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Lake County, Florida Solid Waste Management Plan

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LAKE COUNTY, FLORIDA
SOLID WASTE MANAGEMENT PLAN

BY

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RESEARCH REPORT

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ABSTRACT

The history of solid waste management in Lake County, Florida is reviewed. The role of governmental agencies is mentioned. Local environmental characteristics and transportation systems are discussed.

Existing collection and disposal practices are presented. A land use analysis of the unincorporated areas of the County is given. Projections of population and solid waste quantities are listed.

Two computer models are presented. Their optimum solutions are analyzed in detail. The cost associated with implementing either plan is presented. A recommended plan is given based on a combination of transfer stations and sanitary landfills.

ACKNOWLEDGEMENT

I sincerely wish to thank everyone who contributed to the preparation of this report:

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CHAPTER I

INTRODUCTION

Objective

The objective of this report is to present a comprehensive long-range resource recovery and management plan for Lake County, Florida. This report should serve as the initial basis for decision making in implementing the plan. It must be reviewed and revised as needed to accommodate future changes.

Scope

Two important variables in the plan were established in the initial stages of the data collection: the time frame and the geographical extent. Failure to have done so could have resulted in either excessive or inadequate data collection.

The time frame of this plan covers the 20-year span from 1975 to 1995. This span is generally recognized as the minimum to be used in formulating resource recovery and management plans, especially for acquiring disposal sites.[1]

This plan provides a resource recovery and management program for all areas of Lake County, Florida. It covers, in addition to the unincorporated areas, all of the fourteen existing incorporated areas of the county.

Regional Approach

In general, a plan of this nature should cover the largest feasible geographical area. Several advantages of a regional approach are:

1. increased flexibility in locating and acquiring disposal sites
2. higher discounts for a greater volume of equipment orders
3. coordination of pollution control activities, and
4. economies of scale for items such as administration, operation, and land acquisition.

Forthcoming rules of the State of Florida will require all public agencies, including counties and municipalities, to submit a resource recovery and management program by May 1, 1977. The final deadline for approval of the program by the State is July 1, 1977.[2] The plan given in this report should essentially satisfy these rules, if adopted and implemented by Lake County and each of the municipalities.

Enabling Legislation

There are provisions in the Florida Statutes which allow the local governmental units to enter into interlocal agreements in order to

> " . . . provide services and facilities in a manner and pursuant to forms of governmental organization that will accord best with geographical, economic, population, and other factors influencing the needs and development of local communities."[3]

This legislation provides the legal basis for joint county-municipal action as proposed in this report. There are several important items which should be defined in these agreements, including:

1. expiration date of the regional authority
2. financial contributions, extent of services and responsibilities of each member
3. a non-withdrawal clause
4. procedures for new members to join, and
5. regional boundaries.

CHAPTER II

SUMMARY AND RECOMMENDATIONS

Summary

Lake County, Florida will be faced with the problem of disposing of about 3,220,000 tons of solid waste in the next twenty years. This report provides data to aid the local public agencies in decision making to meet this problem.

The major emphasis of this report has been on site selection of transfer stations and sanitary landfills through computer modeling techniques. It should be noted that the optimum solutions to the computer models are in terms of what is most economical for the county as a whole. Factors not considered in the models include levels of service to particular areas, environmental problems which may be encountered at particular sites, and public acceptance of the proposals. Therefore it is necessary for local public officals to consider these subjective factors to the best of their ability before implementing a solid waste management system.

Recommendations

All of the fourteen municipalities in Lake County shall be responsible for solid waste collection within their respective corporate limits. The collection systems established are to be controlled by each individual incorporated area, as best fit local circumstances.

Collections in the unincorporated areas shall continue to be performed by county-franchised collectors, in accordance with Ordinance 1972-2. The five existing franchise areas should be replaced by the ten Proposed Collection Service Areas(PCSA's) shown in this report. This would result in more realistic boundaries for solid waste collection areas.

A county wide system of transfer stations should be constructed and operated at strategic locations throughout the county. According to the optimum solutions of the computer models, primary consideration should be given to the following locations:

Astor (North Lake County)

Leesburg (Northwest Lake County)

Clermont (South Lake County)

In order to provide a higher level of service county wide, and to prevent economic hardships in certain areas, some consideration should be given to installing additional transfer stations. Locations for which secondary consider-

ation should be given are:

Paisley (Northeast Lake County)

Mount Dora (North Central Lake County)

Sanitary landfilling operations should be consolidated into a county-wide system. The optimum solutions to the computer models indicate that land for this purpose should be acquired at the following locations:

Sorrento area	175 Acres
Lady Lake area	175 Acres
Astatula area	175 Acres
Umatilla area	110 Acres

An alternate approach would involve acquiring 280 acres of land in the Sorrento area and eliminating the Umatilla Site, if not enough suitable land can be located in the Umatilla area. Any variation in the location of the disposal sites could affect the need for transfer stations in an area.

CHAPTER III

BACKGROUND

History of Solid Waste Management in Lake County, Florida

Prior to 1972 solid waste in Lake County was burned at open dumps located throughout the County. Collection of solid waste in the unincorporated areas was performed by private collectors with little or no regulation by County agencies. This laissez-faire approach to the problem of solid waste was substantially abandoned in 1972.

During that year the Lake County Board of County Commissioners implemented two major reforms. One was the halting of open burning at all county-operated dumps. The county initiated daily covering of solid waste at three of the larger disposal sites: Astatula, Clermont, and Lady Lake. Additionally, county personnel began applying cover material over solid waste on a non-daily basis at eleven smaller sites: Astor, Bay Lake, Empire, Harrington, Log House, Montverde, Okahumpka, Paisley, Stuckey, Tavares, and Umatilla. Since then, the county began phasing out operations at several sites, as shown below:

DISPOSAL SITE	CLOSE OUT MONTH
Okahumpka	June 1972
Tavares	Feb. 1973

Harrington	Apr. 1973
Empire	Nov. 1973
Bay Lake	Sept. 1974
Montverde	Sept. 1974

Operations at the sites near Astor and Clermont are scheduled to be phased out during July 1975.

The second major reform by the Board of County Commissioners was the adoption of Ordinance 1972-2, the Lake County, Florida Refuse and Garbage Disposal Ordinance. It substantially increased the county's regulatory functions in the solid waste management field. The introduction to the Ordinance is given below, in order to show the scope of its provisions:

> A bill to be entitled An Ordinance relating to the regulation and control of the accumulation, burning, collection, disposal and transportation of garbage in Lake County in all areas not within boundaries of any municipality; providing for definitions, providing for franchises and their renewal; providing for the terms and conditions of such franchises, and the method of operation of said franchises; providing for the suspension or relinquishment of franchises; providing the equipment requirement for franchises; providing the method of operations of the franchises; providing for franchise fees; requiring franchises for the collection, hauling, or transportation of refuse for hire, permitting the County to provide a disposal site; providing for landfill fees; providing for agreements between municipalities and/or certain industries, and the County for landfill use fees; providing for customer responsibilities; declaring the violation of the ordinance a misdemeanor and authorizing the Board of County Commissioners by suit to enjoin the violation of the ordinance; providing the Board of County Commissioners with regulatory powers; providing that the ordinance shall be liberally construed, providing the severability clause; and providing an effective date. [1]

Governmental Agencies

State

The State of Florida Environmental Reorganization Act of 1975 created a new agency, the Department of Environmental Regulation (DER), effective July 1, 1975. The DER will continue enforcement of existing State pollution control and environmental laws and regulations. Chapter 17-7 of the Florida Administrative Code contains the rules of the DER (formerly rules of the Department of Pollution Control,DPC) which pertain to resource recovery and management.

The DER organization plan provides for three divisions. The Division of Administrative Services includes personnel, fiscal, purchasing, education and information activities. The Division of Environmental Programs includes administration and coordination responsibilities and supervision of programs relating to planning, grants,air quality, water quality and quantity, noise and solid waste management. The Division of Environmental Permitting includes duties and programs relating to power plant certification, processing of permits, licenses, certificates and exemptions, enforcement and supervision of district operations.[2]

Regional

Lake County is a member of the East Central Florida Regional Planning Council (ECFRPC), along with the following other counties: Brevard, Indian River, Orange, Osceola,

and Seminole. The ECFRPC does not promulgate any rules or regulations which directly affect the solid waste management program in Lake County. However, it can serve in an advisory capacity by assisting in the preparation of regional solid waste management plans. Also, the ECFRPC can apply for federal funding for the preparation of such plans by private consultants.

County

The County agency primarily responsible for handling the solid waste management program is the Lake County Landfill Department. This department currently operates the disposal sites, collects fees from landfill users, and regulates the county franchises. Other county departments which assist in the solid waste management program are: Road & Bridge (County Engineer), Pollution Control, Health, and Planning & Zoning. Functions performed by the other county agencies include site location and acquisition, rezoning, permit preparations, and equipment repair.

Physical Characteristics

Location

Lake County is located in the central part of Florida. It is bordered by Marion County on the north, Volusia County on the north and east, Orange and Seminole Counties on the east, Polk County on the south, and Sumter County on the west (see Figure 1). Lake County has a total area of 1,162.9 square miles, of which 960.5 are land and 202.4 are water.[3]

Geology and Soils

There are six geologic formations on or near the surface in the Lake County area.[4] From the oldest and deepest of Eocene age to the youngest of Pleistocene-Recent age, they are the Crystal River, the Suwannee Limestone, the Hawthorn, the Fort Preston, the Fort Thompson, and Ocala Limestone. These formations are covered by recently deposited sandy and clayey marine terraces, except in a few small areas where erosion has exposed the older strata.

A transgressive sea flooded and eroded the land and deposited water-worked sediment identified in these geologic formations. The soils formed in the most recent, overlying sandy and clayey material.

The Crystal River Formation is the only one which underlies the entire county. It consists of a hard, cavernous and porous limestone, and is not exposed any place in the county.

Overlying the Crystal River Formation is the Suwannee Limestone. Its only known exposure is at the bottom of the Palatlakaha River near

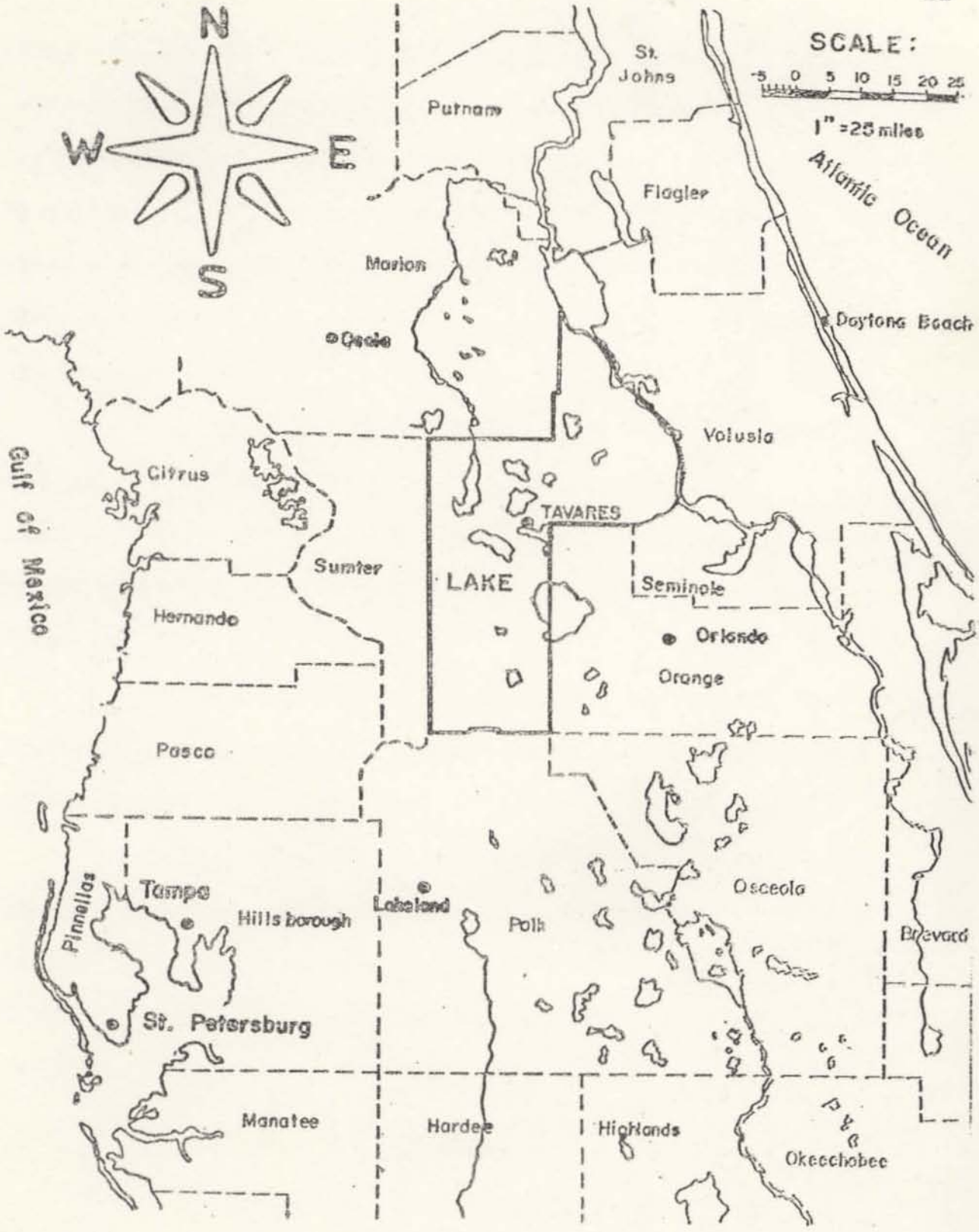


FIGURE 1
LOCATION MAP
LAKE COUNTY, FLORIDA

State Road 48. The Suwannee Limestone is so deeply buried by sandy deposits that it has had little effect on soil formation.

The Hawthorn Formation consists of interbedded sand, clay, marl, limestone, fuller's earth and phosphate. Shell fragments are scattered over the land surface one mile southwest of Howey-In-The-Hills. Phosphatic material is exposed along the sides and bottoms of some nearby sinks.

The Fort Preston Formation underlies about 54 percent of the county. Its sediment is poorly sorted quartz grains in a clay matrix, ranging in size from very fine sand to pebbles. The clay portion is predominantly Kaolin. Florida's construction sands are from this formation.

The Fort Thompson Formation underlies about three percent of the county, primarily around Lake Apopka. It consists of both fresh and marine deposits, and is covered with fibrous organic material.

The Ocala Limestone Formation underlies the entire county. It consists of as much as 98 percent carbonates. Water which moved down through the overlying sand dissolved and removed much of the carbonate material, creating numerous caverns. The collapse of the caverns formed many lakes in the area.

Topography

A sand ridge runs generally north and south through the middle of Lake County. The ridge is gently sloping to very steep, with the highest points west of Lake Apopka in the Sugarloaf Mountain area. The elevation of the highest point is about 315 feet (see Figure 2).

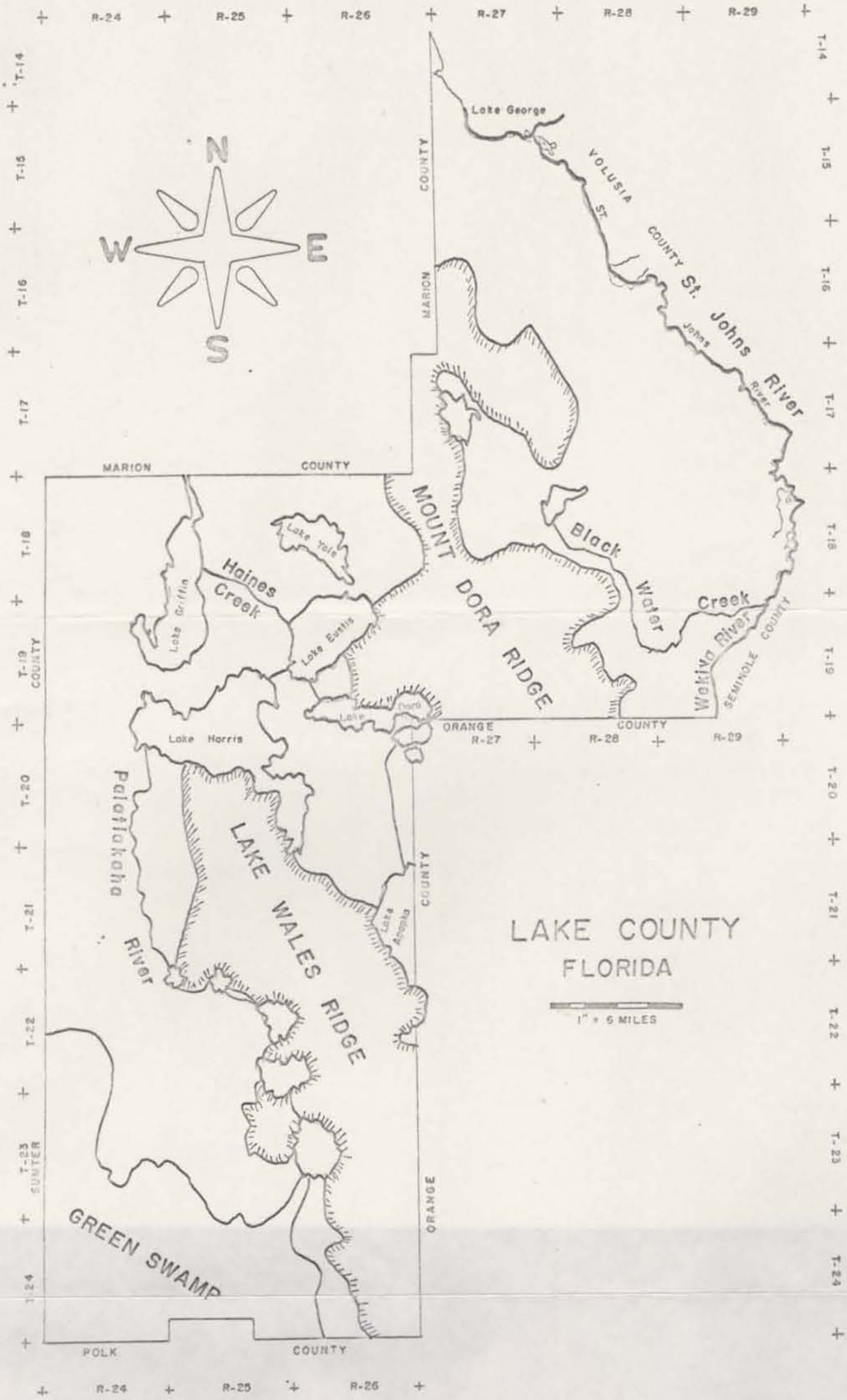


FIGURE 2
DRAINAGE AND PHYSIOGRAPHIC FEATURES

The ridge drops off to the south and west to an elevation of about 100 feet, to 60 feet in the north near Lake Griffin, and to about 50 to 70 feet east and northeast. Areas along the St. Johns River are the lowest in the county, ranging down to about six feet in elevation.

About two-thirds of the county is gently sloping to steep uplands that are predominantly well drained and dotted with numerous lakes. Short, very steep slopes are adjacent to many of the lakes, ponds, and depressions.

Bordering the ridge to the west are broad, less sloping, almost level stretches of flatwoods, penetrated by a few slow-moving streams. This area also abounds with lakes, ponds, and swamps.

Climate

Lake County's climate is characterized by long, warm, somewhat humid summers and mild, dry winters. The average annual rainfall is about 51 inches, with about 60 percent occurring from June through September.

During the summer the temperature varies only slightly from day to day. Although the temperature reaches 90°F on an average of about 125 days a year, it seldom reaches 100°F or higher. Relative humidity seldom drops below 50 percent during June, July, and August resulting in few hot dry winds in the county.

Winter temperatures vary considerably from day to day, mostly as a result of periodic cold fronts which move in from Canada. The average minimum daily temperature in winter is about 50°F. Periods of winter cold usually last only two or three days. See Table 1

TABLE 1

TEMPERATURE AND PRECIPITATION

Month	Temperature		Precipitation		
	Average Daily Maximum (^{o}F)	Average Daily Minimum (^{o}F)	Average Total (inches)	One year in ten will have -	
				Less than- (inches)	More than- (inches)
January	73	50	2.0	0.5	4.8
February	74	52	2.6	0.9	5.3
March	79	56	3.9	1.0	7.9
April	82	60	3.7	1.6	5.9
May	87	66	3.4	0.9	5.0
June	90	71	7.1	4.4	9.2
July	91	73	8.8	3.9	11.8
August	91	73	6.6	4.6	10.3
September	89	72	6.5	3.3	11.4
October	85	65	3.1	1.2	6.5
November	78	56	1.5	0.2	3.6
December	74	51	2.0	0.7	3.7

SOURCE: U.S. Department of Agriculture, Soil Survey of the Lake County Area (Washington, D.C.: Government Printing Office, 1975), p. 80.

for monthly temperature and precipitation data.

Prevailing winds are generally southerly in spring and summer and northerly in fall and winter. Windspeed during the day usually ranges from eight to fifteen miles per hour, dropping below eight miles per hour at night.

Groundwater Table

Most ground water in Lake County is drawn from the Floridan aquifer, composed of the six geologic formations discussed previously. The sandy and clayey deposits overlying the Floridan aquifer constitute a shallow clastic aquifer, used primarily for individual domestic water supply. The saturated thickness of the clastic aquifer is usually less than 100 feet, compared with about 2,000 feet for the Floridan aquifer. The Floridan aquifer is more permeable than the clastic aquifer, and has a greater water supply potential.[5]

The water in a well that penetrates the Floridan aquifer rises to the potentiometric surface at the well point. Figure 3 shows the depth to water and potentiometric surface of the Floridan aquifer. Artesian flow occurs in those wells where the potentiometric surface is higher than the ground surface elevation at the well site.

Public Utilities

The existing utility franchise areas for Lake County are shown in Figure 4. All of the utilities shown provide at least electrical energy to customers in their areas. In addition, the City of Leesburg and the City of Mount Dora provide water distribution and wastewater collection in certain areas.

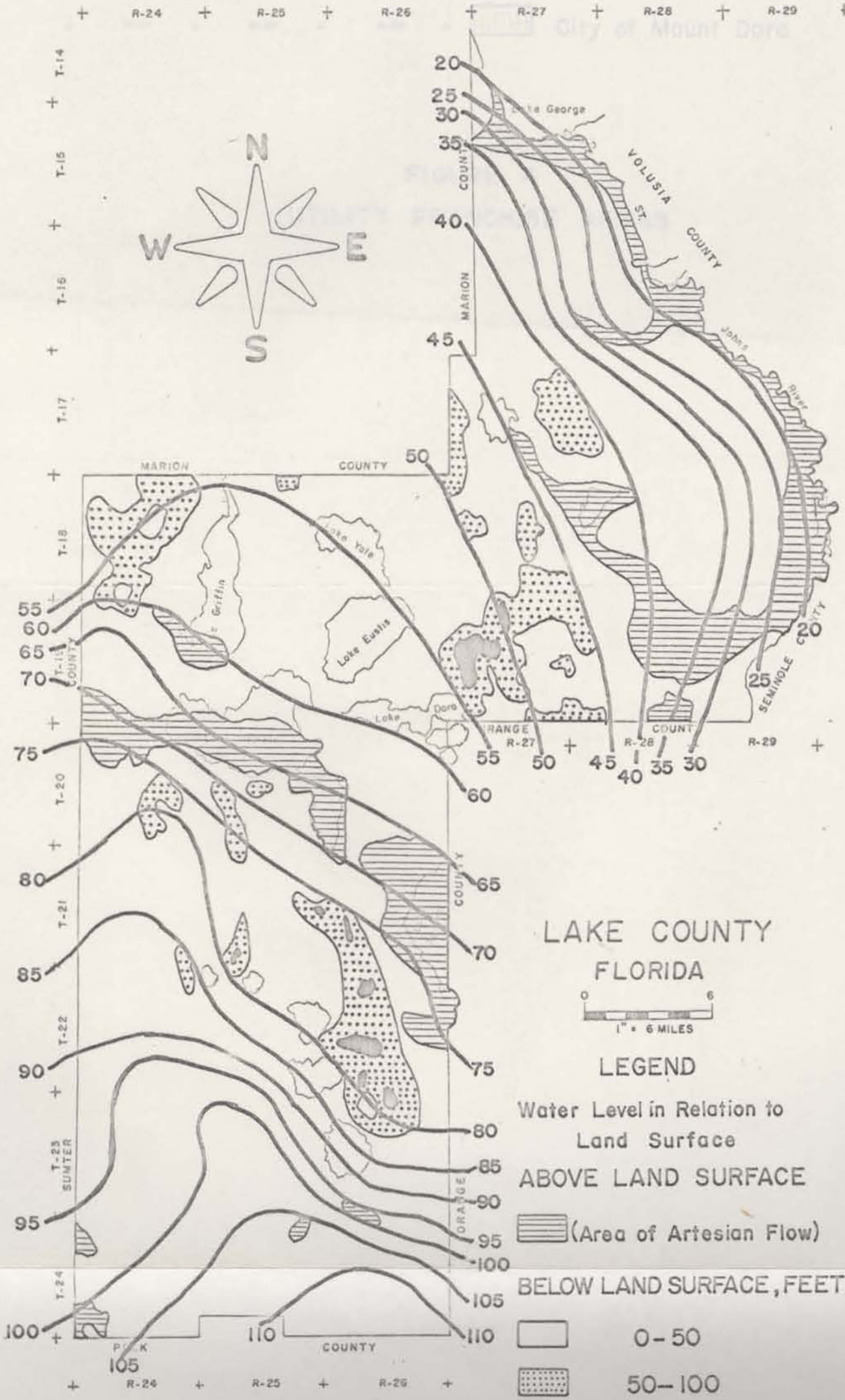


FIGURE 3

DEPTH TO WATER AND POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, MAY 1968

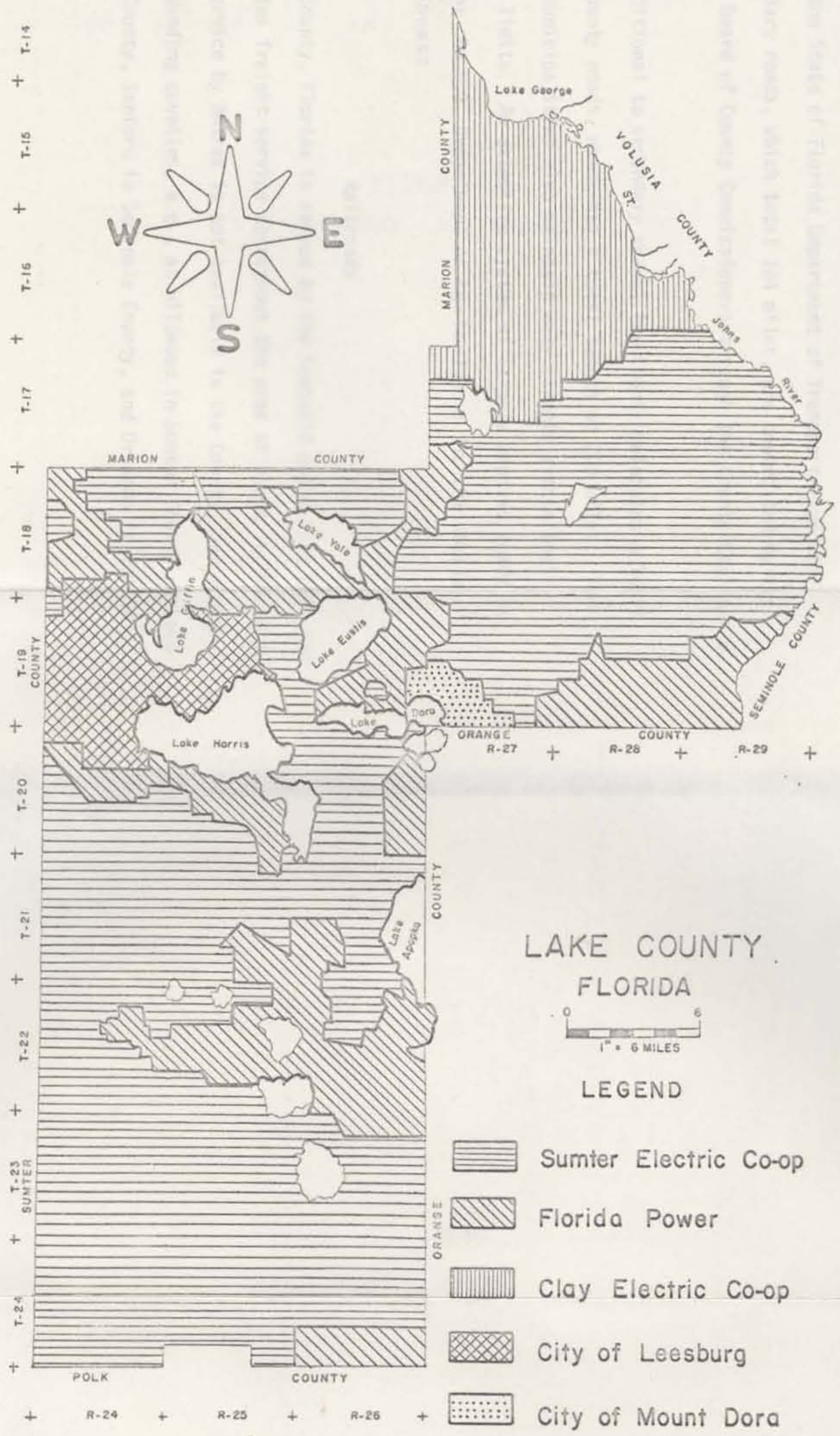


FIGURE 4

UTILITY FRANCHISE AREAS

Transportation System

Highways

The State primary and secondary highway network is shown in Figure 5. Primary roads, totaling 310 miles, are under the jurisdiction of the State of Florida Department of Transportation(DOT). State secondary roads, which total 184 miles, are controlled by the Lake County Board of County Commissioners through the County Engineer's Office.

In additional to secondary roads, the County maintains a local system of County roads, which has a total length of 700 miles. The individual municipalities also maintain city streets within their corporation limits. An extensive system of largely unpaved roads is maintained by the U.S. Department of Agriculture in the Ocala National Forest.

Railroads

Lake County, Florida is served by the Seaboard Coast Line Railroad which provides freight service throughout the area as shown in Figure 6. Passenger service by Amtrak is not available in the County, but rather in the surrounding counties, e.g., at Wildwood in Sumter County, DeLand in Volusia County, Sanford in Seminole County, and Orlando in Orange County.

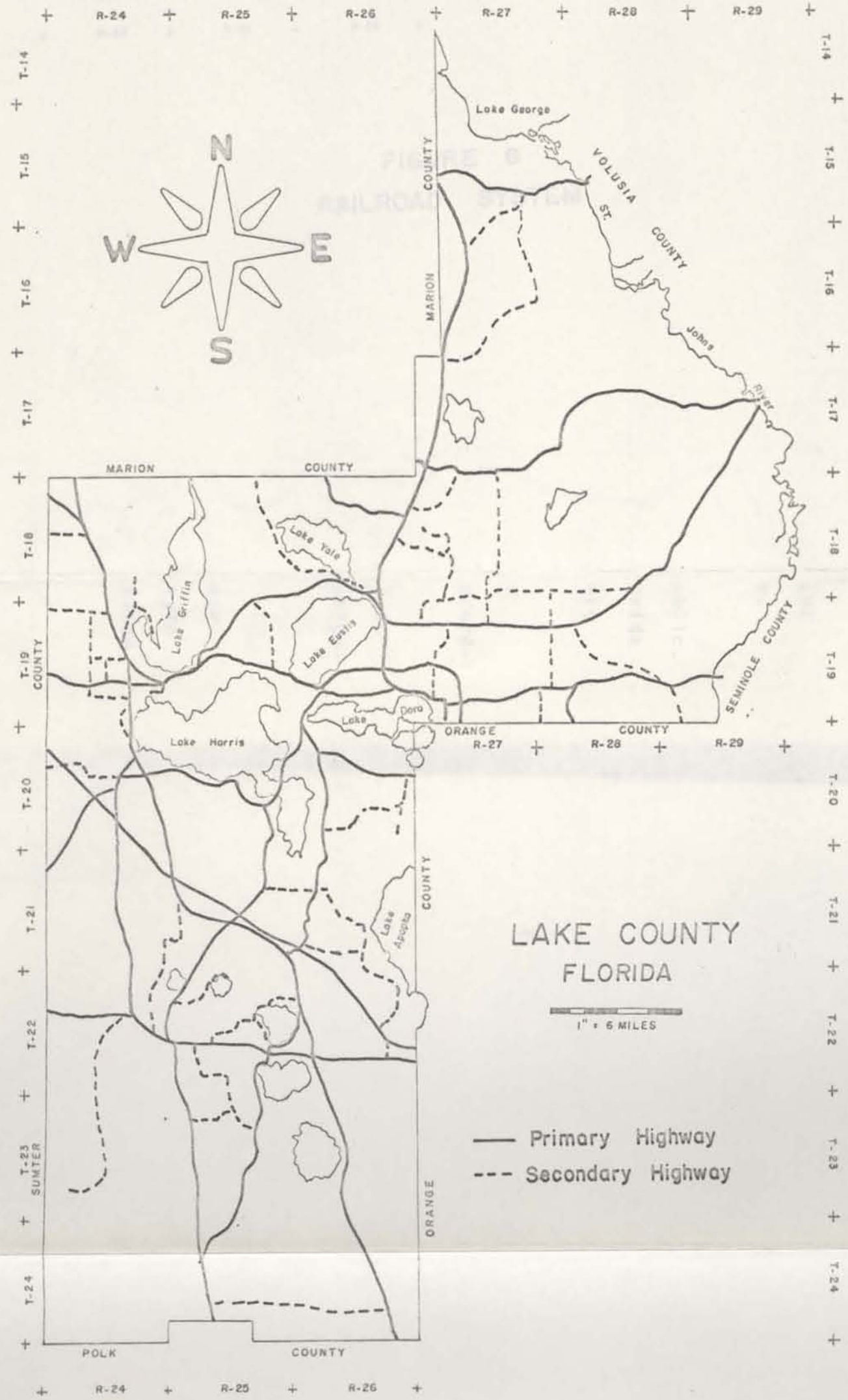


FIGURE 5
HIGHWAY NETWORK

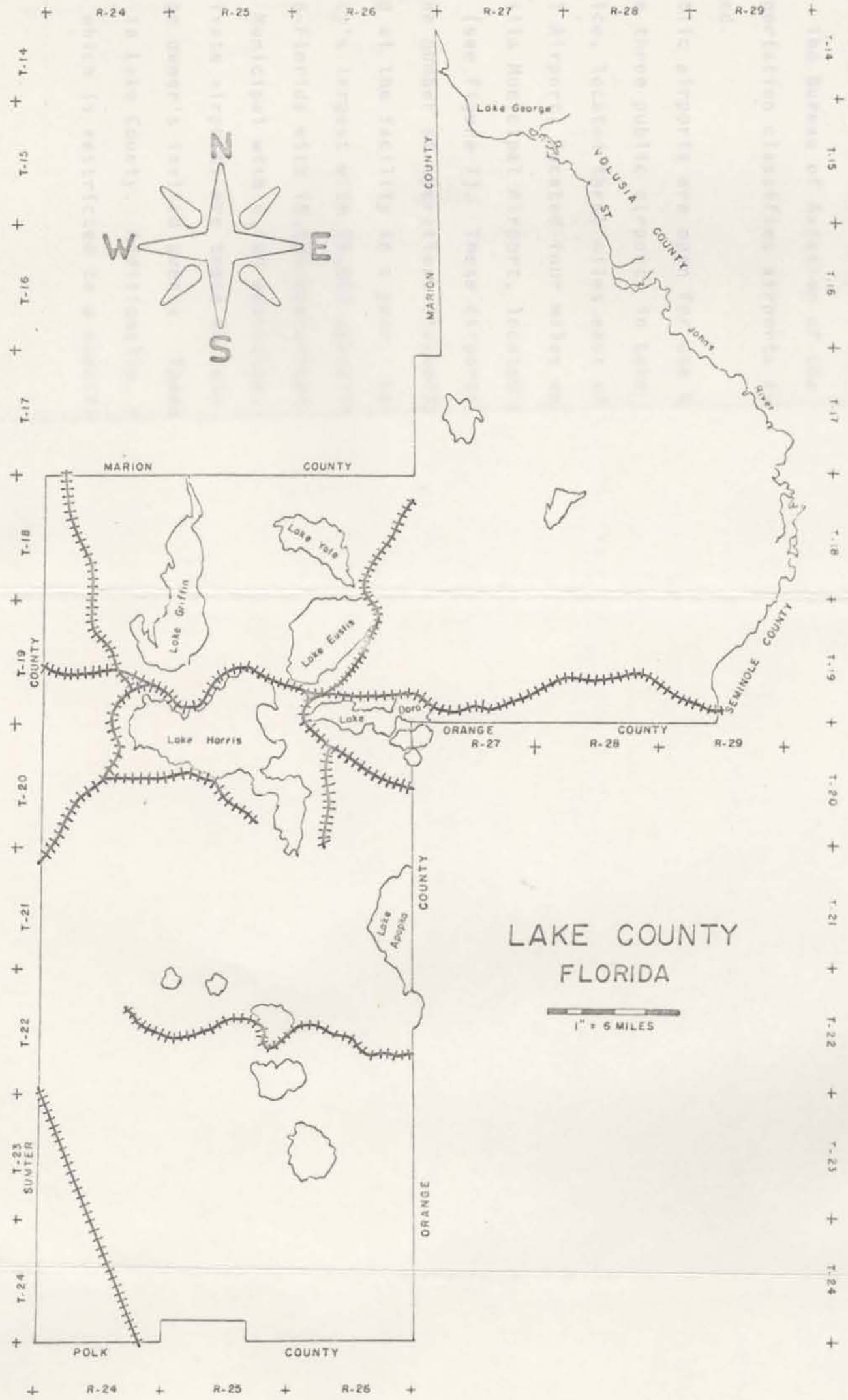


FIGURE 6

RAILROAD SYSTEM

Airports

There are several public and private airports operating in Lake County, but the closest ones with regularly scheduled commercial flights are in Ocala and Orlando. The Bureau of Aviation of the Florida Department of Transportation classifies airports as public, private, or limited.

Public airports are open for use by the general public. There are three public airports in Lake County: Mid-Florida Air Service, located three miles east of Eustis; Leesburg Municipal Airport, located four miles east of Leesburg; and Umatilla Municipal Airport, located one mile east of Umatilla (see Figure 7). These airports can be sized according to the number of operations (takeoffs or landings) occurring at the facility in a year. Leesburg Municipal is the county's largest with 29,800 operations per year, followed by Mid-Florida with 18,000 operations per year, and Umatilla Municipal with 4,400 operations per year.[6]

Private airports are those for use only by the owner and by the owner's invited guests. There are eight private airports in Lake County. Additionally, there is one limited airport, which is restricted to a specific purpose.

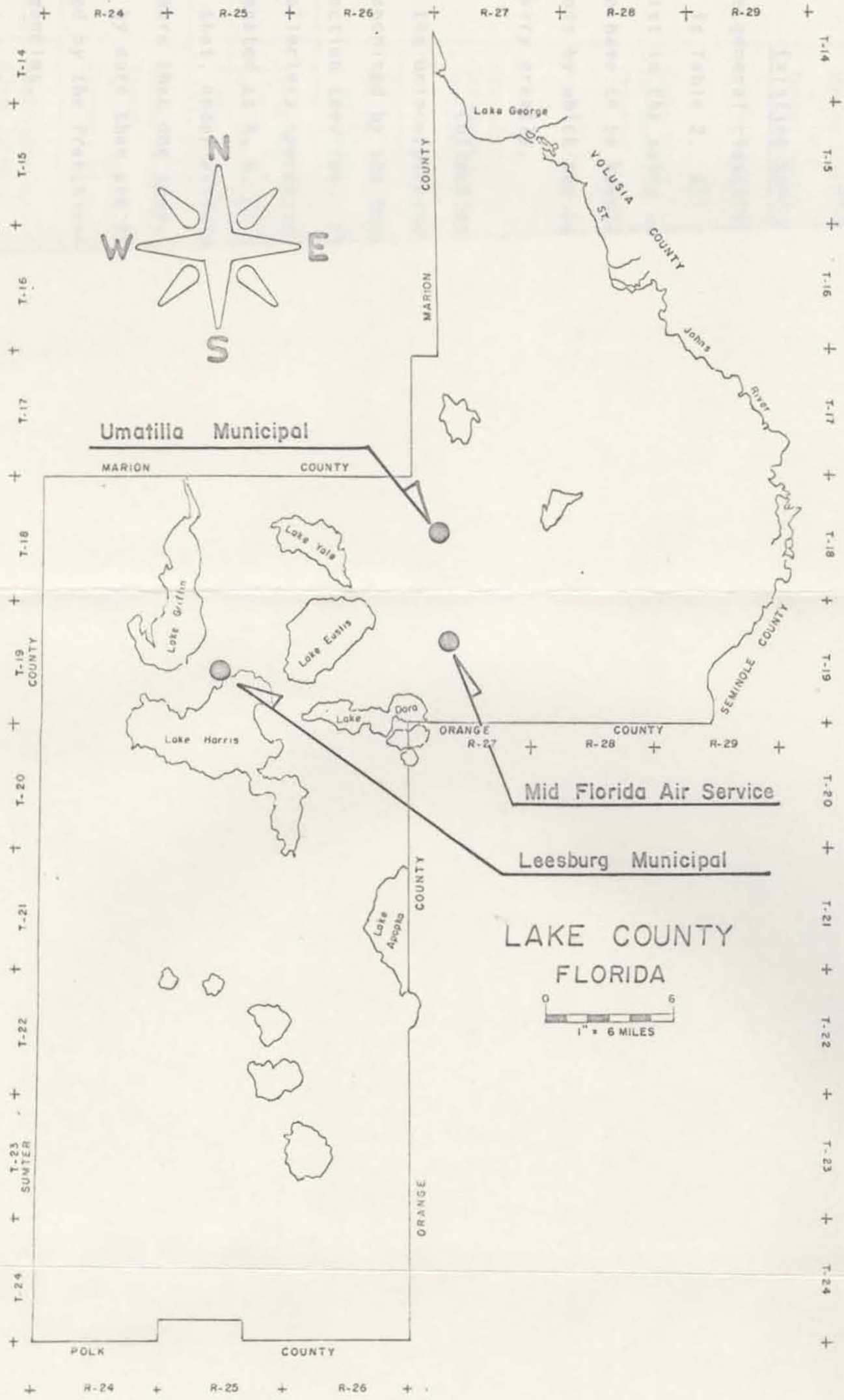


FIGURE 7
PUBLIC AIRPORTS

CHAPTER IV

DATA BASE

Existing Solid Waste Practices

The general classification of solid waste materials is shown in Table 2. All of the twelve major types of solid waste exist in the solid waste "stream" of Lake County and therefore have to be handled by the appropriate agencies. The methods by which the local governmental units meet this problem vary greatly.

Collection Practices

In the unincorporated areas of the county, private firms franchised by the Board of County Commissioners perform the collection services. There are currently fourteen franchised collectors operating in Lake County. Franchise areas are designated as A, B, C, D, and E, and are shown in Figure 8. Note that, under existing regulations, a franchisee may service more than one area. Also, a franchise area may be serviced by more than one franchisee. Collection fees are determined by the franchisee without regulation by any county agencies.

Municipal collection agencies usually operate in their

TABLE 2

GENERAL CLASSIFICATION OF
SOLID WASTE MATERIALS

Garbage	Wastes from the preparation, cooking and serving of food Market refuse, waste from the handling, storage, and sale of produce and meats	
Rubbish	Combustible (primarily organic)	Paper, cardboard, cartons Wood, boxes, excelsior Plastics Rags, cloth, bedding Leather, rubber Grass, leaves, yard trimmings
	Noncombustible (primarily inorganic)	Metals, tin cans, metal foils Dirt Stones, bricks, ceramics crockery Glass bottles Other mineral refuse
Ashes	Residue from fires used for cooking and for heating buildings, cinders	
Bulky wastes	Large auto parts, tires Stoves, refrigerators, other large appliances Furniture, large crates Trees, branches, palm fronds, stumps, flotage	
Street refuse	Street sweepings, dirt Leaves Catch basin dirt Contents of litter receptacles	
Dead animals	Small animals: cats, dogs, poultry, etc. Large animals: horses, cows, etc.	

TABLE 2-Continued

GENERAL CLASSIFICATION OF
SOLID WASTE MATERIALS

Abandoned vehicles	Automobiles, trucks
Construction & demolition wastes	Lumber, roofing, and sheathing scraps Rubble, broken concrete, plaster, etc. Conduit, pipe, wire, insulation, etc.
Industrial refuse	Solid wastes resulting from industrial processes and manufacturing operations, such as food-processing wastes, boiler house cinders, wood, plastic, and metal scraps and shavings, etc.
Special wastes	Hazardous wastes: pathlogical wastes, explosives, radioactive materials Security wastes: Confidential documents, negotiable papers, etc.
Animal and agricultural wastes	Manures, crop residues
Sewage treatment residues	Coarse screenings, grit,septic tank sludge, dewatered sludge

SOURCE: U.S. Environmental Protection Agency, Guidelines for Local Governments on Solid Waste Management(Washington, D.C.: Government Printing Office, 1971), p. 42.

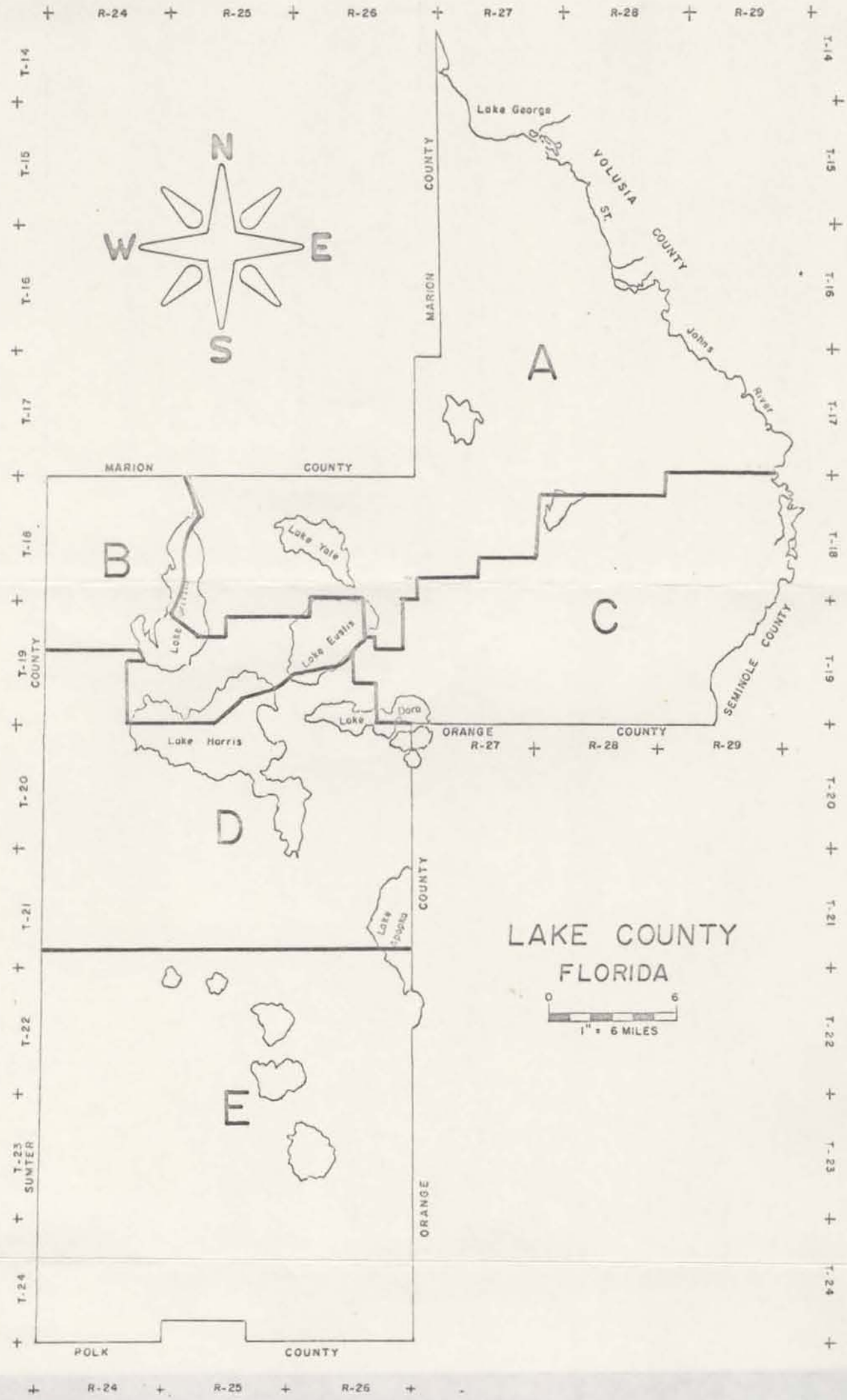


FIGURE 8

LAKE COUNTY SOLID WASTE COLLECTION FRANCHISE AREAS

respective city limits. A couple of municipalities however, do collect a small amount of solid waste in adjacent unincorporated areas. Mascotte has less than ten customers outside the city, and Mount Dora provides collection services to unincorporated areas serviced by the municipal utilities department on a voluntary basis.

Levels of collection service vary greatly among the fourteen incorporated areas in the county. Table 4 shows the major solid waste types collected by municipal collection agencies. Based on the estimated 1975 population and solid waste collection data, the municipal collection rates range up to 7.8 cubic yards/person/year. The town of Montverde provides no municipal solid waste collection services. Astatula and Lady Lake collect mostly street refuse, while Fruitland Park collects only rubbish. The remaining ten municipalities collect both garbage and rubbish. Incorporated areas without complete public collection services are served by private collectors which also have county franchises.

The county-franchised collectors generally provide service during the week from Monday through Friday, with a few performing collections on Saturdays. This practice is also followed by the municipal collection agencies. None of the collectors, county-franchised or municipal, make collections on Sundays under normal operating conditions.

Garbage and rubbish are collected at least once per week by all county-franchised and municipal collectors which handle these types of solid waste. Many collectors offer a higher frequency of service, especially for garbage collection, which may be two or more times per

PRESENT SOLID WASTE COLLECTION RATES
FOR INCORPORATED AREAS*

Incorporated Areas	Estimated 1975 Population	Collection Rates		
		Monthly Mean (Yd^3/Month)	Annual per Capita (Yd^3/Person/Yr)	Waste Types Collected
Astatula	440	32	0.9	Street refuse
Clermont	3,995	1,790	5.4	Garbage & Rubbish
Eustis	7,185	3,272	5.5	Garbage & Rubbish
Fruitland Park	1,580	243	1.8	Rubbish
Groveland	2,275	769	4.1	Garbage & Rubbish
Howey-In-The-Hills	500	125	3.0	Garbage & Rubbish
Lady Lake	400	19	0.6	Street refuse
Leesburg	13,540	8,788	7.8	Garbage & Rubbish
Mascotte	1,135	241	2.5	Garbage & Rubbish
Minneola	1,045	586	6.7	Garbage & Rubbish
Montverde	305	...**	...**	...**
Mount Dora	5,120	2,633	6.2	Garbage & Rubbish
Tavares	3,905	1,438	4.4	Garbage & Rubbish
Umatilla	1,740	833	5.7	Garbage & Rubbish

* Includes only waste which is collected by Municipal Agencies

** No municipal collections

week.

As might be expected, there is wide diversity in the types of equipment used to collect solid waste. Packer trucks form the central part of most collection systems. The average packer has a capacity of about 20 cubic yards, with some rated as high as 25 cubic yards.

Front loading container loaders are used mostly in the larger municipalities, where there is extensive container utilization in commercial and institutional districts. The containers generally range in size from one to eight cubic yards, depending on the needs of the users.

Mount Dora operates a small transfer station for its collection vehicles. They drive up a ramp and expel their loads into a bin,under which awaits a 43 cubic yard Dempster trailer. The filled trailer, pulled by a Ford tractor, transfers the solid waste to the disposal site.

Disposal Practices

Solid waste collected in Lake County is disposed of at the existing sites shown in Figure 9. The Leesburg and Howey-In-The-Hills disposal sites are operated by the two respective municipalities and are for city residents only. The site at Umatilla is operated by Lake County, but is intended to serve only the residents within the city limits of Umatilla. The remaining sites are operated by Lake County for the general public.

The quantities of solid waste received at the disposal sites are recorded on a volumetric basis in terms of cubic yards. Table 4 shows the volumes of solid waste buried at county operated disposal sites from October 1972 through March 1975. These volumes are based on estimates by attendants and operators, and are for solid waste prior to compaction by crawler tractors at the sites. Table 5 shows the volumes of solid waste collected by municipal agencies and disposed of at county-operated sites.

The primary method of disposal is the trench method of sanitary landfilling. This is accomplished as follows:

1. a disposal trench is excavated at the site, usually by a dragline
2. collection vehicles deposit their solid waste near the working face in the trench

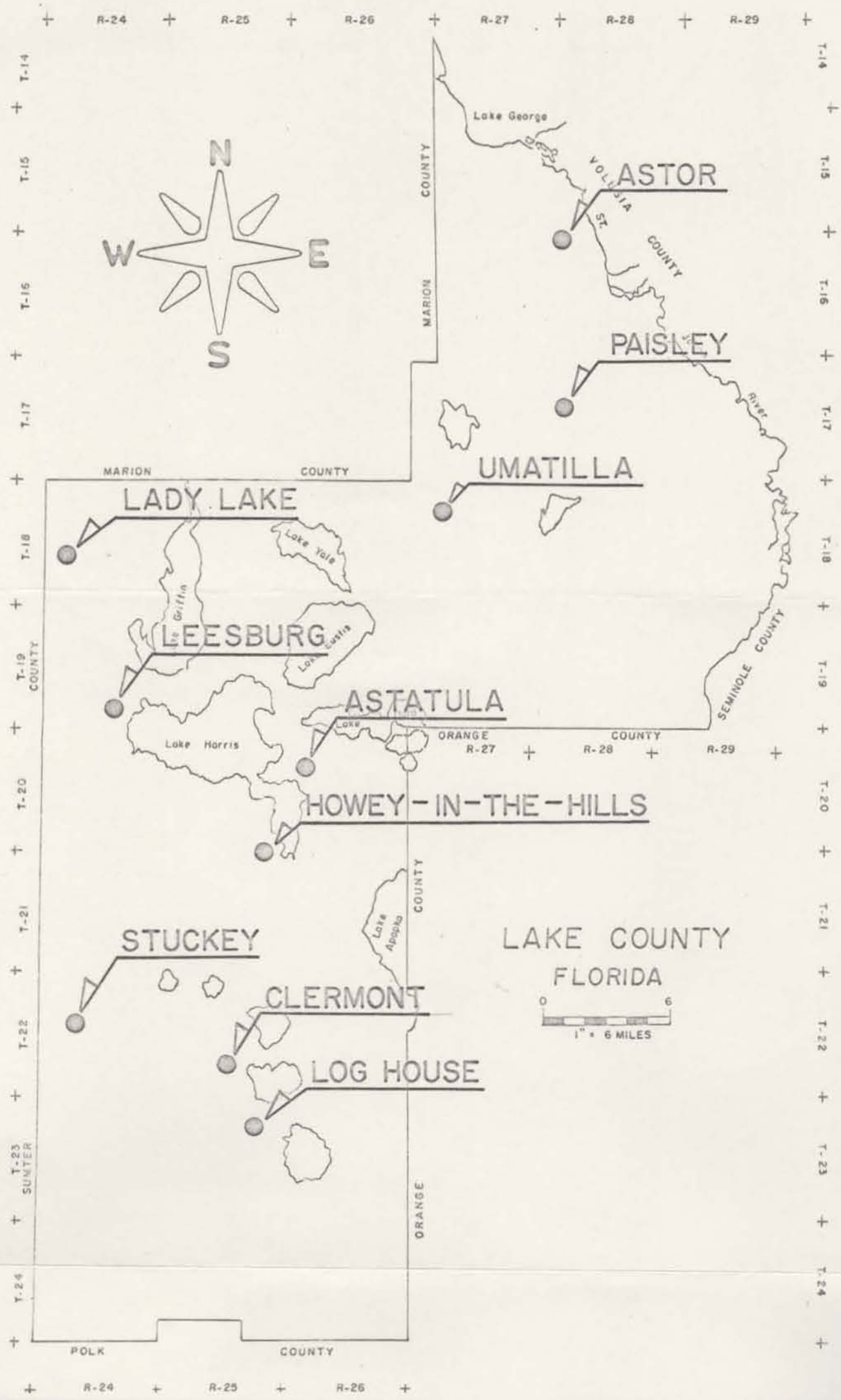


FIGURE 9

SOLID WASTE DISPOSAL SITES

TABLE 4

SOLID WASTE BURIED AT COUNTY OPERATED DISPOSAL SITES
(Volume in Cubic Yards)

Month, Year	Site		
	Astatula	Astor	Bay Lake
Oct. , 1972	12,850	1,850	300
Nov. , 1972	13,800	1,650	0
Dec. , 1972	13,680	1,900	200
Jan. , 1973	13,193	2,150	600
Feb. , 1973	13,541	1,900	300
Mar. , 1973	17,339	2,200	550
Apr. , 1973	17,764	2,650	350
May , 1973	16,514	2,095	450
June , 1973	17,170	1,790	650
July , 1973	15,246	1,402	1,100
Aug. , 1973	17,742	1,640	750
Sept., 1973	16,295	1,300	750
Oct. , 1973	16,180	2,125	750
Nov. , 1973	17,123	1,600	900
Dec. , 1973	15,787	1,835	500
Jan. , 1974	19,153	1,780	1,300
Feb. , 1974	16,485	1,950	1,000
Mar. , 1974	18,087	3,150	500
Apr. , 1974	19,023	4,750	700
May , 1974	18,446	4,375	800
June , 1974	16,312	3,950	550
July , 1974	15,312	3,650	750
Aug. , 1974	14,916	2,575	700
Sept., 1974	12,855	2,115	700
Oct. , 1974	15,031	1,910	Closed 9/74
Nov. , 1974	12,778	1,735	
Dec. , 1974	13,155	1,715	
Jan. , 1975	15,463	1,855	
Feb. , 1975	13,282	1,660	
Mar. , 1975	13,451	1,975	
Total	467,973	67,232	15,150
Mean	15,599	2,241	631
Std. Dev.	1,997	869	290

TABLE 4-Continued

SOLID WASTE BURIED AT COUNTY OPERATED DISPOSAL SITES
(Volume in Cubic Yards)

Month, Year	Site		
	Clermont	Empire	Harrington
Oct. , 1972	6,650	850	700
Nov. , 1972	4,945	850	800
Dec. , 1972	4,025	850	1,800
Jan. , 1973	4,060	1,300	1,700
Feb. , 1973	4,456	1,250	1,500
Mar. , 1973	5,733	1,400	1,650
Apr. , 1973	6,747	1,000	2,150
May , 1973	5,222	1,150	Closed 4/73
June , 1973	4,936	1,450	
July , 1973	5,757	1,650	
Aug. , 1973	5,186	1,450	
Sept., 1973	4,843	1,600	
Oct. , 1973	5,623	4,150	
Nov. , 1973	5,325	2,350	
Dec. , 1973	4,596	Closed 11/73	
Jan. , 1974	6,302		
Feb. , 1974	5,027		
Mar. , 1974	5,701		
Apr. , 1974	5,460		
May , 1974	5,890		
June , 1974	4,564		
July , 1974	4,933		
Aug. , 1974	4,905		
Sept., 1974	4,652		
Oct. , 1974	5,481		
Nov. , 1974	5,086		
Dec. , 1974	4,858		
Jan. , 1975	5,102		
Feb. , 1975	5,069		
Mar. , 1975	6,141		
Total	157,275	21,300	10,300
Mean	5,242	1,521	1,471
Std. Dev.	672	856	532

TABLE 4-Continued

SOLID WASTE BURIED AT COUNTY OPERATED DISPOSAL SITES
(Volume in Cubic Yards)

Month, Year	Site		
	Lady Lake	Log House	Montverde
Oct. , 1972	8,109	1,000	1,100
Nov. , 1972	7,608	850	1,000
Dec. , 1972	6,470	1,000	1,100
Jan. , 1973	7,661	900	1,250
Feb. , 1973	4,823	900	1,400
Mar. , 1973	6,742	950	1,250
Apr. , 1973	6,381	1,100	1,350
May , 1973	5,972	1,300	1,250
June , 1973	6,362	1,350	1,300
July , 1973	6,866	2,050	2,350
Aug. , 1973	6,232	1,400	1,600
Sept., 1973	5,439	1,200	1,500
Oct. , 1973	5,679	2,000	2,100
Nov. , 1973	5,830	1,400	1,450
Dec. , 1973	5,225	1,300	1,000
Jan. , 1974	5,780	2,450	3,500
Feb. , 1974	5,744	1,550	2,450
Mar. , 1974	6,856	1,550	2,000
Apr. , 1974	6,186	1,100	2,200
May , 1974	6,282	1,850	2,300
June , 1974	6,030	1,700	1,900
July , 1974	5,403	1,950	1,750
Aug. , 1974	5,693	1,350	1,700
Sept., 1974	4,825	1,175	1,450
Oct. , 1974	5,913	1,450	Closed 9/74
Nov. , 1974	6,044	900	
Dec. , 1974	5,834	400	
Jan. , 1975	6,449	2,400	
Feb. , 1975	5,928	925	
Mar. , 1975	6,584	1,025	
Total	184,950	40,475	40,250
Mean	6,165	1,349	1,677
Std. Dev.	757	480	589

TABLE 4-Continued

SOLID WASTE BURIED AT COUNTY OPERATED DISPOSAL SITES
(Volume in Cubic Yards)

Month, Year	Site		
	Paisley	Stuckey	Tavares
Oct. , 1972	1,450	1,050	300
Nov. , 1972	1,900	1,300	800
Dec. , 1972	1,950	1,100	400
Jan. , 1973	2,500	1,250	250
Feb. , 1973	2,250	1,350	800
Mar. , 1973	1,000	1,400	Closed 2/73
Apr. , 1973	3,450	1,400	
May , 1973	1,850	1,350	
June , 1973	3,050	1,400	
July , 1973	3,300	2,050	
Aug. , 1973	3,450	1,100	
Sept., 1973	3,300	1,750	
Oct. , 1973	3,700	2,350	
Nov. , 1973	3,550	2,050	
Dec. , 1973	3,100	3,250	
Jan. , 1974	3,650	3,750	
Feb. , 1974	3,700	3,250	
Mar. , 1974	3,550	2,950	
Apr. , 1974	4,250	3,400	
May , 1974	4,175	3,800	
June , 1974	4,850	2,700	
July , 1974	6,075	3,450	
Aug. , 1974	6,240	1,950	
Sept., 1974	2,365	1,450	
Oct. , 1974	2,123	1,900	
Nov. , 1974	1,280	1,700	
Dec. , 1974	1,620	700	
Jan. , 1975	1,770	1,700	
Feb. , 1975	1,680	1,625	
Mar. , 1975	1,830	2,465	
Total	88,958	60,940	2,550
Mean	2,965	2,031	510
Std. Dev.	1,318	892	270

TABLE 4-Continued

SOLID WASTE BURIED AT COUNTY OPERATED SITES
(Volume in Cubic Yards)

Month, Year	Site	Totals (All County Operated Sites)
	Umatilla	
Oct. , 1972	700	36,909
Nov. , 1972	1,200	36,703
Dec. , 1972	300	34,775
Jan. , 1973	700	37,514
Feb. , 1973	900	35,370
Mar. , 1973	1,850	42,064
Apr. , 1973	700	45,042
May , 1973	550	37,703
June , 1973	1,100	40,558
July , 1973	n.a.	41,771
Aug. , 1973	750	41,300
Sept., 1973	1,200	39,177
Oct. , 1973	2,450	47,107
Nov. , 1973	1,700	43,278
Dec. , 1973	1,500	38,093
Jan. , 1974	3,100	50,765
Feb. , 1974	3,200	44,356
Mar. , 1974	2,050	46,394
Apr. , 1974	3,050	50,119
May , 1974	2,350	50,268
June , 1974	2,750	45,306
July , 1974	3,500	46,773
Aug. , 1974	2,800	42,829
Sept., 1974	2,800	34,387
Oct. , 1974	3,500	37,308
Nov. , 1974	2,100	31,623
Dec. , 1974	1,400	29 682
Jan. , 1975	2,800	37,539
Feb. , 1975	2,100	32,269
Mar. , 1975	2,075	35,546
Total	55,175	1,212,528
Mean	1,903	40,418
Std. Dev.	972	5,701

TABLE 5

SOLID WASTE COLLECTED BY CITIES AND BURIED AT COUNTY OPERATED DISPOSAL SITES (Volume in Cubic Yards)

Month, Year	City		
	Astatula	Clermont	Eustis
Oct. , 1972		2,371	3,375
Nov. , 1972		1,692	2,175
Dec. , 1972		2,169	3,074
Jan. , 1973		1,588	2,676
Feb. , 1973		1,986	3,092
Mar. , 1973		1,327	2,030
Apr. , 1973		2,058	3,160
May , 1973		2,766	4,195
June , 1973		1,927	2,960
July , 1973		2,017	3,618
Aug. , 1973		2,021	3,060
Sept., 1973		2,355	4,071
Oct. , 1973		2,065	3,165
Nov. , 1973		1,789	3,220
Dec. , 1973		2,033	4,151
Jan. , 1974		1,346	3,140
Feb. , 1974	160	2,016	4,355
Mar. , 1974	5	1,588	3,455
Apr. , 1974	70	1,621	3,650
May , 1974	30	1,494	3,670
June , 1974	15	2,045	4,085
July , 1974	30	1,334	3,000
Aug. , 1974	42	1,442	2,985
Sept., 1974	25	1,887	3,979
Oct. , 1974	10	1,445	2,840
Nov. , 1974	10	1,789	3,780
Dec. , 1974	17	1,050	1,825
Jan. , 1975	0	1,519	3,085
Feb. , 1975	15	1,499	3,290
Mar. , 1975	15	1,459	3,011
Total	444	53,698	98,172
Mean	32	1,790	3,272
Std. Dev.	41	377	622

TABLE 5-Continued

SOLID WASTE COLLECTED BY CITIES AND BURIED AT COUNTY OPERATED DISPOSAL SITES (Volume in Cubic Yards)

Month, Year	City		
	Fruitland Park	Groveland	Lady Lake
Oct. , 1972	210	1,080	15
Nov. , 1972	28	713	12
Dec. , 1972	70	723	24
Jan. , 1973	184	625	15
Feb. , 1973	99	646	25
Mar. , 1973	79	534	10
Apr. , 1973	146	918	28
May , 1973	202	1,333	20
June , 1973	205	1,022	21
July , 1973	278	1,053	15
Aug. , 1973	235	953	12
Sept , 1973	328	835	23
Oct. , 1973	192	388	8
Nov. , 1973	152	339	17
Dec. , 1973	192	464	25
Jan. , 1974	104	573	5
Feb. , 1974	238	895	7
Mar. , 1974	244	650	29
Apr. , 1974	316	775	31
May , 1974	345	764	27
June , 1974	375	924	43
July , 1974	284	687	30
Aug. , 1974	356	660	10
Sept., 1974	350	1,053	38
Oct. , 1974	394	694	8
Nov. , 1974	284	856	28
Dec. , 1974	168	500	14
Jan. , 1975	240	770	15
Feb. , 1975	363	868	14
Mar. , 1975	623	766	14
Total	7,284	23,061	583
Mean	243	769	19
Std. Dev.	122	222	10

TABLE 5-Continued

SOLID WASTE COLLECTED BY CITIES AND BURIED AT COUNTY OPERATED DISPOSAL SITES (Volume in Cubic Yards)

Month, Year	City			
	Mascotte	Minneola	Mount Dora	Tavares
Oct. , 1972	92	623	2,956	1,882
Nov. , 1972	100	523	2,469	1,359
Dec. , 1972	151	815	2,671	1,435
Jan. , 1973	103	642	2,064	1,166
Feb. , 1973	216	723	2,531	1,412
Mar. , 1973	241	395	1,802	976
Apr. , 1973	210	641	2,562	1,500
May . 1973	442	852	3,379	1,754
June , 1973	232	536	2,704	1,388
July , 1973	297	600	3,556	1,704
Aug. , 1973	196	592	2,510	1,211
Sept., 1973	240	772	3,331	1,515
Oct. , 1973	162	703	2,578	1,168
Nov. , 1973	180	714	2,412	1,268
Dec. , 1973	214	964	2,884	1,530
Jan. , 1974	173	493	2,158	1,151
Feb. , 1974	266	750	3,468	1,913
Mar. , 1974	239	590	2,443	1,412
Apr. , 1974	219	509	2,518	1,350
May , 1974	257	502	2,774	1,325
June , 1974	343	511	3,544	1,563
July , 1974	316	347	2,521	1,246
Aug. , 1974	282	503	2,055	1,377
Sept., 1974	337	550	3,048	1,695
Oct. , 1974	259	475	2,220	1,374
Nov. , 1974	241	468	2,655	1,672
Dec. , 1974	176	268	1,508	984
Jan. , 1975	342	374	2,507	1,557
Feb. , 1975	334	583	2,859	1,760
Mar. , 1975	366	549	2,293	1,497
Total	7,226	17,567	78,980	43,144
Mean	241	586	2,633	1,438
Std. Dev.	83	155	497	240

3. a landfill machine, usually a crawler tractor, maneuvers the waste into a layer compacted on the working face
4. a layer of cover material is applied at the end of the working day
5. final cover material is applied following completion of the trench.

The major exception to the abovementioned procedure is the non-daily application of cover material at the smaller disposal sites. No open burning is practiced at any county or city-operated disposal sites.

Land Use Analysis

The unincorporated area of Lake County contains approximately 695,650 acres of land and water. Water accounts for 130,000 acres and agricultural land covers approximately 250,000 acres. Only 31,362 acres, comprising 5.5% of the total land area of 565,650 acres is developed. Urbanized land has increased from 24.68 square miles (15,796 acres) in 1966 to 49 square miles (31,362 acres) in 1974.[1]

The county's pattern of land use is well defined between agricultural and urban uses because of the overwhelming dominance of agriculture. Urban land usage stretches along highways and to a lesser degree along county roads. Pockets of development, some dating back to the 19th Century, are scattered throughout the county.

The major concentration of urbanization extends through the central portion of the County from Lady Lake to Umatilla. Urban land usage concentrates along this corridor with scattered pockets of development along roads which radiate from US 27 and 441.

There are no major concentrations of development in the northeast portion of Lake County. However, unincorporated urban development is located in several pockets and scattered adjacent to major highways. These areas include Astor-Astor Park, Paisley, Cassia, Mt. Plymouth, Sorrento and Altoona.

The area north of Florida's Turnpike and south of Lake Harris and Lake Dora contains very little urbanization. However, the area south of Leesburg, extending along US 27, has experienced some high intensity land uses, with more in the early development stages.

Unlike the northern portions of the county, the unincorporated areas surrounding the southern cities are not as intensively developed. Astatula, Howey-In-The-Hills, Montverde, Minneola, Clermont, Groveland, and Mascotte have not experienced the degree of fringe development that has occurred around the northern cities in the county. However, scattered development has occurred near all cities in the southern portion of the county.

Residential Land Use

Residential land use comprises 30.3% of the total unincorporated developed area of Lake County. Single family structures are predominant; However, mobile homes comprise a very high percentage of the total residential units in the county, rising from 16% to 45% of total units between 1966 and 1974. Residential development remains low density, with an overall average density of 2.4 units per developed acre.

Commercial Development

Major concentrations of commercial enterprises exist along US 27 between Fruitland Park and Leesburg, and along US 441 between Leesburg and Tavares. Scattered commercial areas in other portions of the county support the rural population and/or the tourist trade. A strong trend exists toward strip commercial development along major highways. Most major concentrations of commercial businesses are located within the cities. However, in the past eight years, business activities have begun to relocate outside the cities.

Industrial Development

Most industrial land use relates to citrus production, equipment storage, building material manufacturing or fertilizer production, However, there has been a growth in more diversified industries, including electronics, sporting goods and mobile home production.

Agriculture

Over 250,000 acres of land are used agriculturally, including 130,000 acres of citrus and 50,000 acres of pasture. Even though development has claimed some agricultural acreage, most losses have been marginal. Lake County is basically an agricultural county. It is rural with only a minimal amount of urbanization.

Population

According to the U.S. Bureau of Census, Lake County's population has increased as shown below:

Year	Population
1900	7,467
1930	23,161
1940	27,255
1950	36,340
1960	57,383
1970	69,305

Projections made by the East Central Florida Regional Planning Council, ECFRPC, put the county's total population at 105,181 by 1980 and at 145,250 by 1990.[2]

The ECFRPC has prepared population projections for each of the fourteen incorporated areas for 1980 and 1990.[3] Values for the years 1975, 1985, and 1995 were determined by linear interpolation and extrapolation of the ECFRPC projections. Table 6 shows the population estimates and projections of the incorporated areas from 1970 to 1995.

Lake County has been divided into six planning areas by the ECFRPC. While these areas may be useful for general planning purposes, they are not ideal for dealing with solid waste collection and disposal. Also, the present franchise areas run essentially along political lines (county commissioner districts). Therefore, for this report,

TABLE 6

POPULATION ESTIMATES AND PROJECTIONS,
INCORPORATED AREAS, 1970-1995

Incorporated Area	PCSA*	1970	1975	1980	1985	1990	1995
Astatula	8	388	440	494	545	600	655
Clermont	10	3,661	3,995	4,329	4,665	5,000	5,335
Eustis	5	6,722	7,185	7,650	8,475	9,300	10,125
Fruitland Park	7	1,359	1,580	1,805	2,030	2,250	2,475
Groveland	9	1,928	2,275	2,626	2,985	3,350	3,710
Howey-In-The-Hills	8	466	500	533	565	600	635
Lady Lake	7	382	400	416	435	450	465
Leesburg	7	11,869	13,540	15,213	16,830	18,450	20,070
Mascotte	9	966	1,135	1,304	1,475	1,650	1,825
Minneola	10	878	1,045	1,214	1,380	1,550	1,720
Montverde	10	308	305	304	300	300	300
Mount Dora	5	4,543	5,120	5,695	6,400	7,100	7,800
Tavares	5	3,261	3,905	4,553	5,200	5,850	6,500
Umatilla	3	1,600	1,740	1,875	2,015	2,150	2,290
Total		38,331	43,165	48,011	53,300	58,600	63,905

SOURCE: East Central Florida Regional Planning Council, Upper Oklawaha River Basin Plan (Winter Park, Florida, 1971), p. 29.

* Proposed Collection Service Area in which the municipality is located

the county has been divided into Proposed Collection Service Areas (PCSA's), as shown in Figure 10.

It is intended that a PCSA be a natural collection service area , the boundaries of which are based on factors such as land use, population, topography, and geography.

Population projections for the PCSA's were made by comparing census tract data, future land use plans, and ECFRPC estimates. Data for a PCSA may or may not include the incorporated areas within its boundaries. This distinction is indicated wherever needed for clarification. Table 7 shows population projections for the unincorporated portions of PCSA's from 1970 to 1995, while Table 8 gives similar data which includes both incorporated and unincorporated parts of each PCSA.

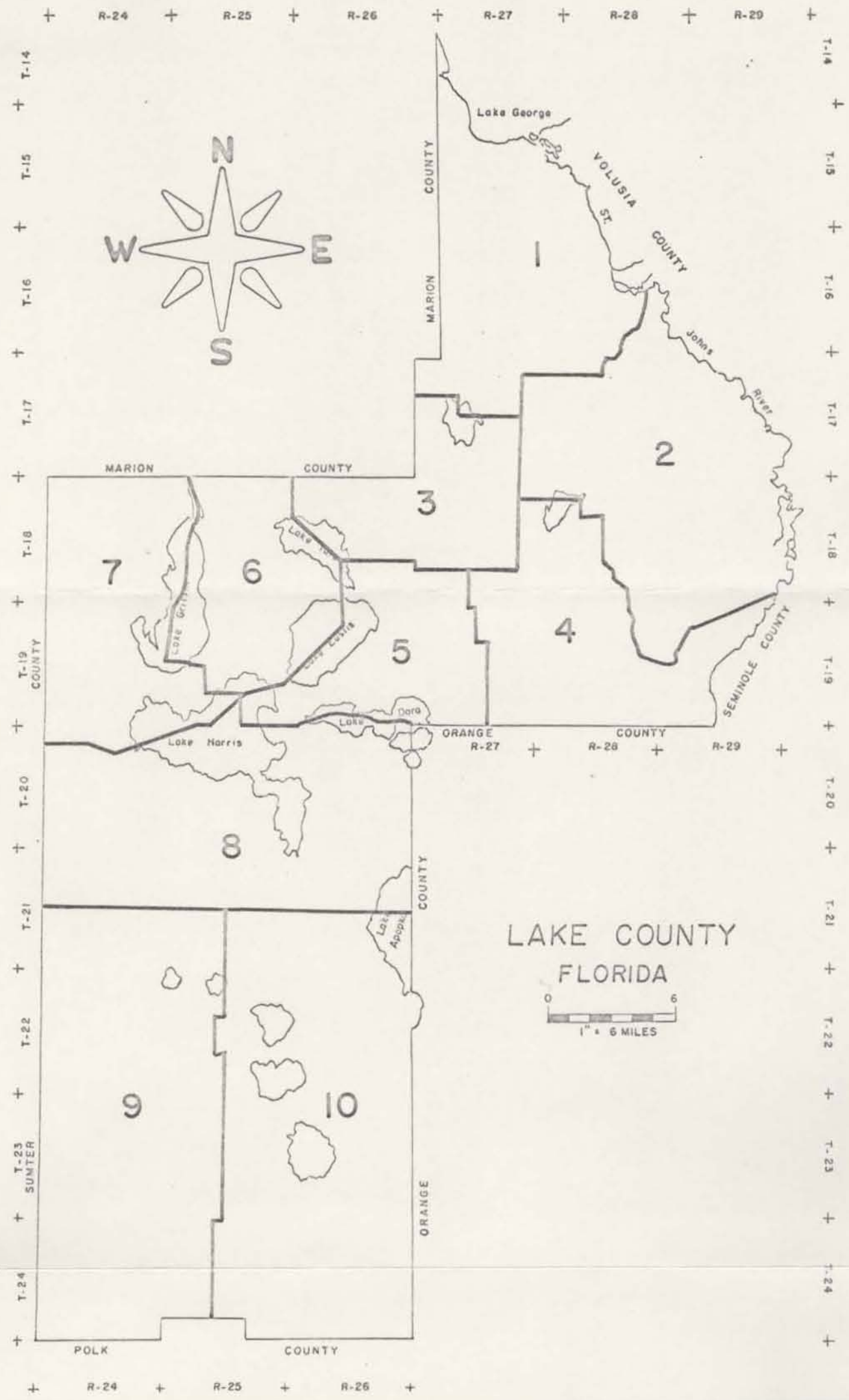


FIGURE 10

PROPOSED COLLECTION SERVICE AREAS

TABLE 7

POPULATION ESTIMATES AND PROJECTIONS,
UNINCORPORATED AREAS, 1970-1995

PCSA*	1970	1975	1980	1985	1990	1995
1	520	725	930	1,160	1,390	1,620
2	1,890	2,640	3,385	4,210	5,040	5,870
3	1,465	2,045	2,625	3,270	3,910	4,550
4	1,835	2,560	3,285	4,090	4,890	5,695
5	8,655	12,080	15,505	19,300	23,090	26,885
6	2,860	3,990	5,125	6,380	7,635	8,890
7	6,175	8,620	11,060	13,765	16,470	19,175
8	2,870	4,850	6,825	9,250	11,670	14,095
9	2,824	3,940	5,060	6,300	7,535	8,775
10	1,880	2,625	3,370	4,195	5,020	5,845
Total	30,974	44,075	57,170	71,920	86,650	101,400

SOURCE: East Central Florida Regional Planning Council, Population: 1970, 1980, 1990 (Winter Park, Florida, 1974), p.12.

* Proposed Collection Service Area

TABLE 8

POPULATION ESTIMATES AND PROJECTIONS,
PROPOSED COLLECTION SERVICE AREAS, 1970-1995

PCSA*	1970	1975	1980	1985	1990	1995
1	520	725	930	1,160	1,390	1,620
2	1,890	2,640	3,385	4,210	5,040	5,870
3	3,065	3,785	4,500	5,285	6,060	6,840
4	1,835	2,560	3,285	4,090	4,890	5,695
5	23,181	28,290	33,403	39,375	45,340	51,310
6	2,860	3,990	5,125	6,380	7,635	8,890
7	19,785	24,140	28,494	33,060	37,620	42,185
8	3,724	5,790	7,852	10,360	12,870	15,385
9	5,718	7,350	8,990	10,760	12,535	14,310
10	6,727	7,970	9,217	10,540	11,870	13,200
Total	69,305	87,240	105,181	125,200	145,250	165,305

SOURCE: East Central Florida Regional Planning Council, Population: 1970,1980,1990 (Winter Park, Florida, 1974). p. 12.

* Proposed Collection Service Area(Includes both incorporated and unincorporated areas)

Solid Waste Quantities

As previously indicated, present records for solid waste quantities are only on a volumetric basis (cubic yards). The volume can be converted to estimated weights by assuming that the average cubic yard of solid waste delivered to the landfill sites weighs about 365 pounds in the collection vehicles. This figure is reasonable considering the heterogeneous nature of the solid waste.

In order to project the solid waste collection rates, the existing data were analyzed by the method of least squares. The objective of this method is to determine the best fit of a straight line to a given set of data. Let x equal the time in months, beginning with October 1972, and let y equal the volume in cubic yards of solid waste delivered to all county operated disposal sites for a particular month. Then y may be predicted for any future month according to the equation:

$$y = a + bx$$

where:

$$a = \frac{(\Sigma x^2)(\Sigma y) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2}$$

$$b = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$$

n = number of data points

Table 9 shows the data analysis for the thirty-month period from October 1972 (x=1) through March 1975 (x=30). The equation which best fits the data is

$$y = 41{,}294.32 - 56.56x$$

which is a straight line plot with a y-intercept of 41,294.32 cubic yards and a slope of -56.56 cubic yards per month. If this equation were extrapolated through July 1995 (x=274) then the collection rate for that month would be only about 25,800 cubic yards, approximately sixty five per cent of the existing rate.

On the other hand, the state of Florida projections indicate that the amount of solid waste generated in Florida will increase as follows:

Year	Solid Waste Generation Rate (pounds per person per day)
1975	6
1980	8
1985	10
1990	12
1995	14

If the 133 per cent increase in the per capita generation rate were used along with the 89 per cent increase in population by 1995, then the result would be a collection rate (pounds per day) that is 340 per cent greater than the 1975 rate.

TABLE 9

DATA ANALYSIS-METHOD OF LEAST SQUARES
OCTOBER 1972- MARCH 1975

x	x^2	y	xy
1	1	36,909	36,909
2	4	36,703	73,406
3	9	34,775	104,325
4	16	37,514	150,056
5	25	35,370	176,850
6	36	42,064	252,384
7	49	45,042	315,294
8	64	37,703	301,624
9	81	40,558	365,022
10	100	41,771	417,710
11	121	41,300	454,300
12	144	39,177	470,124
13	169	47,107	612,391
14	196	43,278	605,892
15	225	38,093	571,395
16	256	50,765	812,240
17	289	44,356	754,052
18	324	46,394	835,092
19	361	50,119	952,261
20	400	50,268	1,005,360
21	441	45,306	951,426
22	484	46,773	1,029,006
23	529	42,829	985,067
24	576	34,387	825,288
25	625	37,308	932,700
26	676	31,623	822,198
27	729	29,682	801,414
28	784	37,539	1,051,092
29	841	32,269	935,801
30	900	35,546	1,066,380
Totals 465	9,455	1,212,528	18,667,059

The projections used in this report are based on per capita collection rates which remain constant from 1975 through 1995. This means that an area's projections will vary with the same increase in percentage as its population.

Tables 10, 11, amd 12 show projected solid waste collection rates for incorporated areas, unincorporated areas, and proposed collection service areas (PCSA'S), respectively. The data for the incorporated areas include all solid waste collected within the respective city limits, by both municipal and private collectors. The per capita rates vary from city to city, and tend to be higher in the more populated cities.

There is wide diversity in per capita collection rates for the unincorporated areas, particularly for PCSA'S 1, 2, 3. These areas, with relatively low resident populations, are in and around the extremely popular Ocala National Forest. Also, disposal sites in these areas are subjected to a high (approximately 50 per cent) useage rate by residents of adjoining counties.

The projected annual and cumulative amounts of solid waste to be collected for all of Lake County (including the fourteen municipalities) are shown in Table 13. According to these figures, from the present time through 1995, Lake County will be faced with the problem of

TABLE 10

PROJECTED SOLID WASTE COLLECTION RATES
FOR INCORPORATED AREAS

Incorporated Area	Average Collection Rate* (Pounds/Person/Day)	Projected solid waste collection rates(Tons/Day)				
		1975	1980	1985	1990	1995
Astatula	4.5	0.9	1.1	1.2	1.4	1.5
Clermont	5.4	10.8	11.7	12.6	13.5	14.4
Eustis	5.5	19.8	21.0	23.3	25.6	27.8
Fruitland Park	5.0	4.0	4.5	5.1	5.6	6.2
Groveland	4.1	4.7	5.4	6.1	6.9	7.6
Howey-In-The-Hills	5.0	1.3	1.3	1.4	1.5	1.6
Lady Lake	5.0	1.0	1.0	1.1	1.1	1.2
Leesburg	7.8	52.8	59.3	65.6	72.0	78.3
Mascotte	2.5	1.4	1.6	1.8	2.1	2.3
Minneola	6.7	3.5	4.1	4.6	5.2	5.8
Montverde	2.7	0.4	0.4	0.4	0.4	0.4
Mount Dora	6.2	15.9	17.7	19.8	22.0	24.2
Tavares	4.4	8.6	10.0	11.4	12.9	14.3
Umatilla	5.7	5.0	5.3	5.7	6.1	6.5
Total		130.1	144.4	160.1	176.3	192.1

* Based on no increase in per capita rates from 1975 to 1995

TABLE 11

PROJECTED SOLID WASTE COLLECTION RATES
FOR UNINCORPORATED AREAS

PCSA*	Average Collection Rate** (Pounds/Person/day)	Projected Solid Waste Collection Rates (Tons/Day)				
		1975	1980	1985	1990	1995
1	40.0	14.5	18.6	23.2	27.8	32.4
2	15.0	19.8	25.4	31.6	37.8	44.0
3	9.0	9.2	11.8	14.7	17.6	20.5
4	6.0	7.7	9.9	12.3	14.7	17.1
5	6.5	39.3	50.4	62.7	75.0	87.4
6	6.5	13.0	16.7	20.7	24.8	28.9
7	7.0	30.2	38.7	48.2	57.6	67.1
8	6.0	14.6	20.5	27.8	35.0	42.3
9	6.0	11.8	15.2	18.9	22.6	26.3
10	6.0	7.9	10.1	12.6	15.1	17.5
Total		168.0	217.3	272.7	328.0	383.5

* Proposed Collection Service Area(Unincorporated area only)
** Based on no increase in per capita rates from 1975 to 1995

TABLE 12

PROJECTED SOLID WASTE COLLECTION RATES
FOR PROPOSED COLLECTION SERVICE AREAS

PCSA*	Projected Solid Waste Collection Rates(Tons/Day)				
	1975	1980	1985	1990	1995
1	14.5	18.6	23.2	27.8	32.4
2	19.8	25.4	31.6	37.8	44.0
3	14.2	17.1	20.4	23.7	27.0
4	7.7	9.9	12.3	14.7	17.1
5	83.6	99.1	117.2	135.5	153.7
6	13.0	16.7	20.7	24.8	28.9
7	88.0	103.5	120.0	136.3	152.8
8	16.8	22.9	30.4	37.9	45.4
9	17.9	22.2	26.8	31.6	36.2
10	22.6	26.3	30.2	34.2	38.1
Total	298.1	361.7	432.8	504.3	575.6

* Proposed Collection Service Area(Includes both incorporated and unincorporated areas)

TABLE 13

PROJECTED ANNUAL AND CUMULATIVE
SOLID WASTE COLLECTION

Year	Solid Waste Collected		
	Daily (Tons/Day)	Annual (Tons/Year)	Cumulative Since 1975 (Tons)
1976	310.8	113,400	113,400
1977	323.5	118,100	231,500
1978	336.3	122,700	354,200
1979	349.0	127,400	481,600
1980	361.7	132,400	614,000
1981	375.9	137,200	751,200
1982	390.1	142,400	893,600
1983	404.4	147,600	1,041,200
1984	418.6	153,200	1,194,400
1985	432.8	158,000	1,352,400
1986	447.1	163,200	1,515,600
1987	461.4	168,400	1,684,000
1988	475.7	174,100	1,858,100
1989	490.0	178,800	2,036,900
1990	504.3	184,100	2,221,000
1991	518.6	189,300	2,410,300
1992	532.8	195,000	2,605,300
1993	547.1	199,700	2,805,000
1994	561.3	204,900	3,009,900
1995	575.6	210,100	3,220,000

disposing of approximately 3,220,000 tons of solid waste.

In order to appreciate the magnitude of the situation, the following illustration is offered. If this amount of solid waste could be placed on an acre of land (roughly equivalent to the playing area of a football field) the height of this theoretical pile would be about 4,000 feet. This is based on an average compacted density of 1,000 pounds per cubic yard, about three times the density of uncompacted solid waste.

CHAPTER V

COMPUTER MODELING

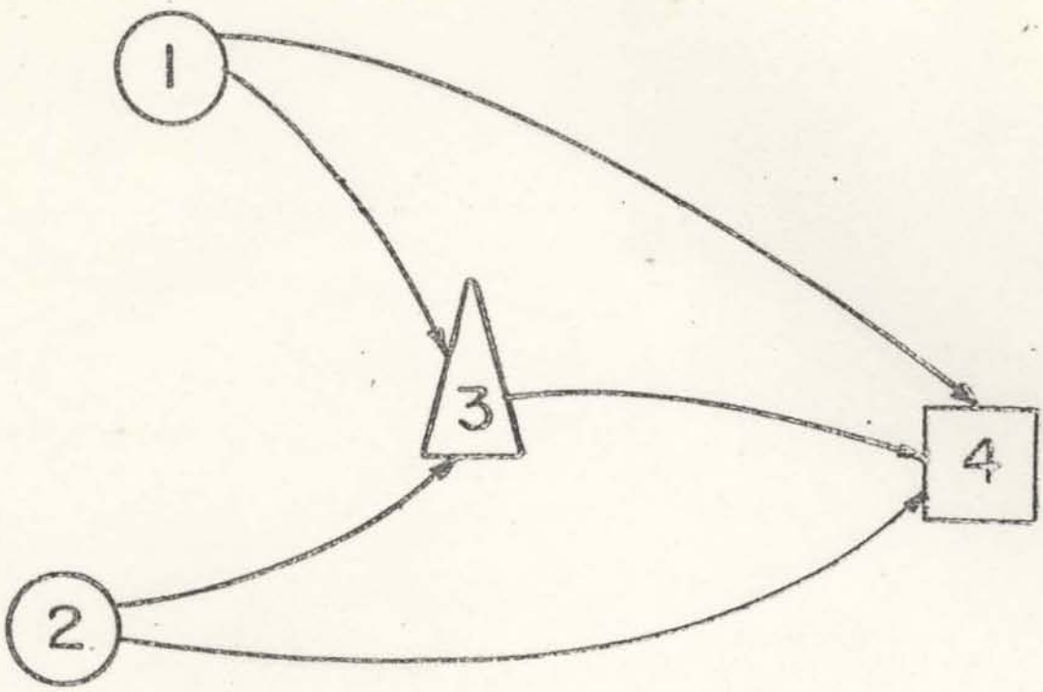
General Description

The computer model for this report uses a modified version of the "SOLWASTE" program supplied by Dr. Martin P. Wanielista, P.E., of Florida Technological University at Orlando, Florida. The program was modified to enable it to handle the rather large; complex models established for Lake County. See the appendix for data imput formats.

The model is based on minimizing cost functions which are subject to constraints. The program uses mixed integer techniques and a heuristic algorithm to determine a near optimum solution with a minimum amount of computer time.

The model includes all costs in the transportation, processing and disposal phases of a solid waste system. It excludes collection costs by defining the haul operation as beginning when the final collection pickup is made. Thus, the model used herein is a macro-model, as opposed to a micro-model which would be used for the collection phase of the system.

A simplified model is shown in Figure 11 to illustrate




Collection Area Centroid


Transfer Station


Sanitary Landfill

FIGURE II
SIMPLIFIED MODEL

the concepts involved. Nodes one and two represent the centroids of two different collection areas, while node three is a possible transfer station and node four represents a sanitary landfill. Given that areas one and two each generate a certain amount of solid waste, the problem is to find the most economical way to transport it to the disposal area, node four. Solid waste from each area may be transported in collection vehicles directly to the disposal area, or to the transfer station. Any waste received at the transfer station would then be transported in special vehicles suited for such purposes.

In this simplified model there are only five different routes, and the problem is relatively easy. As more nodes are added to the model, it becomes virtually impossible to manually analyze all possible combinations of routes in order to determine the minimum total cost of transportation, processing, and disposal. For a completely interconnected model (except between any two nodes of the same type)

$$R = [(C) \times (T+D)] + [(T) \times (D)]$$

Where R = total number of possible routes

C = number of collection area nodes

T = number of transfer station nodes

D = number of disposal (sanitary landfill) nodes

Computer Model Number 100

Computer model number 100 consists of twenty four collection area nodes, four transfer station nodes, and four sanitary landfill nodes. Table 14 identifies each of the respective model nodes, also shown in Figure 12.

Routing data for model number 100 are listed in Table 15. In order to allow for all possible combinations of routes to appear in the optimum solution, every collection area node is linked to all of the transfer station nodes and to all of the sanitary landfill nodes. In turn, each of the four transfer station nodes is linked to each sanitary landfill node. This results in a model with 208 different routes [(24 x 8) + (4 x 4) = 208].

The optimum solution to model number 100 is also shown in Figure 12. This model's optimum solution utilizes four transfer stations and three sanitary landfills. Notice that node number 32, the proposed South Lake Sanitary Landfill, does not appear in the optimum solution.

Table 16 showns the required capacity of each of the four transfer stations in model number 100 for each year through 1995. Note that the capacities are rated in terms of tons per day for an 8 hr/day, 5 days/week operation. If operations were conducted at any different length or frequency, the data in this table should be adjusted accordingly.

TABLE 14

COMPUTER MODEL NUMBER 100
NODE IDENTIFICATION

Node No.	Node Identification
1	Astatula (Incorporated Area)
2	Clermont " "
3	Eustis " "
4	Fruitland Park " "
5	Groveland " "
6	Howey-In-The-Hills " "
7	Lady Lake " "
8	Leesburg " "
9	Mascotte " "
10	Minneola " "
11	Montverde " "
12	Mount Dora " "
13	Tavares " "
14	Umatilla " "
15	PCSA No. 1 (Unincorporated Area Only)
16	PCSA No. 2 " "
17	PCSA No. 3 " "
18	PCSA No. 4 " "
19	PCSA No. 5 " "
20	PCSA No. 6 " "
21	PCSA No. 7 " "
22	PCSA No. 8 " "
23	PCSA No. 9 " "
24	PCSA No.10 " "
25	North Lake Transfer Station (Astor)
26	North-Central Lake Transfer Station (Mt. Dora)
27	Northwest Lake Transfer Station (Leesburg)
28	South Lake Transfer Station (Clermont)
29	North-Central Lake Sanitary Landfill(Sorrento)
30	Northwest Lake Sanitary Landfill (Lady Lake)
31	South-Central Lake Sanitary Landfill (Astatula)
32	South Lake Sanitary Landfill (Sugarloaf Mt.)

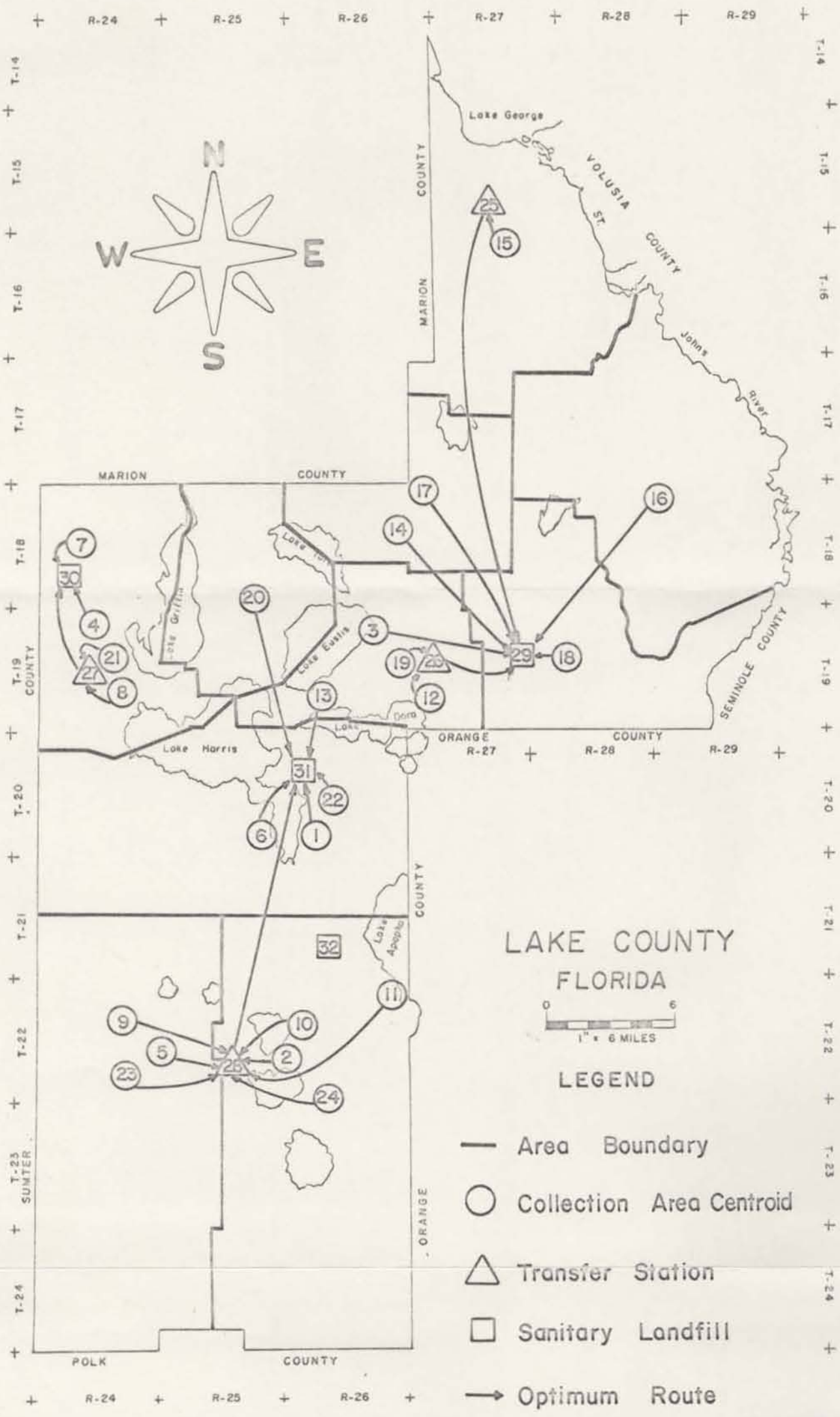


FIGURE 12
COMPUTER MODEL NUMBER 100

TABLE 15

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
1	1	25	34
2	1	26	13
3	1	27	19
4	1	28	15
5	1	29	19
6	1	30	25
7	1	31	4
8	1	32	6
9	2	25	49
10	2	26	28
11	2	27	26
12	2	28	4
13	2	29	36
14	2	30	31
15	2	31	16
16	2	32	8
17	3	25	22
18	3	26	4
19	3	27	16
20	3	28	28
21	3	29	8
22	3	30	22
23	3	31	9
24	3	32	19
25	4	25	37
26	4	26	18
27	4	27	4
28	4	28	28
29	4	29	25
30	4	30	5

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
31	4	31	17
32	4	32	23
33	5	25	47
34	5	26	26
35	5	27	23
36	5	28	4
37	5	29	32
38	5	30	29
39	5	31	19
40	5	32	12
41	6	25	34
42	6	26	13
43	6	27	15
44	6	28	17
45	6	29	19
46	6	30	21
47	6	31	8
48	6	32	9
49	7	25	43
50	7	26	23
51	7	27	8
52	7	28	32
53	7	29	30
54	7	30	2
55	7	31	21
56	7	32	27
57	8	25	37
58	8	26	15
59	8	27	2
60	8	28	25

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node to	One-Way Route Length (Miles)
61	8	29	22
62	8	30	9
63	8	31	15
64	8	32	20
65	9	25	48
66	9	26	27
67	9	27	19
68	9	28	6
69	9	29	34
70	9	30	13
71	9	31	21
72	9	32	15
73	10	25	46
74	10	26	25
75	10	27	24
76	10	28	6
77	10	29	32
78	10	30	29
79	10	31	14
80	10	32	6
81	11	25	44
82	11	26	24
83	11	27	26
84	11	28	13
85	11	29	30
86	11	30	32
87	11	31	15
88	11	32	6
89	12	25	27
90	12	26	2

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
91	12	27	19
92	12	28	29
93	12	29	8
94	12	30	25
95	12	31	12
96	12	32	22
97	13	25	27
98	13	26	3
99	13	27	13
100	13	28	24
101	13	29	13
102	13	30	19
103	13	31	5
104	13	32	14
105	14	25	16
106	14	26	10
107	14	27	20
108	14	28	35
109	14	29	14
110	14	30	26
111	14	31	16
112	14	32	24
113	15	25	3
114	15	26	27
115	15	27	37
116	15	28	53
117	15	29	31
118	15	30	43
119	15	31	33
120	15	32	41

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
121	16	25	25
122	16	26	18
123	16	27	36
124	16	28	45
125	16	29	14
126	16	30	40
127	16	31	28
128	16	32	38
129	17	25	14
130	17	26	12
131	17	27	22
132	17	28	36
133	17	29	15
134	17	30	28
135	17	31	17
136	17	32	27
137	18	25	30
138	18	26	8
139	18	27	27
140	18	28	39
141	18	29	3
142	18	30	33
143	18	31	19
144	18	32	29
145	19	25	25
146	19	26	1
147	19	27	16
148	19	28	29
149	19	29	8
150	19	30	23

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
151	19	31	9
152	19	32	19
153	20	25	26
154	20	26	12
155	20	27	10
156	20	28	29
157	20	29	15
158	20	30	16
159	20	31	11
160	20	32	21
161	21	25	36
162	21	26	17
163	21	27	1
164	21	28	27
165	21	29	24
166	21	30	7
167	21	31	16
168	21	32	26
169	22	25	33
170	22	26	12
171	22	27	18
172	22	28	16
173	22	29	18
174	22	30	24
175	22	31	2
176	22	32	8
177	23	25	49
178	23	26	29
179	23	27	24
180	23	28	6

TABLE 15-Continued

COMPUTER MODEL NUMBER 100
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
181	23	29	35
182	23	30	29
183	23	31	21
184	23	32	15
185	24	25	50
186	24	26	29
187	24	27	27
188	24	28	6
189	24	29	35
190	24	30	33
191	24	31	18
192	24	32	9
193	25	29	29
194	25	30	41
195	25	31	31
196	25	32	41
197	26	29	7
198	26	30	24
199	26	31	11
200	26	32	21
201	27	29	25
202	27	30	9
203	27	31	18
204	27	32	23
205	28	29	33
206	28	30	32
207	28	31	18
208	28	32	10

TABLE 16

COMPUTER MODEL NUMBER 100
TRANSFER STATION CAPACITY REQUIREMENTS

Year	Required Transfer Station Capacity*			
	North (Astor)	North-Central (Mt. Dora)	Northwest (Leesburg)	South (Clermont)
1975	20.3	77.3	116.2	56.7
1976	21.4	80.9	120.4	58.9
1977	22.6	84.5	124.6	61.2
1978	23.7	88.1	128.8	63.4
1979	24.9	91.7	133.0	65.7
1980	26.0	95.3	137.2	67.9
1981	27.3	99.3	141.6	70.3
1982	28.6	103.4	146.0	72.7
1983	29.9	107.4	150.5	75.0
1984	31.2	111.5	154.9	77.4
1985	32.5	115.5	159.3	79.8
1986	33.8	119.6	163.7	82.3
1987	35.1	123.6	168.1	84.7
1988	36.3	127.7	172.6	87.2
1989	37.6	131.7	177.0	89.6
1990	38.9	135.8	181.4	92.1
1991	40.2	139.9	185.8	94.5
1992	41.5	144.0	190.3	96.9
1993	42.8	148.0	194.7	99.2
1994	44.1	152.1	199.2	101.6
1995	45.4	156.2	203.6	104.0

* Tons/Day for 8 hr day, 5 day week

Acreage Requirments for each of the three sanitary landfills of model number 100 are shown in Table 17. These figures are based on the following assumptions:

1. the average density of compacted solid waste in the landfills is 800 pounds per cubic yard
2. the average height of a lift in a sanitary landfill is 10 feet, excluding any cover material
3. twenty per cent of the total land is utilized for access roads, buffer zones, utilities, sanitary facilities, sheds, and all other areas which are not actually used for burying solid wastes.

The total amount of land required for all sanitary landfills is shown in Table 18. These figures apply to both computer model number 100 and number 101.

TABLE 17

COMPUTER MODEL NUMBER 100
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	North-Central Sanitary Landfill (Sorrento)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual (Ac./Yr)	Cumulative Since 1975 (Acres)
1976	137.0	49,800	9.6	9.6
1977	142.7	52,100	10.1	19.7
1978	148.6	54,200	10.5	30.2
1979	154.3	56,400	10.9	41.1
1980	160.1	58,600	11.3	52.4
1981	166.7	60,800	11.8	64.2
1982	173.3	63,300	12.3	76.5
1983	180.1	65,700	12.8	89.3
1984	186.7	68,300	13.2	102.5
1985	193.3	70,600	13.7	116.2
1986	199.9	73,000	14.1	130.3
1987	206.6	75,400	14.6	144.9
1988	213.3	78,100	15.1	160.0
1989	220.0	80,300	15.5	175.5
1990	226.6	82,800	16.1	191.6
1991	233.3	85,100	16.5	208.1
1992	239.9	87,800	17.1	225.2
1993	246.6	90,000	17.5	242.7
1994	253.2	92,400	17.9	260.6
1995	259.9	94,800	18.4	279.0

TABLE 17-Continued

COMPUTER MODEL NUMBER 100
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	Northwest Sanitary Landfill (Lady Lake)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual Ac./Yr)	Cumulative Since 1975 (Acres)
1976	91.1	33,300	6.5	6.5
1977	94.2	34,400	6.7	13.2
1978	97.3	35,500	6.9	20.1
1979	100.4	36,600	7.1	27.2
1980	103.5	37,900	7.3	34.5
1981	106.8	39,000	7.6	42.1
1982	110.1	40,200	7.8	49.9
1983	113.4	41,400	8.0	57.9
1984	116.7	42,700	8.3	66.2
1985	120.0	43,800	8.5	74.7
1986	123.3	45,000	8.7	83.4
1987	126.5	46,200	8.9	92.3
1988	129.8	47,500	9.2	101.5
1989	133.0	48,500	9.4	110.9
1990	136.3	49,700	9.6	120.5
1991	139.6	51,000	9.9	130.4
1992	142.9	52,300	10.1	140.5
1993	146.2	53,400	10.3	150.8
1994	149.5	54,600	10.6	161.4
1995	152.8	55,800	10.8	172.2

TABLE 17-Continued

COMPUTER MODEL NUMBER 100
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	South-Central Sanitary Landfill (Astatula)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual (Ac./Yr)	Cumulative Since 1975 (Acres)
1976	82.7	30,300	5.9	5.9
1977	86.6	31,600	6.1	12.0
1978	90.4	33,000	6.4	18.4
1979	94.3	34,400	6.7	25.1
1980	98.1	35,900	7.0	32.1
1981	102.4	37,400	7.2	39.3
1982	106.7	38,900	7.5	46.8
1983	110.9	40,500	7.8	54.6
1984	115.2	42,200	8.2	62.8
1985	119.5	43,600	8.4	71.2
1986	123.9	45,200	8.8	80.0
1987	128.3	46,800	9.1	89.1
1988	132.6	48,500	9.4	98.5
1989	137.0	50,000	9.7	108.2
1990	141.4	51,600	10.0	118.2
1991	145.7	53,200	10.3	128.5
1992	150.0	54,900	10.6	139.1
1993	154.3	56,300	10.9	150.0
1994	158.6	57,900	11.2	161.2
1995	162.9	59,500	11.5	172.7

TABLE 18

LAND REQUIRED FOR SOLID WASTE DISPOSAL
AT SANITARY LANDFILLS

Year	Land Required	
	Annual (Acres/Year)	Cumulative Since 1975 (Acres)
1976	22.0	22.0
1977	22.9	44.9
1978	23.8	68.7
1979	24.7	93.4
1980	25.6	119.0
1981	26.6	145.6
1982	27.6	173.2
1983	28.6	201.8
1984	29.7	231.5
1985	30.6	262.1
1986	31.6	293.7
1987	32.6	326.3
1988	33.7	360.0
1989	34.6	394.6
1990	35.7	430.3
1991	36.7	467.0
1992	37.8	504.8
1993	38.7	543.5
1994	39.7	583.2
1995	40.7	623.9

Computer Model Number 101

Computer model number 101 contains the same number of nodes and routes as model number 100. One transfer station node and one sanitary landfill node were relocated to determine the sensitivity of the model to such a change. Figure 13 shows the location of all nodes used in this model, and Table 19 identifies each of the model's nodes. The route data for model number 101 are shown in Table 20.

Figure 13 also shows the optimum solution to model number 101. This model's optimum solution utilizes three transfer stations and four sanitary landfills. Note that node number 26, the Northeast Lake Transfer Station, does not appear in model number 101's optimum solution.

Table 21 shows the capacity requirements for the three transfer stations, rated for operating at 8 hr/day, 5 days/week. The sizes for these three stations are exactly the same as their sizes in the previous model (number 100). The only difference is the omission of the North-Central Transfer Station near Mt. Dora, which was not included in model number 101.

Land requirements for the four sanitary landfills are shown in Table 22. The acreage requirements for the South-Central (Astatula) and the Northwest (Lady Lake) Sanitary Landfills are the same in both computer models. In model

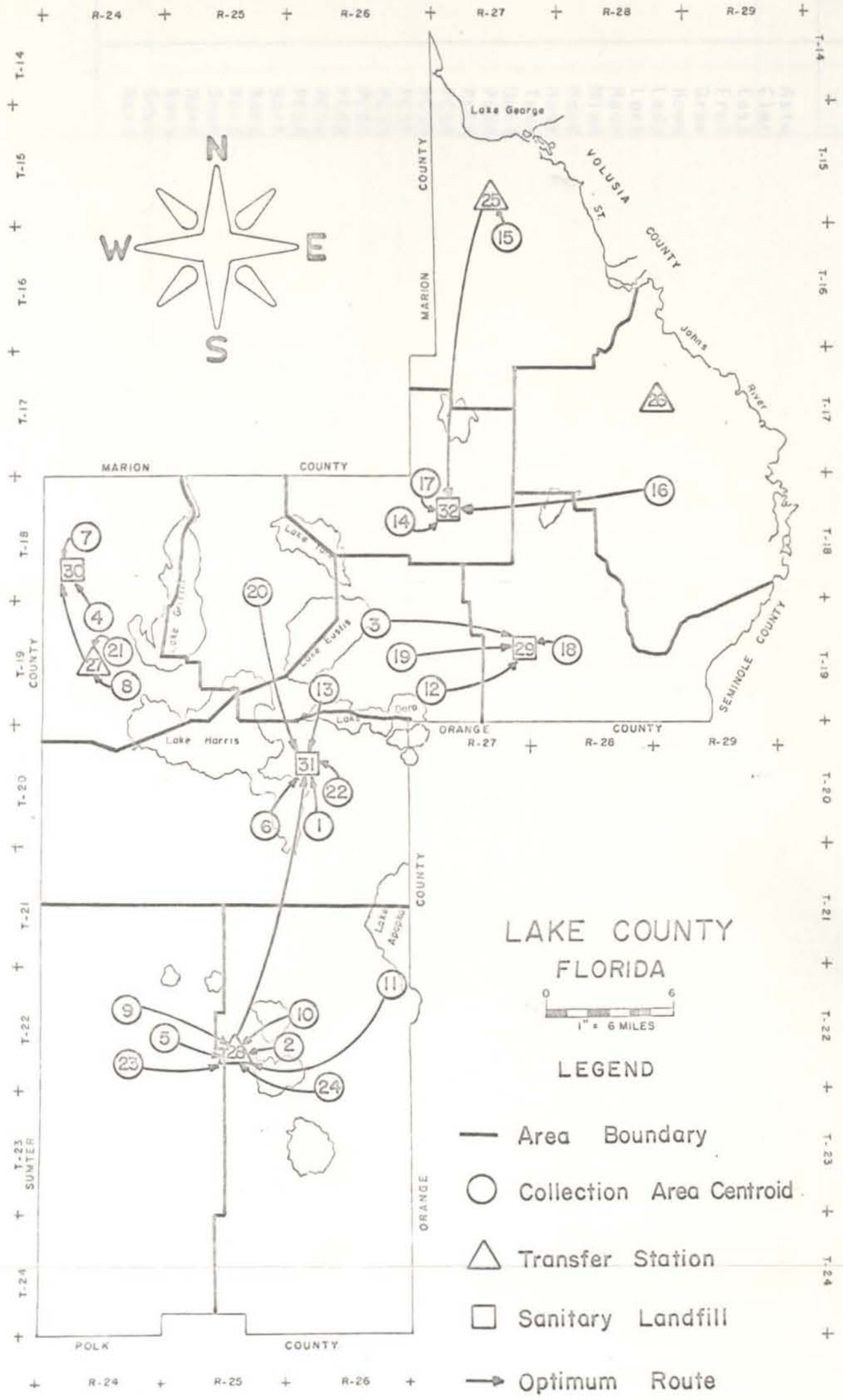


FIGURE 13
COMPUTER MODEL NUMBER 101

TABLE 19

COMPUTER MODEL NUMBER 101
NODE IDENTIFICATION

Node No.	Node Identification
1	Astatula (Incorporated Area)
2	Clermont " "
3	Eustis " "
4	Fruitland Park " "
5	Groveland " "
6	Howey-In-The-Hills " "
7	Lady Lake " "
8	Leesburg " "
9	Mascotte " "
10	Minneola " "
11	Montverde " "
12	Mount Dora " "
13	Tavares " "
14	Umatilla " "
15	PCSA No. 1 (Unincorporated Area Only)
16	PCSA No. 2 " "
17	PCSA No. 3 " "
18	PCSA No. 4 " "
19	PCSA No. 5 " "
20	PCSA No. 6 " "
21	PCSA No. 7 " "
22	PCSA No. 8 " "
23	PCSA No. 9 " "
24	PCSA No.10 " "
25	North Lake Transfer Station (Astor)
26	Northeast Lake Transfer Station (Paisley)
27	Northwest Lake Transfer Station (Leesburg)
28	South Lake Transfer Station (Clermont)
29	North Central Lake Sanitary Landfill(Sorrento)
30	Northwest Lake Sanitary Landfill (Lady Lake)
31	South-Central Lake Sanitary Landfill (Astatula)
32	North Lake Sanitary Landfill (Umatilla)

TABLE 20

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
1	1	25	34
2	1	26	35
3	1	27	19
4	1	28	15
5	1	29	19
6	1	30	25
7	1	31	4
8	1	32	21
9	2	25	49
10	2	26	47
11	2	27	26
12	2	28	4
13	2	29	36
14	2	30	31
15	2	31	16
16	2	32	33
17	3	25	22
18	3	26	22
19	3	27	16
20	3	28	28
21	3	29	8
22	3	30	22
23	3	31	9
24	3	32	8
25	4	25	37
26	4	26	40
27	4	27	4
28	4	28	28
29	4	29	25
30	4	30	5

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
31	4	31	17
32	4	32	25
33	5	25	47
34	5	26	47
35	5	27	23
36	5	28	4
37	5	29	32
38	5	30	29
39	5	31	19
40	5	32	33
41	6	25	34
42	6	26	35
43	6	27	15
44	6	28	17
45	6	29	19
46	6	30	21
47	6	31	8
48	6	32	21
49	7	25	43
50	7	26	44
51	7	27	8
52	7	28	32
53	7	29	30
54	7	30	2
55	7	31	21
56	7	32	30
57	8	25	37
58	8	26	37
59	8	27	2
60	8	28	25

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
61	8	29	22
62	8	30	9
63	8	31	15
64	8	32	20
65	9	25	48
66	9	26	49
67	9	27	19
68	9	28	6
69	9	29	34
70	9	30	13
71	9	31	21
72	9	32	35
73	10	25	46
74	10	26	47
75	10	27	24
76	10	28	6
77	10	29	32
78	10	30	29
79	10	31	14
80	10	32	32
81	11	25	44
82	11	26	47
83	11	27	26
84	11	28	13
85	11	29	30
86	11	30	32
87	11	31	15
88	11	32	33
89	12	25	27
90	12	26	25

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
91	12	27	19
92	12	28	29
93	12	29	8
94	12	30	25
95	12	31	12
96	12	32	15
97	13	25	27
98	13	26	28
99	13	27	13
100	13	28	24
101	13	29	13
102	13	30	19
103	13	31	5
104	13	32	14
105	14	25	16
106	14	26	16
107	14	27	20
108	14	28	35
109	14	29	14
110	14	30	26
111	14	31	16
112	14	32	2
113	15	25	3
114	15	26	28
115	15	27	37
116	15	28	53
117	15	29	31
118	15	30	43
119	15	31	33
120	15	32	18

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
121	16	25	25
122	16	26	6
123	16	27	36
124	16	28	45
125	16	29	14
126	16	30	40
127	16	31	28
128	16	32	12
129	17	25	14
130	17	26	14
131	17	27	22
132	17	28	36
133	17	29	15
134	17	30	28
135	17	31	17
136	17	32	1
137	18	25	30
138	18	26	17
139	18	27	27
140	18	28	39
141	18	29	3
142	18	30	33
143	18	31	19
144	18	32	15
145	19	25	25
146	19	26	23
147	19	27	16
148	19	28	29
149	19	29	8
150	19	30	23

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
151	19	31	9
152	19	32	10
153	20	25	26
154	20	26	25
155	20	27	10
156	20	28	29
157	20	29	15
158	20	30	16
159	20	31	11
160	20	32	12
161	21	25	36
162	21	26	35
163	21	27	1
164	21	28	27
165	21	29	24
166	21	30	7
167	21	31	16
168	21	32	23
169	22	25	33
170	22	26	34
171	22	27	18
172	22	28	16
173	22	29	18
174	22	30	24
175	22	31	2
176	22	32	19
177	23	25	49
178	23	26	49
179	23	27	24
180	23	28	6

TABLE 20-Continued

COMPUTER MODEL NUMBER 101
ROUTE DATA

Route No.	Node From	Node To	One-Way Route Length (Miles)
181	23	29	35
182	23	30	29
183	23	31	21
184	23	32	37
185	24	25	50
186	24	26	51
187	24	27	27
188	24	28	6
189	24	29	35
190	24	30	33
191	24	31	18
192	24	32	35
193	25	29	29
194	25	30	41
195	25	31	31
196	25	32	16
197	26	29	23
198	26	30	45
199	26	31	32
200	26	32	14
201	27	29	25
202	27	30	9
203	27	31	18
204	27	32	24
205	28	29	33
206	28	30	32
207	28	31	18
208	28	32	37

TABLE 21

COMPUTER MODEL NUMBER 101
TRANSFER STATION CAPACITY REQUIREMENTS

Year	Required Transfer Station Capacity		
	North (Astor)	Northwest (Leesburg)	South (Clermont)
1975	20.3	116.2	56.7
1976	21.4	120.4	58.9
1977	22.6	124.6	61.2
1978	23.7	128.8	63.4
1979	24.9	133.0	65.7
1980	26.0	137.2	67.9
1981	27.3	141.6	70.3
1982	28.6	146.0	72.7
1983	29.9	150.5	75.0
1984	31.2	154.9	77.4
1985	32.5	159.3	79.8
1986	33.8	163.7	82.3
1987	35.1	168.1	84.7
1988	36.3	172.6	87.2
1989	37.6	177.0	89.6
1990	38.9	181.4	92.1
1991	40.2	185.8	94.5
1992	41.5	190.3	96.9
1993	42.8	194.7	99.2
1994	44.1	199.2	101.6
1995	45.4	203.6	104.0

* Tons/Day for 8 hr day, 5 day week

TABLE 22

COMPUTER MODEL NUMBER 101
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	North-Central Sanitary Landfill (Sorrento)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual (Ac./Yr)	Cumulative Since 1975 (Acres)
1976	86.0	31,100	6.0	6.0
1977	89.2	32,600	6.3	12.3
1978	92.5	33,700	6.5	18.8
1979	95.7	35,000	6.8	25.6
1980	99.0	36,200	7.0	32.6
1981	102.3	37,500	7.3	39.9
1982	106.6	39,000	7.6	47.5
1983	110.5	40,300	7.9	55.4
1984	114.3	41,800	8.1	63.5
1985	118.1	43,200	8.4	71.9
1986	121.9	44,500	8.6	80.5
1987	125.8	45,900	8.9	89.4
1988	129.6	47,500	9.2	98.6
1989	133.5	48,700	9.4	108.0
1990	137.3	50,200	9.8	117.8
1991	141.2	51,500	10.0	127.8
1992	145.0	53,100	10.4	138.2
1993	148.8	54,300	10.6	148.8
1994	152.6	55,700	10.8	159.6
1995	156.5	57,100	11.1	170.7

TABLE 22-Continued

COMPUTER MODEL NUMBER 101
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	Northwest Sanitary Landfill (Lady Lake)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual Ac./Yr)	Cumulative Since 1975 (Acres)
1976	91.1	33,300	6.5	6.5
1977	94.2	34,400	6.7	13.2
1978	97.3	35,500	6.9	20.1
1979	100.4	36,600	7.1	27.2
1980	103.5	37,900	7.3	34.5
1981	106.8	39,000	7.6	42.1
1982	110.1	40,200	7.8	49.9
1983	113.4	41,400	8.0	57.9
1984	116.7	42,700	8.3	66.2
1985	120.0	43,800	8.5	74.7
1986	123.3	45,000	8.7	83.4
1987	126.5	46,200	8.9	92.3
1988	129.8	47,500	9.2	101.5
1989	133.0	48,500	9.4	110.9
1990	136.3	49,700	9.6	120.5
1991	139.6	51,000	9.9	130.4
1992	142.9	52,300	10.1	140.5
1993	146.2	53,400	10.3	150.8
1994	149.5	54,600	10.6	161.4
1995	152.8	55,800	10.8	172.2

TABLE 22-Continued

COMPUTER MODEL NUMBER 101
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	South-Central Sanitary Landfill (Astatula)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual (Ac./Yr)	Cumulative Since 1975 (Acres)
1976	82.7	30,300	5.9	5.9
1977	86.6	31,600	6.1	12.0
1978	90.4	33,000	6.4	18.4
1979	94.3	34,400	6.7	25.1
1980	98.1	35,900	7.0	32.1
1981	102.4	37,400	7.2	39.3
1982	106.7	38.900	7.5	46.8
1983	110.9	40,500	7.8	54.6
1984	115.2	42,200	8.2	62.8
1985	119.5	43,600	8.4	71.2
1986	123.9	45,200	8.8	80.0
1987	128.3	46,800	9.1	89.1
1988	132.6	48,500	9.4	98.5
1989	137.0	50,000	9.7	108.2
1990	141.4	51,600	10.0	118.2
1991	145.7	53,200	10.3	128.5
1992	150.0	54,900	10.6	139.1
1993	154.3	56,300	10.9	150.0
1994	158.6	57,900	11.2	161.2
1995	162.9	59,500	11.5	172.7

TABLE 22-Continued

COMPUTER MODEL NUMBER 101
SANITARY LANDFILL ACREAGE REQUIREMENTS

Year	North Sanitary Landfill (Umatilla)			
	Solid Waste Received		Acreage Required	
	Daily (Tons/Day)	Annual (Tons/Yr)	Annual (Ac./Yr)	Cumulative Since 1975 (Acres)
1976	51.0	18,700	3.6	3.6
1977	53.5	19,500	3.8	7.4
1978	56.1	20,500	4.0	11.4
1979	58.6	21,400	4.1	15.5
1980	61.1	22,400	4.3	19.8
1981	63.9	23,300	4.5	24.3
1982	66.7	24,300	4.7	29.0
1983	69.6	25,400	4.9	33.9
1984	72.4	26,500	5.1	39.0
1985	75.2	27,400	5.3	44.3
1986	78.0	28,500	5.5	49.8
1987	80.8	29,500	5.7	55.5
1988	83.7	30,600	5.9	61.4
1989	86.5	31,600	6.1	67.5
1990	89.3	32,600	6.3	73.8
1991	92.1	33,600	6.5	80.3
1992	94.9	34,700	6.7	87.0
1993	97.8	35,700	6.9	93.9
1994	100.6	36,700	7.1	101.0
1995	103.4	37,700	7.3	108.3

number 101 the North Lake (Umatilla) Sanitary Landfill receives a portion of the solid waste which was disposed of at the North-Central (Sorrento) Sanitary Landfill in model number 100. As previously noted, Table 18 shows the total amount of land required at all sanitary landfills through 1995.

CHAPTER VI

SYSTEM COSTS

The purpose of this chapter is to provide a cost estimate for implementing and operating a solid waste management system. Two systems, corresponding to the optimum solutions to the computer models, will be evaluated and compared.

Initial Capital Costs

Computer Model Number 100

Transfer Stations

This system requires four transfer stations in the following areas: Astor, Mount Dora, Leesburg, and Clermont. The estimated initial capital costs for these stations are shown in Tables 23 through 26, respectively. Based on current prices, the total initial capital outlay for all four transfer stations would be $571,000.

Transfer Haul

The transfer haul operation requires compactor trailers and tractors to transport solid waste from the transfer stations to the sanitary landfills. Based on estimated volumes of solid waste collection, two 65 cubic

TABLE 23

ASTOR TRANSFER STATION
ESTIMATED CAPITAL COST

BASIS: Provide initially a 50 ton/8 hr day transfer station with no expansion capability.

Item	Estimated Cost
Building (30' x 30')	$13,500
Transfer Equipment (None)	0
Sitework	25,000
Land (5 acres)	10,000
Miscellaneous	4,500
TOTAL CAPITAL COST	$53,000

TABLE 24

MOUNT DORA TRANSFER STATION
ESTIMATED CAPITAL COST

BASIS: Provide initially a 100 ton/8 hr day transfer station with expansion capability for a total capacity of 200 ton/8 hr day by 1994.

Item	Estimated Cost
Building (50' x 60')	$ 60,000
Transfer Equipment	
1 stationary compactor with hopper	25,000
Sitework	50,000
Land (5 acres)	10,000
Miscellaneous	15,000
TOTAL CAPITAL COST	$160,000

TABLE 25

LEESBURG TRANSFER STATION
ESTIMATED CAPITAL COST

BASIS: Provide initially a 150 ton/8 hr day transfer station with expansion capability for a total capacity of 250 ton/8 hr day by 1995.

Item	Estimated Cost
Building (50' x 80')	$ 80,000
Transfer Equipment	
1 stationary compactor with hopper	25,000
Sitework	75,000
Land (5 acres)	10,000
Miscellaneous	20,000
TOTAL CAPITAL COST	$210,000

TABLE 26

CLERMONT TRANSFER STATION
ESTIMATED CAPITAL COST

BASIS: Provide initially a 100 ton/8 hr day transfer station with expansion capability for a total capacity of 150 ton/8 hr day by 1994.

Item	Estimated Cost
Building (40' x 60')	$ 48,000
Transfer Equipment	
1 stationary compactor with hopper	25,000
Sitework	50,000
Land (5 acres)	10,000
Miscellaneous	15,000
TOTAL CAPITAL COST	$148,000

yard compactor trailers would be required initially for each of the four transfer stations. One tractor each would be needed for the Astor and Mount Dora stations, and two tractors each for the Leesburg and Clermont stations, for a total initial requirement of six tractors. With current prices, $24,000 per trailer and $27,000 per tractor, the initial capital outlay for the transfer haul operation would be $354,000.

According to projections of solid waste collection rates, future requirements for the transfer haul operation are:

Year	Event	Estimated Capital Cost
1982	Add one tractor at Mount Dora	$27,000
1994	Add one trailer at Clermont	24,000
1995	Add one trailer at Leesburg	24,000

Thus, by 1995 the total transfer haul fleet would consist of ten trailers and seven tractors.

Sanitary Landfills

There are three sanitary landfills proposed in this system in the following areas: Sorrento, Lady Lake, and Astatula. The initial capital requirements for these three landfills are shown in Tables 27 through 29 respectively. The sites are each sized to handle solid waste through 1995. The total initial capital requirements for all three sanitary landfills is $2,083,000. In 1983 a 955 Caterpiller

TABLE 27

SORRENTO SANITARY LANDFILL
ESTIMATED CAPITAL COST

BASIS: A. COMPUTER MODEL NUMBER 100: Provide a 280 acre sanitary landfill to initially handle 137 TPD with a 1995 rate of 260 TPD.

B. COMPUTER MODEL NUMBER 101: Provide a 175 acre sanitary landfill to initially handle 86 TPD with a 1995 rate of 157 TPD.

Item	Estimated Cost	
	Basis A	Basis B
Equipment		
1 977 Cat. Crawler Loader	$ 80,000	$ 80,000
1 Pickup Truck	4,000	4,000
Building, roads, wells, fencing, etc.	125,000	75,000
Sitework	56,000	35,000
Land	550,000	350,000
Miscellaneous	80,000	50,000
TOTAL CAPITAL COST	$895,000	$594,000

TABLE 28

LADY LAKE SANITARY LANDFILL
ESTIMATED CAPITAL COST

BASIS: Provide a 175 acre sanitary landfill to initially handle 91 TPD with a 1995 rate of 153 TPD.

Item	Estimated Cost
Equipment	
1 977 Cat. Crawler Loader	$ 80,000
1 pickup Truck	4,000
Building, roads, wells, fencing, etc.	75,000
Sitework	35,000
Land (175 acres)	350,000
Miscellaneous	50,000
TOTAL CAPITAL COST	$594,000

TABLE 29

ASTATULA SANITARY LANDFILL

ESTIMATED CAPITAL COST

BASIS: Provide a 175 acre sanitary landfill to initially handle 83 TPD with a 1995 rate of 163 TPD.

Item	Estimated Cost
Equipment	
1 977 Cat. Crawler Loader	$ 80,000
1 pickup Truck	4,000
Building, roads, wells, fencing, etc.	75,000
Sitework	35,000
Land (175 acres)	350,000
Miscellaneous	50,000
TOTAL CAPITAL COST	$594,000

TABLE 30

UMATILLA SANITARY LANDFILL
ESTIMATED CAPITAL COST

BASIS: Provide a 110 acre sanitary landfill to initially handle 51 TPD with a 1995 rate of 103 TPD.

Item	Estimated Cost
Equipment	
1 955 Cat. Crawler Loader	$50,000
1 Pickup Truck	4,000
Building, roads, wells, fencing, etc.	50,000
Sitework	25,000
Land (110 acres)	200,000
Miscellaneous	30,000
TOTAL CAPITAL COST	$359,000

Crawler Loader, or its equivalent, costing about $50,000, should be added at the Sorrento Sanitary Landfill to handle the increased solid waste load.

Computer Model Number 101

Transfer Stations

Three transfer stations are required for this system, located in the following areas: Astor, Leesburg, Clermont. These stations are the same as their counterparts for Model Number 100, due to similarities in the optimum solutions of both models. The only difference is the absence of the Mount Dora Transfer Station in Model Number 101. Tables 23, 25, and 26 show the estimated capital costs for each station, which total $411,000.

Transfer Haul

In this model one trailer and one tractor would be required for the Astor Transfer Station. The Leesburg and Clermont Transfer Stations would each require two trailers and two tractors. The initial transfer haul fleet would thus consist of five trailers and five tractors, at a total cost of $255,000.

Projections indicate that one trailer should be added to the Clermont Station in 1994 and one trailer to the Leesburg Station in 1995. The transfer haul fleet in 1995 would then consist of seven trailers and five tractors.

Sanitary Landfills

Four sanitary landfills appear in the optimum solution to Computer Model Number 101: Sorrento, Lady Lake, Astatula, and Umatilla. Their estimated initial capital requirements are shown in Tables 27 through 30, respectively. The total for all four sanitary landfills is $2,807,000.

Operating, Replacement, and Maintenance Costs

Computer Model Number 100

Transfer Stations

Table 31 shows operating costs for three different sizes of transfer stations. This data serves as the basis for Figure 14, which shows how annual operating costs for transfer stations vary with the amount of solid waste handled. Figure 14, in turn, provides the basis for Table 32, which projects the annual operating costs for each transfer station in the system through 1995.

Replacement costs are based on straightline depreciation with no residual values. The buildings are depreciated over a 15 year span, and equipment over a 10 year period. Annual depreciation costs, when added to the operating costs, provide the annual operating, replacement, and maintenance (ORM) costs. Table 33 shows the projected total ORM costs for the transfer stations in this system.

TABLE 31

ESTIMATED OPERATING COSTS FOR
TRANSFER STATIONS

Item	Capacity (Tons/day)		
	50	100	200
Personnel			
Supervisors	0	0	1
Operators	1	1	1
Annual Cost of Salaries and Wages	$ 9,000	$ 9,000	$20,000
Annual Cost of Fringe Benefits, Holidays, Vacation, Overtime, etc.	2,200	2,200	5,000
Annual Cost of Utilities, Insurance, Accounting	4,000	7,500	15,000
Annual Cost of Maintenance, Supplies, and Repairs	1,200	2,500	5,000
Total Annual Operating Costs	$16,400	$21,200	$45,000
Cost per Ton	$1.26	$0.82	$0.87

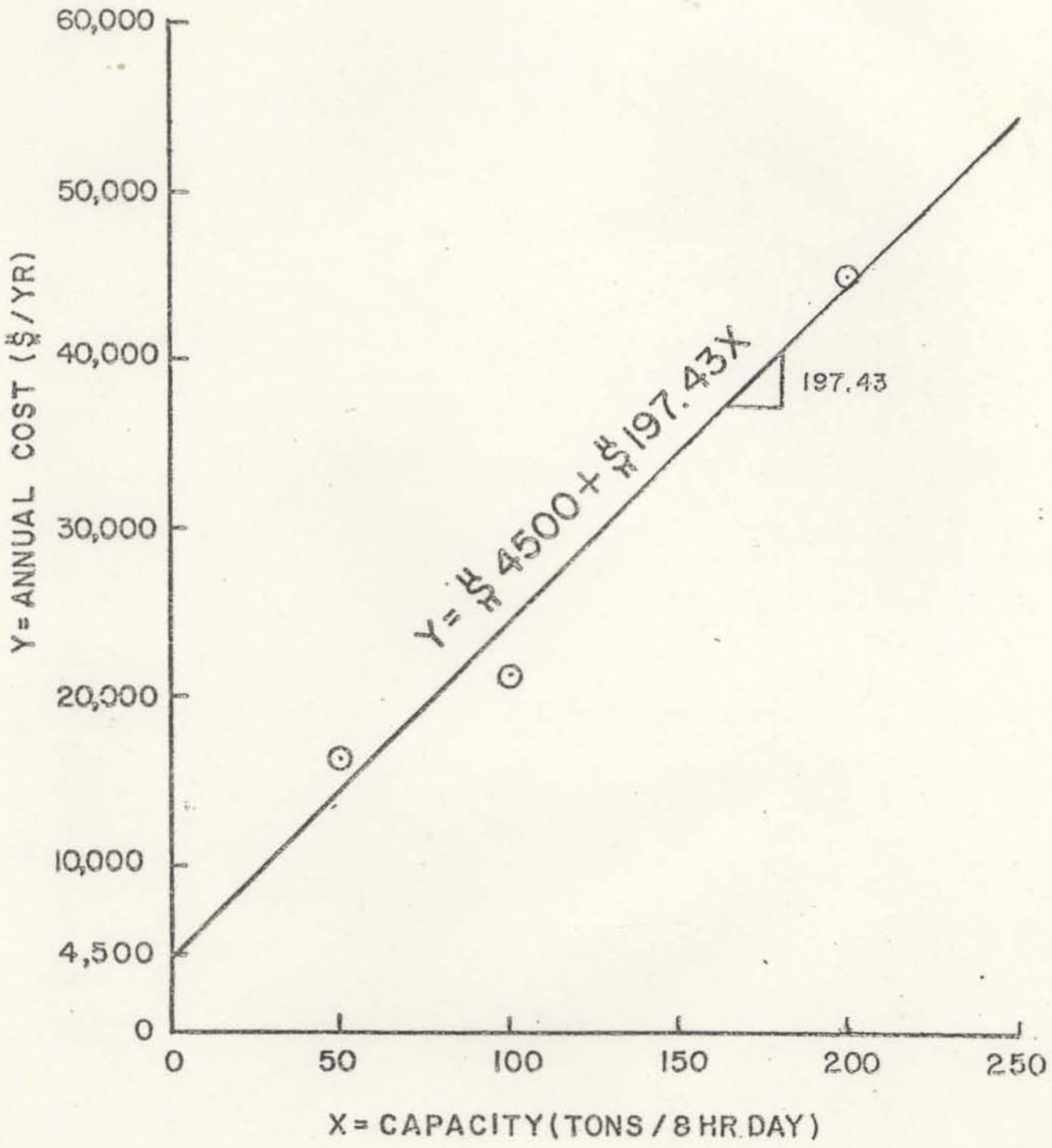


FIGURE 14

ANNUAL OPERATING COST FUNCTION

FOR TRANSFER STATIONS

TABLE 32

COMPUTER MODEL NUMBER 100
PROJECTION OF ANNUAL OPERATING COSTS
FOR TRANSFER STATIONS

Fiscal Year	Astor	Mount Dora	Leesburg	Clermont	Total
1975-1976	$ 8,500	$19,800	$27,400	$15,700	$ 71,400
1976-1977	8,700	20,500	28,300	16,100	73,600
1977-1978	9,000	21,200	29,100	16,600	75,900
1978-1979	9,200	21,900	29,900	17,000	78,000
1979-1980	9,400	22,600	30,800	17,500	80,300
1980-1981	9,600	23,300	31,600	17,900	82,400
1981-1982	9,900	24,100	32,500	18,400	84,900
1982-1983	10,100	24,900	33,300	18,900	87,200
1983-1984	10,400	25,700	34,200	19,300	89,600
1984-1985	10,700	26,500	35,100	19,800	92,100
1985-1986	10,900	27,300	36,000	20,300	94,500
1986-1987	11,200	28,100	36,800	20,700	96,800
1987-1988	11,400	28,900	37,700	21,200	99,200
1988-1989	11,700	29,700	38,600	21,700	101,700
1989-1990	11,900	30,500	39,400	22,200	104,000
1990-1991	12,200	31,300	40,300	22,700	106,500
1991-1992	12,400	32,100	41,200	23,200	108,900
1992-1993	12,700	32,900	42,100	23,600	111,300
1993-1994	13,000	33,700	42,900	24,100	113,700
1994-1995	13,200	34,500	43,800	24,600	116,100

TABLE 33

COMPUTER MODEL NUMBER 100
PROJECTION OF ANNUAL ORM COSTS
FOR TRANSFER STATIONS

FISCAL YEAR	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	$20,900	$ 71,400	$ 92,300
1976-1977	20,900	73,600	94,500
1977-1978	20,900	75,900	96,800
1978-1979	20,900	78,000	98,900
1979-1980	20,900	80,300	101,200
1980-1981	20,900	82,400	103,300
1981-1982	20,900	84,900	105,800
1982-1983	20,900	87,200	108,100
1983-1984	20,900	89,600	110,500
1984-1985	20,900	92,100	113,000
1985-1986	20,900	94,500	115,400
1986-1987	20,900	96,800	117,700
1987-1988	20,900	99,200	120,100
1988-1989	20,900	101,700	122,600
1989-1990	20,900	104,000	124,900
1990-1991	20,900	106,500	127,400
1991-1992	20,900	108,900	129,800
1992-1993	20,900	111,300	132,200
1993-1994	20,900	113,700	134,600
1994-1995	20,900	116,100	137,000

Transfer Haul

The projected annual ORM costs for the transfer haul operation are given in Table 34. They are based on straight line depreciation of the equipment: $4,200/year per trailer and $4,500/year for each tractor. The annual operating costs are based on $3,000/year for each trailer and $7,000/year for each tractor.

Sanitary Landfills

Table 35 shows how operating costs for sanitary landfills vary with the size of the landfills. This data is reflected in Figure 15 which shows how annual operating costs vary with the amount of solid waste handled at the landfill.

Table 36 shows the projected annual operating costs for the three landfills in this system, based on the graph in Figure 15. Depreciation costs are based on straight line depreciation with no residual value; five years are used for equipment and twenty years for all other items. The total annual ORM costs for the sanitary landfills are shown in Table 37.

Computer Model Number 101

Transfer Stations

The projected annual operating costs for transfer stations, based on Figure 14, are shown in Table 38. Note that the cost for each station is the same as in Model

TABLE 34

COMPUTER MODEL NUMBER 100
PROJECTION OF ANNUAL ORM COSTS
TRANSFER HAUL OPERATION

FISCAL YEAR	NUMBER OF TRAILERS/TRACTORS	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	8 / 6	$61,000	$66,000	$127,000
1976-1977	8 / 6	61,000	66,000	127,000
1977-1978	8 / 6	61,000	66,000	127,000
1978-1979	8 / 6	61,000	66,000	127,000
1979-1980	8 / 6	61,000	66,000	127,000
1980-1981	8 / 6	61,000	66,000	127,000
1981-1982	8 / 6	61,000	66,000	127,000
1982-1983	8 / 7	65,000	73,000	138,000
1983-1984	8 / 7	65,000	73,000	138,000
1984-1985	8 / 7	65,000	73,000	138,000
1985-1986	8 / 7	65,000	73,000	138,000
1986-1987	8 / 7	65,000	73,000	138,000
1987-1988	8 / 7	65,000	73,000	138,000
1988-1989	8 / 7	65,000	73,000	138,000
1989-1990	8 / 7	65,000	73,000	138,000
1990-1991	8 / 7	65,000	73,000	138,000
1991-1992	8 / 7	65,000	73,000	138,000
1992-1993	8 / 7	65,000	73,000	138,000
1993-1994	9 / 7	69,000	76,000	145,000
1994-1995	10 / 7	74,000	79,000	153,000

TABLE 35

ESTIMATED OPERATING COSTS FOR
SANITARY LANDFILLS

Item	Capacity (Tons/day)		
	50	100	200
Personnel			
Foreman	0	0	1
Operators	0	0	2
Attendants	1	1	1
Annual Cost of Salaries and Wages	$ 9,000	$20,000	$43,000
Annual Cost of Fringe Benefits, Holidays, Vacation, Overtime, etc.	2,000	5,000	10,800
Annual Cost of Utilities, Insurance, Accounting, Supplies	2,000	3,500	6,000
Annual Equipment Operating Costs	12,000	22,000	40,000
Total Annual Operating Cost	$25,200	$50,500	$99,800
Cost per Ton	$1.38	$1.38	$1.37

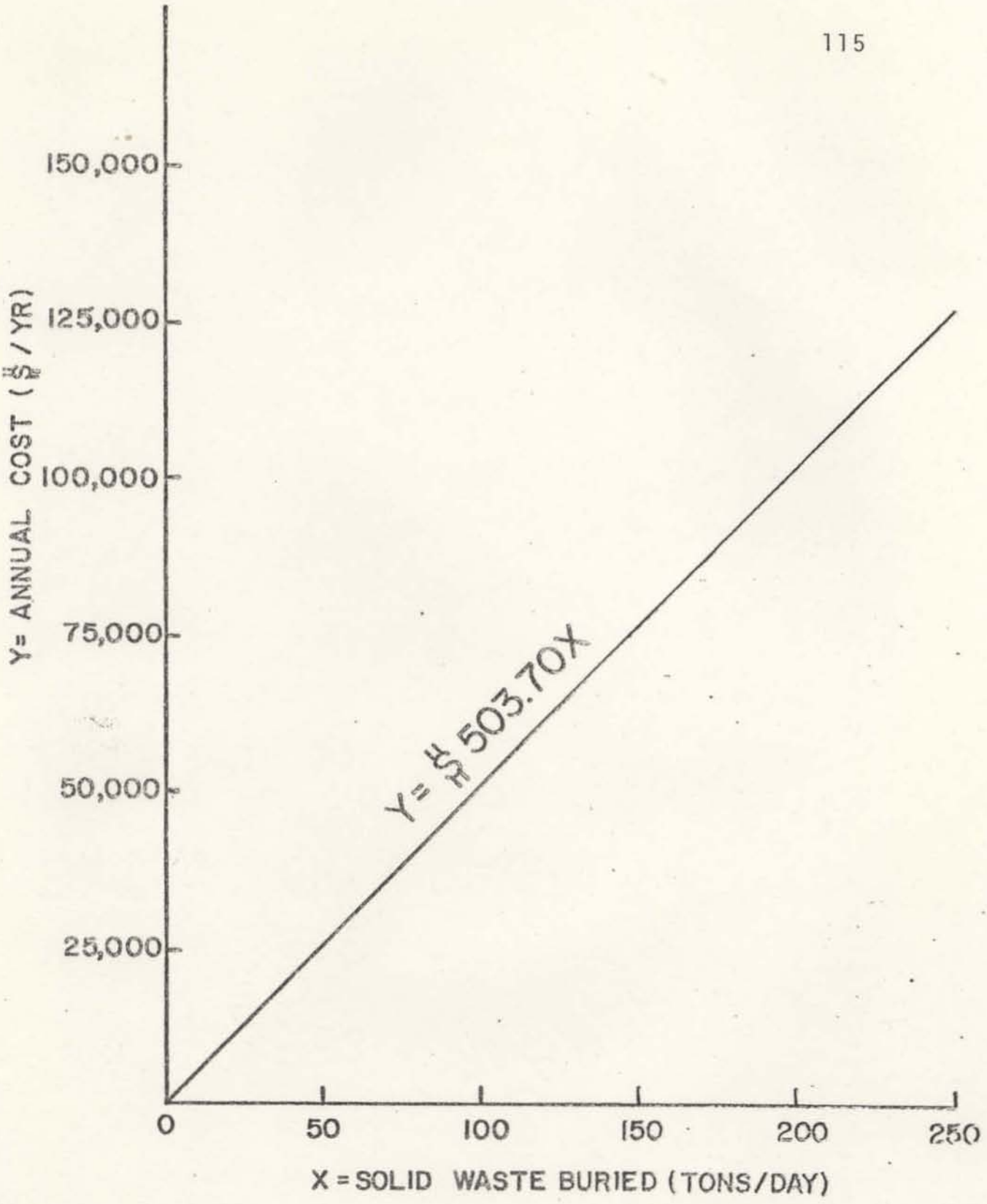


FIGURE 15

ANNUAL OPERATING COST FUNCTION
FOR SANITARY LANDFILLS

TABLE 36

COMPUTER MODEL NUMBER 100
PROJECTION OF ANNUAL OPERATING COSTS
FOR SANITARY LANDFILLS

Fiscal Year	Sorrento	Lady Lake	Astatula	Total
1975-1976	$ 68,700	$46,000	$ 41,800	$156,500
1976-1977	71,900	47,500	43,600	163,000
1977-1978	74,800	49,000	45,500	169,300
1978-1979	77,800	50,500	47,500	175,800
1979-1980	80,900	52,300	49,600	182,800
1980-1981	83,900	53,800	51,600	189,300
1981-1982	87,400	55,500	53,700	196,600
1982-1983	90,700	57,100	55,900	203,700
1983-1984	94,300	58,900	58,200	211,400
1984-1985	97,400	60,400	60,200	218,000
1985-1986	100,700	62,100	62,400	225,200
1986-1987	104,100	63,800	64,600	232,500
1987-1988	107,800	65,600	66,900	240,300
1988-1989	110,800	66,900	69,000	246,700
1989-1990	114,300	68,600	71,200	254,100
1990-1991	117,400	70,400	73,400	261,200
1991-1992	121,200	72,200	75,800	269,200
1992-1993	124,200	73,700	77,700	275,600
1993-1994	127,500	75,300	79,900	282,700
1994-1995	130,800	77,000	82,100	289,900

TABLE 37

COMPUTER MODEL NUMBER 100
PROJECTION OF ANNUAL ORM COSTS
FOR SANITARY LANDFILLS

FISCAL YEAR	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	$142,000	$156,500	$298,500
1976-1977	142,000	163,000	305,000
1977-1978	142,000	169,300	311,300
1978-1979	142,000	175,800	317,800
1979-1980	142,000	182,800	324,800
1980-1981	142,000	189,300	331,300
1981-1982	142,000	196,600	338,600
1982-1983	142,000	203,700	345,700
1983-1984	152,000	211,400	363,400
1984-1985	152,000	218,000	370,000
1985-1986	152,000	225,200	377,200
1986-1987	152,000	232,500	384,500
1987-1988	152,000	240,300	392,300
1988-1989	152,000	246,700	398,700
1989-1990	152,000	254,100	406,100
1990-1991	152,000	261,200	413,200
1991-1992	152,000	269,200	421,200
1992-1993	152,000	275,600	427,600
1993-1994	152,000	282,700	434,700
1994-1995	152,000	289,900	441,900

TABLE 38

COMPUTER MODEL NUMBER 101
PROJECTION OF ANNUAL OPERATING COSTS
FOR TRANFER STATIONS

Fiscal Year	Astor	Leesburg	Clermont	Total
1975-1976	$ 8,500	$27,400	$15,700	$51,600
1976-1977	8,700	28,300	16,100	53,100
1977-1978	9,000	29,100	16,600	54,700
1978-1979	9,200	29,900	17,000	56,100
1979-1980	9,400	30,800	17,500	57,700
1980-1981	9,600	31,600	17,900	59,100
1981-1982	9,900	32,500	18,400	60,800
1982-1983	10,100	33,300	18,900	62,300
1983-1984	10,400	34,200	19,300	63,900
1984-1985	10,700	35,100	19,800	65,600
1985-1986	10,900	36,000	20,300	67,200
1986-1987	11,200	36,800	20,700	68,700
1987-1988	11,400	37,700	21,200	70,300
1988-1989	11,700	38,600	21,700	72,000
1989-1990	11,900	39,400	22,200	73,500
1990-1991	12,200	40,300	22,700	75,200
1991-1992	12,400	41,200	23,200	76,800
1992-1993	12,700	42,100	23,600	78,400
1993-1994	13,000	42,900	24,100	80,000
1994-1995	13,200	43,800	24,600	81,600

Number 100. The total costs are different, due solely to the exclusion of the Mount Dora station in Model Number 101.

Depreciation costs are figured in the same manner as for the previous model. Table 39 shows the projected ORM costs for all transfer stations included in Model Number 101's optimum solution.

Transfer Haul

Operating and depreciation costs for the transfer haul operation are projected on the same basis as for the previous model. The total annual ORM costs for Model Number 101's transfer haul operation are projected in Table 40.

Sanitary Landfills

The annual operating costs for each sanitary landfill, based on Figure 15, are shown in Table 41. Table 42 shows the system's total annual ORM costs for sanitary landfills through 1995.

Summary of System Costs

A solid waste system as defined in this report consists of three well defined subsystems:

1) - transfer stations
2) - transfer haul
3) - sanitary landfills

In order to determine the most economical system, it is necessary to combine all subsystem costs to establish the

TABLE 39

COMPUTER MODEL NUMBER 101
PROJECTION OF ANNUAL ORM COSTS
FOR TRANSFER STATIONS

FISCAL YEAR	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	$14,400	$51,600	$66,000
1976-1977	14,400	53,100	67,500
1977-1978	14,400	54,700	69,100
1978-1979	14,400	56,100	70,500
1979-1980	14,400	57,700	72,100
1980-1981	14,400	59,100	73,500
1981-1982	14,400	60,800	75,200
1982-1983	14,400	62,300	76,700
1983-1984	14,400	63,900	78,300
1984-1985	14,400	65,600	80,000
1985-1986	14,400	67,200	81,600
1986-1987	14,400	68,700	83,100
1987-1988	14,400	70,300	84,700
1988-1989	14,400	72,000	86,400
1989-1990	14,400	73,500	87,900
1990-1991	14,400	75,200	89,600
1991-1992	14,400	76,800	91,200
1992-1993	14,400	78,400	92,800
1993-1994	14,400	80,000	94,400
1994-1995	14,400	81,600	96,000

TABLE 40

COMPUTER MODEL NUMBER 101
PROJECTION OF ANNUAL ORM COSTS
TRANSFER HAUL OPERATION

FISCAL YEAR	NUMBER OF TRAILERS/TRACTORS	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	5 / 5	$44,000	$50,000	$94,000
1976-1977	5 / 5	44,000	50,000	94,000
1977-1978	5 / 5	44,000	50,000	94,000
1978-1979	5 / 5	44,000	50,000	94,000
1979-1980	5 / 5	44,000	50,000	94,000
1980-1981	5 / 5	44,000	50,000	94,000
1981-1982	5 / 5	44,000	50,000	94,000
1982-1983	5 / 5	44,000	50,000	94,000
1983-1984	5 / 5	44,000	50,000	94,000
1984-1985	5 / 5	44,000	50,000	94,000
1985-1986	5 / 5	44,000	50,000	94,000
1986-1987	5 / 5	44,000	50,000	94,000
1987-1988	5 / 5	44,000	50,000	94,000
1988-1989	5 / 5	44,000	50,000	94,000
1989-1990	5 / 5	44,000	50,000	94,000
1990-1991	5 / 5	44,000	50,000	94,000
1991-1992	5 / 5	44,000	50,000	94,000
1992-1993	5 / 5	44,000	50,000	94,000
1993-1994	6 / 5	48,000	53,000	101,000
1994-1995	7 / 5	52,000	56,000	108,000

TABLE 41

COMPUTER MODEL NUMBER 101
PROJECTION OF ANNUAL OPERATING COSTS
FOR SANITARY LANDFILLS

Fiscal Year	Sorrento	Lady Lake	Astatula	Umatilla	Total
1975-1976	$42,900	$46,000	$41,800	$25,800	$156,500
1976-1977	45,000	47,500	43,600	26,900	163,000
1977-1978	46,500	49,000	45,500	28,300	169,300
1978-1979	48,300	50,500	47,500	29,500	175,800
1979-1980	50,000	52,300	49,600	30,900	182,800
1980-1981	51,800	53,800	51,600	32,200	189,400
1981-1982	53,800	55,500	53,700	33,500	196,500
1982-1983	55,600	57,100	55,900	35,100	203,700
1983-1984	57,700	58,900	58,200	36,600	211,400
1984-1985	59,600	60,400	60,200	37,800	218,000
1985-1986	61,400	62,100	62,400	39,300	225,200
1986-1987	63,300	63,800	64,600	40,700	232,400
1987-1988	65,600	65,600	66,900	42,200	240,300
1988-1989	67,200	66,900	69,000	43,600	246,700
1989-1990	69,300	68,600	71,200	45,000	254,100
1990-1991	71,100	70,400	73,400	46,400	261,300
1991-1992	73,300	72,200	75,800	47,900	269,200
1992-1993	74,900	73,700	77,700	49,300	275,600
1993-1994	76,900	75,300	79,900	50,600	282,700
1994-1995	78,800	77,000	82,100	52,000	289,900

TABLE 42

COMPUTER MODEL NUMBER 101
PROJECTION OF ANNUAL ORM COSTS
FOR SANITARY LANDFILLS

FISCAL YEAR	ANNUAL DEPRECIATION COSTS	ANNUAL OPERATING COSTS	TOTAL ANNUAL ORM COSTS
1975-1976	$152,900	$156,500	$309,400
1976-1977	152,900	163,000	315,900
1977-1978	152,900	169,300	322,200
1978-1979	152,900	175,800	328,700
1979-1980	152,900	182,800	335,700
1980-1981	152,900	189,400	342,300
1981-1982	152,900	196,500	349,400
1982-1983	152,900	203,700	356,600
1983-1984	152,900	211,400	364,300
1984-1985	152,900	218,000	370,900
1985-1986	152,900	225,200	378,100
1986-1987	152,900	232,400	385,300
1987-1988	152,900	240,300	393,200
1988-1989	152,900	246,700	399,600
1989-1990	152,900	254,100	407,000
1990-1991	152,900	261,300	414,200
1991-1992	152,900	269,200	422,100
1992-1993	152,900	275,600	428,500
1993-1994	152,900	282,700	435,600
1994-1995	152,900	289,900	442,800

overall system cost. Table 43 shows the initial capital requirements for both systems. It also shows selected annual ORM costs for both systems.

The system based on Model Number 101 has both a lower initial capital outlay and also a lower ORM cost year by year, when compared with Model Number 100. Note that system 100's costs, both capital and ORM, are lower for the sanitary landfill subsystem, compared to system number 101. This indicates that three landfills (system 100) are more economical than four landfills (system 101), considering only the landfill subsystem.

However, system 100 requires four transfer stations compared to only three such stations for system 101. When the costs for the transfer station subsystem and the accompanying transfer haul subsystem are taken into account, the cost advantage of system 100's landfill operation quickly disappear. Therefore system number 101 is more economical than system number 100.

TABLE 43

SUMMARY OF SYSTEM COSTS

	MODEL #100	MODEL #101
INITIAL CAPITAL OUTLAY		
SANITARY LANDFILLS	$2,083,000	$2,141,000
TRANSFER STATIONS	571,000	411,000
TRANSFER HAUL	354,000	255,000
TOTAL	$3,008,000	$2,807,000
ANNUAL ORM COST (1975-1976)		
SANITARY LANDFILLS	$ 298,500	$ 309,400
TRANSFER STATIONS	92,300	66,000
TRANSFER HAUL	127,000	94,000
TOTAL	$ 517,800	$ 469,400
ANNUAL ORM COST (1994-1995)		
SANITARY LANDFILLS	$ 441,900	$ 442,800
TRANSFER STATIONS	137,000	96,000
TRANSFER HAUL	153,000	108,000
TOTAL	$ 731,900	$ 646,800

APPENDIX

INPUT DATA FORMAT FOR "SOLWASTE"

FIRST CARD

DATA: (A) # of years for P.W. calculations

(B) Discount rate-fraction

(C) Yearly TPD increase rate-fraction

(D) IPROG = 1 if capital cost of route is not per unit length

= 0 if capital cost of route is per unit length

FORMAT: I5, 2F5.4, I5

SECOND CARD

DATA: (A) Integer 1

(B) Integer 1

(C) Integer 2

(D) XXX = any three digits

FORMAT: 4I5

THIRD CARD

DATA: (A) # of nodes

(B) # of disposal sites

(C) # of routes

(D) # of forcing constraints

FORMAT: 4I5

FOURTH CARD

DATA: (A) Large fixed cost for artificials in million $ (Use 800.)

FORMAT: F10.3

FIFTH & SIXTH CARDS

DATA: COLLECTION ROUTE COSTS

5th card
- (A) First T.P.D. value
- (B) Capital Cost ($) for (A)
- (C) ORM Cost ($/yr/mi) for (A)
- (D) Second T.P.D. value
- (E) Capital Cost ($) for (D)
- (F) ORM Cost ($/yr/mi) for (D)
- (G) Third T.P.D. value

6th card
- (H) Capital Cost ($) for (G)
- (I) ORM Cost ($/yr/mi) for (G)

FORMAT: 7F10.2; 2F10.2

SEVENTH & EIGHTH CARDS

DATA: TRANSFER ROUTE COSTS (Including capital requirements for transfer stations)

7th card
- (A) First T.P.D. value
- (B) Capital Cost ($) for (A)
- (C) ORM Cost ($/yr/mi) for (A)
- (D) Second T.P.D.
- (E) Capital Cost ($) for (D)
- (F) ORM Cost ($/yr/mi) for (D)
- (G) Third T.P.D. value

8th card
- (H) Capital Cost ($) for (G)
- (I) ORM Cost ($/yr/mi) for (G)

FORMAT: 7F10.2; 2F10.2

ROUTE CARDS (One card for each route)

DATA: (A) Route #

(B) One way route length, miles

(C) Route type = 1 for transfer route

= 0 for collection route

FORMAT: A1, 2A2, F10.0, I4

BLANK CARD

DISPOSAL SITE CARDS (Four cards required for each site)

CARD I DATA: (A) Disposal Site #

(B) Land Cost ($/Ac)

(C) Acres/TPD

(D) Additional Work($)

(E) Upper bound (T.P.D.)

CARD I FORMAT: A1, 2A2, 4X, 3F10.2, 1X, F10.3

CARD II DATA: (A) First T.P.D. value

(B) Capital Cost ($) for (A)

(C) Capital Cost ($) for additional work

(D) ORM Cost ($/yr) for (A)

CARD II FORMAT: 4F10.1

CARDS III & IV: REPEAT CARD II PROCEDURE USING TWO DIFFERENT T.P.D. values

BLANK CARD (Only after final card for final disposal site)

NODE INPUT DATA CARDS (Two cards required for each node)

DATA: (A) Node #

(B) T.P.D.

(C) Disposal #

(D) Routes out of node (15 max)

(E) Routes into node (30 max)

FORMAT: I3, F8.2, 23I3/23I3

FINAL DATA CARD

DATA: (A) RHS round off = 0.001

(B) Matrix round off = 0.000005

FORMAT: 2F10.9

END CARDS

(A) /* Columns 1,2

(B) // Columns 1,2

FOOTNOTES

Chapter I

1 U.S. Environmental Protection Agency, Guidelines for Local Governments on Solid Waste Management, Solid Waste Series Publication No. SW-17c. (Washington, D.C.: Government Printing Office, 1971), p. 7.

2 Florida, Rules of the Department of Pollution Control, Florida Administration Code, Chapter 17-7 (1975), p. 1.

3 Florida, Florida Statutes, Chapter 163 (1973), p. 650.

Chapter III

1 Lake County, Florida, Refuse and Garbage Disposal Ordinance, Ordinance 1972-2 (1972), p. 1.

2 Florida, Department of Pollution Control, Newsletter, (May 1975), p. 1.

3 University of Florida, College of Business Administration, Florida Statistical Abstract, 1970 (Gainesville, Florida, 1970), p. 3.

4 U.S. Department of Agriculture, Soil Survey of the Lake County Area (Washington, D.C. : Government Printing Office, 1975), p. 80.

5 U.S. Department of the Interior, Groundwater in Lake County, Florida, by Darwin D. Knochenmus, Map Series No. 44 (Tallahassee, Florida, 1971).

6 Lake County, Florida, Transportation Plan (Tavares, Florida, 1975).

FOOTNOTES-Continued

Chapter IV

1 Lake County, Florida, A Comprehensive Development Plan Summary for Lake County, Florida (Tavares, Florida, 1975), p. 13.

2 East Central Florida Regional Planning Council, Population: 1970,1980,1990 (Winter Park, Florida, 1974),p. 2.

3 East Central Florida Regional Planning Council, Upper Oklawaha River Basin Plan (Winter Park, Florida, 1971), p. 29.

4 Florida. Department of Health and Rehabilitative Services, State of Florida Solid Waste Management Plan (Jacksonville, Florida, 1971).

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