897.5	25.00	0.019	0.186	6.1	0.0	0.0	0.	AREA SOURCE
24	577.5	2897.5	25.00	0.263	1.268	6.1	0.0	0.0	0.	AREA SOURCE
25	585.5	2897.5	25.00	0.186	0.901	6.1	0.0	0.0	0.	AREA SOURCE
26	586.3	2896.3	6.30	0.077	0.400	6.1	0.0	0.0	0.	AREA SOURCE
27	588.3	2896.3	6.30	0.058	0.055	6.1	0.0	0.0	0.	AREA SOURCE
28	591.3	2896.3	6.30	0.016	0.033	6.1	0.0	0.0	0.	AREA SOURCE
29	593.8	2896.3	6.30	0.008	0.003	6.1	0.0	0.0	0.	AREA SOURCE
30	581.3	2893.8	6.30	0.044	0.162	6.1	0.0	0.0	0.	AREA SOURCE
31	583.8	2893.8	6.30	0.052	0.189	6.1	0.0	0.0	0.	AREA SOURCE
32	586.3	2893.8	6.30	0.041	0.162	6.1	0.0	0.0	0.	AREA SOURCE
33	588.8	2893.8	6.30	0.019	0.082	6.1	0.0	0.0	0.	AREA SOURCE
34	525.0	2900.0	400.00	0.0	0.578	6.1	0.0	0.0	0.	AREA SOURCE
35	545.0	2900.0	400.00	0.0	0.578	6.1	0.0	0.0	0.	AREA SOURCE
36	560.0	2895.0	100.00	0.0	0.145	6.1	0.0	0.0	0.	AREA SOURCE
37	567.5	2892.5	25.00	0.022	0.148	6.1	0.0	0.0	0.	AREA SOURCE
38	572.5	2892.5	25.00	0.156	0.192	6.1	0.0	0.0	0.	AREA SOURCE
39	577.5	2892.5	25.00	0.438	0.975	6.1	0.0	0.0	0.	AREA SOURCE
40	581.3	2891.3	6.30	0.110	0.373	6.1	0.0	0.0	0.	AREA SOURCE
41	583.8	2891.3	6.30	0.038	0.096	6.1	0.0	0.0	0.	AREA SOURCE
42	586.3	2891.3	6.30	0.036	0.203	6.1	0.0	0.0	0.	AREA SOURCE
43	588.5	2891.3	6.30	0.003	0.022	6.1	0.0	0.0	0.	AREA SOURCE
44	592.5	2892.5	25.00	0.038	0.014	6.1	0.0	0.0	0.	AREA SOURCE
45	581.3	2888.8	6.30	0.132	0.463	6.1	0.0	0.0	0.	AREA SOURCE
46	583.8	2888.8	6.30	0.047	0.063	6.1	0.0	0.0	0.	AREA SOURCE
47	586.3	2888.8	6.30	0.063	0.173	6.1	0.0	0.0	0.	AREA SOURCE
48	588.8	2888.8	6.30	0.019	0.055	6.1	0.0	0.0	0.	AREA SOURCE
49	567.5	2887.5	25.00	0.022	0.203	6.1	0.0	0.0	0.	AREA SOURCE
50	572.5	2887.5	25.00	0.055	0.175	6.1	0.0	0.0	0.	AREA SOURCE
51	577.5	2887.5	25.00	0.321	0.915	6.1	0.0	0.0	0.	AREA SOURCE
52	581.3	2886.3	6.30	0.101	0.356	6.1	0.0	0.0	0.	AREA SOURCE
53	583.8	2886.3	6.30	0.082	0.118	6.1	0.0	0.0	0.	AREA SOURCE

54	586.3	2886.3	6.30	0.077	0.216	6.1	0.0	0.0	0.	AREA	SOURCE
55	588.8	2886.3	6.30	0.436	0.142	6.1	0.0	0.0	0.	AREA	SOURCE
56	592.5	2887.5	6.30	0.038	0.014	6.1	0.0	0.0	0.	AREA	SOURCE
57	581.3	2883.8	6.30	0.115	0.307	6.1	0.0	0.0	0.	AREA	SOURCE
58	583.8	2883.8	6.30	0.244	0.592	6.1	0.0	0.0	0.	AREA	SOURCE
59	586.3	2883.8	6.30	0.192	0.367	6.1	0.0	0.0	0.	AREA	SOURCE
60	588.8	2883.8	6.30	0.063	0.093	6.1	0.0	0.0	0.	AREA	SOURCE
61	560.0	2885.0	100.00	0.499	3.526	6.1	0.0	0.0	0.	AREA	SOURCE
62	567.5	2882.5	25.00	0.184	1.277	6.1	0.0	0.0	0.	AREA	SOURCE
63	572.5	2882.5	25.00	0.134	0.997	6.1	0.0	0.0	0.	AREA	SOURCE
64	577.5	2882.5	25.00	0.247	1.395	6.1	0.0	0.0	0.	AREA	SOURCE
65	581.3	2881.3	6.30	0.036	0.137	6.1	0.0	0.0	0.	AREA	SOURCE
66	583.8	2881.3	6.30	0.110	0.416	6.1	0.0	0.0	0.	AREA	SOURCE
67	586.3	2881.3	6.30	0.099	0.170	6.1	0.0	0.0	0.	AREA	SOURCE
68	588.3	2881.3	6.30	0.008	0.058	6.1	0.0	0.0	0.	AREA	SOURCE
69	592.5	2882.5	25.00	0.038	0.014	6.1	0.0	0.0	0.	AREA	SOURCE
70	576.3	2878.8	6.30	0.126	0.258	6.1	0.0	0.0	0.	AREA	SOURCE
71	578.8	2878.8	6.30	0.093	0.244	6.1	0.0	0.0	0.	AREA	SOURCE
72	581.3	2878.8	6.30	0.047	0.047	6.1	0.0	0.0	0.	AREA	SOURCE
73	583.8	2878.8	6.30	0.077	0.279	6.1	0.0	0.0	0.	AREA	SOURCE
74	586.3	2878.8	6.30	0.055	0.159	6.1	0.0	0.0	0.	AREA	SOURCE
75	588.8	2878.8	6.30	0.016	0.052	6.1	0.0	0.0	0.	AREA	SOURCE
76	576.3	2876.3	6.30	0.093	0.296	6.1	0.0	0.0	0.	AREA	SOURCE
77	578.8	2876.3	6.30	0.137	0.416	6.1	0.0	0.0	0.	AREA	SOURCE
78	581.3	2876.3	6.30	0.063	0.118	6.1	0.0	0.0	0.	AREA	SOURCE
79	583.8	2876.3	6.30	0.093	0.293	6.1	0.0	0.0	0.	AREA	SOURCE
80	586.3	2876.3	6.30	0.063	0.123	6.1	0.0	0.0	0.	AREA	SOURCE
81	588.8	2876.3	6.30	0.027	0.063	6.1	0.0	0.0	0.	AREA	SOURCE
82	592.5	2877.5	25.00	0.038	0.014	6.1	0.0	0.0	0.	AREA	SOURCE
83	576.3	2873.8	6.30	0.101	0.260	6.1	0.0	0.0	0.	AREA	SOURCE
84	578.8	2873.8	6.30	0.123	0.455	6.1	0.0	0.0	0.	AREA	SOURCE
85	581.3	2873.8	6.30	0.118	0.474	6.1	0.0	0.0	0.	AREA	SOURCE
86	583.8	2873.8	6.30	0.071	0.101	6.1	0.0	0.0	0.	AREA	SOURCE
87	586.3	2873.8	6.30	0.074	0.168	6.1	0.0	0.0	0.	AREA	SOURCE
88	588.8	2873.8	6.30	0.011	0.044	6.1	0.0	0.0	0.	AREA	SOURCE
89	525.0	2880.0	400.00	0.0	0.578	6.1	0.0	0.0	0.	AREA	SOURCE
90	545.0	2880.0	400.00	0.0	0.578	6.1	0.0	0.0	0.	AREA	SOURCE
91	560.0	2875.0	100.00	0.225	1.444	6.1	0.0	0.0	0.	AREA	SOURCE
92	570.0	2875.0	100.00	0.216	1.753	6.1	0.0	0.0	0.	AREA	SOURCE
93	592.5	2872.5	25.00	0.0	0.0	6.1	0.0	0.0	0.	AREA	SOURCE
94	576.3	2871.3	6.30	0.110	0.584	6.1	0.0	0.0	0.	AREA	SOURCE
95	578.8	2871.3	6.30	0.162	0.441	6.1	0.0	0.0	0.	AREA	SOURCE
96	581.3	2871.3	6.30	0.115	0.510	6.1	0.0	0.0	0.	AREA	SOURCE
97	583.8	2871.3	6.30	0.241	0.674	6.1	0.0	0.0	0.	AREA	SOURCE
98	586.3	2871.3	6.30	0.060	0.189	6.1	0.0	0.0	0.	AREA	SOURCE
99	588.8	2871.3	6.30	0.033	0.068	6.1	0.0	0.0	0.	AREA	SOURCE
100	581.3	2868.8	6.30	0.164	0.458	6.1	0.0	0.0	0.	AREA	SOURCE
101	583.8	2868.8	6.30	0.167	0.236	6.1	0.0	0.0	0.	AREA	SOURCE
102	567.5	2867.5	25.00	0.277	1.218	6.1	0.0	0.0	0.	AREA	SOURCE
103	572.5	2867.5	25.00	0.425	1.293	6.1	0.0	0.0	0.	AREA	SOURCE
104	577.5	2867.5	25.00	0.627	1.485	6.1	0.0	0.0	0.	AREA	SOURCE
105	581.3	2866.3	6.30	0.137	0.205	6.1	0.0	0.0	0.	AREA	SOURCE
106	583.8	2866.3	6.30	0.107	0.219	6.1	0.0	0.0	0.	AREA	SOURCE
107	587.5	2867.5	25.00	0.090	0.186	6.1	0.0	0.0	0.	AREA	SOURCE
108	581.3	2863.8	6.30	0.159	0.211	6.1	0.0	0.0	0.	AREA	SOURCE
109	583.8	2863.8	6.30	0.156	0.274	6.1	0.0	0.0	0.	AREA	SOURCE
110	586.3	2863.8	6.30	0.074	0.112	6.1	0.0	0.0	0.	AREA	SOURCE
111	588.8	2863.8	6.30	0.038	0.055	6.1	0.0	0.0	0.	AREA	SOURCE
112	560.0	2865.0	100.00	0.186	1.649	6.1	0.0	0.0	0.	AREA	SOURCE
113	567.5	2862.5	25.00	0.285	0.879	6.1	0.0	0.0	0.	AREA	SOURCE
114	572.5	2862.5	25.00	0.523	1.382	6.1	0.0	0.0	0.	AREA	SOURCE

115	577.5	2862.5	25.00	0.488	0.792	6.1	0.0	0.0	0.	AREA	SOURCE
116	581.3	2861.3	6.30	0.118	0.255	6.1	0.0	0.0	0.	AREA	SOURCE
117	583.8	2861.3	6.30	0.055	0.112	6.1	0.0	0.0	0.	AREA	SOURCE
118	586.3	2861.3	6.30	0.088	0.129	6.1	0.0	0.0	0.	AREA	SOURCE
119	588.8	2861.3	6.30	0.088	0.077	6.1	0.0	0.0	0.	AREA	SOURCE
120	576.0	2859.0	4.00	0.090	0.203	6.1	0.0	0.0	0.	AREA	SOURCE
121	578.0	2859.0	4.00	0.173	0.241	6.1	0.0	0.0	0.	AREA	SOURCE
122	580.0	2859.0	4.00	0.140	0.345	6.1	0.0	0.0	0.	AREA	SOURCE
123	582.0	2859.0	4.00	0.099	0.225	6.1	0.0	0.0	0.	AREA	SOURCE
124	584.0	2859.0	4.00	0.055	0.038	6.1	0.0	0.0	0.	AREA	SOURCE
125	571.3	2858.8	6.30	0.236	0.556	6.1	0.0	0.0	0.	AREA	SOURCE
126	573.8	2858.8	6.30	0.230	0.622	6.1	0.0	0.0	0.	AREA	SOURCE
127	586.3	2858.8	6.30	0.082	0.077	6.1	0.0	0.0	0.	AREA	SOURCE
128	588.8	2858.8	6.30	0.088	0.077	6.1	0.0	0.0	0.	AREA	SOURCE
129	576.0	2857.0	4.00	0.121	0.164	6.1	0.0	0.0	0.	AREA	SOURCE
130	578.0	2857.0	4.00	0.285	0.203	6.1	0.0	0.0	0.	AREA	SOURCE
131	580.0	2857.0	4.00	0.167	0.288	6.1	0.0	0.0	0.	AREA	SOURCE
132	582.0	2857.0	4.00	0.058	0.148	6.1	0.0	0.0	0.	AREA	SOURCE
133	584.0	2857.0	4.00	0.003	0.003	6.1	0.0	0.0	0.	AREA	SOURCE
134	567.5	2857.5	25.00	0.268	1.016	6.1	0.0	0.0	0.	AREA	SOURCE
135	571.3	2856.3	6.30	0.216	0.455	6.1	0.0	0.0	0.	AREA	SOURCE
136	573.8	2856.3	6.30	0.197	0.551	6.1	0.0	0.0	0.	AREA	SOURCE
137	586.3	2856.3	6.30	0.044	0.071	6.1	0.0	0.0	0.	AREA	SOURCE
138	588.8	2856.3	6.30	0.033	0.055	6.1	0.0	0.0	0.	AREA	SOURCE
139	576.0	2855.0	4.00	0.140	0.274	6.1	0.0	0.0	0.	AREA	SOURCE
140	578.0	2855.0	4.00	0.162	0.279	6.1	0.0	0.0	0.	AREA	SOURCE
141	580.0	2855.0	4.00	0.271	0.677	6.1	0.0	0.0	0.	AREA	SOURCE
142	582.0	2855.0	4.00	0.074	0.255	6.1	0.0	0.0	0.	AREA	SOURCE
143	584.0	2855.0	4.00	0.022	0.112	6.1	0.0	0.0	0.	AREA	SOURCE
144	586.3	2853.8	6.30	0.129	0.263	6.1	0.0	0.0	0.	AREA	SOURCE
145	588.8	2853.8	6.30	0.047	0.041	6.1	0.0	0.0	0.	AREA	SOURCE
146	576.0	2853.0	4.00	0.129	0.238	6.1	0.0	0.0	0.	AREA	SOURCE
147	578.0	2853.0	4.00	0.129	0.230	6.1	0.0	0.0	0.	AREA	SOURCE
148	580.0	2853.0	4.00	0.219	0.526	6.1	0.0	0.0	0.	AREA	SOURCE
149	582.0	2853.0	4.00	0.066	0.063	6.1	0.0	0.0	0.	AREA	SOURCE
150	584.0	2853.0	4.00	0.036	0.156	6.1	0.0	0.0	0.	AREA	SOURCE
151	525.0	2860.0	400.00	0.310	4.186	6.1	0.0	0.0	0.	AREA	SOURCE
152	545.0	2860.0	400.00	0.164	3.384	6.1	0.0	0.0	0.	AREA	SOURCE
153	560.0	2855.0	100.00	0.159	1.485	6.1	0.0	0.0	0.	AREA	SOURCE
154	567.5	2852.5	25.00	0.378	1.474	6.1	0.0	0.0	0.	AREA	SOURCE
155	572.5	2852.5	25.00	1.455	1.786	6.1	0.0	0.0	0.	AREA	SOURCE
156	576.0	2851.0	4.00	0.340	0.378	6.1	0.0	0.0	0.	AREA	SOURCE
157	578.0	2851.0	4.00	0.230	0.290	6.1	0.0	0.0	0.	AREA	SOURCE
158	580.0	2851.0	4.00	0.274	0.449	6.1	0.0	0.0	0.	AREA	SOURCE
159	582.0	2851.0	4.00	0.184	0.153	6.1	0.0	0.0	0.	AREA	SOURCE
160	584.0	2851.0	4.00	0.186	0.219	6.1	0.0	0.0	0.	AREA	SOURCE
161	586.3	2851.3	6.30	0.362	0.227	6.1	0.0	0.0	0.	AREA	SOURCE
162	588.8	2851.3	6.30	0.027	0.014	6.1	0.0	0.0	0.	AREA	SOURCE
163	576.0	2849.0	4.00	0.140	0.170	6.1	0.0	0.0	0.	AREA	SOURCE
164	578.0	2849.0	4.00	0.175	0.178	6.1	0.0	0.0	0.	AREA	SOURCE
165	580.0	2849.0	4.00	0.189	0.318	6.1	0.0	0.0	0.	AREA	SOURCE
166	582.0	2849.0	4.00	0.027	0.030	6.1	0.0	0.0	0.	AREA	SOURCE
167	584.0	2849.0	4.00	0.003	0.003	6.1	0.0	0.0	0.	AREA	SOURCE
168	571.3	2848.8	6.30	0.186	0.219	6.1	0.0	0.0	0.	AREA	SOURCE
169	573.8	2848.8	6.30	0.219	0.227	6.1	0.0	0.0	0.	AREA	SOURCE
170	586.3	2848.8	6.30	0.093	0.030	6.1	0.0	0.0	0.	AREA	SOURCE
171	588.8	2848.8	6.30	0.088	0.011	6.1	0.0	0.0	0.	AREA	SOURCE
172	576.0	2847.0	4.00	0.175	0.211	6.1	0.0	0.0	0.	AREA	SOURCE
173	578.0	2847.0	4.00	0.068	0.140	6.1	0.0	0.0	0.	AREA	SOURCE
174	580.0	2847.0	4.00	0.027	0.148	6.1	0.0	0.0	0.	AREA	SOURCE
175	582.0	2847.0	4.00	0.033	0.170	6.1	0.0	0.0	0.	AREA	SOURCE